A COMPARATIVE STUDY ON DESIGN OF TURKISH COFFEE BREWING MACHINES FOR SELF-SERVICE: "TELVE", "KAHWE" AND "GONDOL"

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ABSTRACT

In the last decades, for the traditional Turkish coffee brewing method, which has a history of five hundred years, new gadgets are being designed. These machines, which are the rivals of the ibrik, are designed to meet the 'need of speed', which is the requirement of the era. Like the other industrial products, they are going to be developed according to the customer requirements. They are going to be successful according to the level of the customer satisfaction they provide.

In this study which comprises five chapters, in the second chapter, the coffee plant, coffee processing, the history of coffee and the coffee brewing methods are mentioned. In the third chapter, the development of western and oriental coffee brewing machines in the history are mentioned. In the fourth chapter, three of the different types of Turkish coffee brewing machines are chosen from the market, and these machines are examined according to the level of their customer requirement satisfaction by means of Quality Function Deployment method. In the fifth chapter, by means of the data obtained from this examination, suggestions are made about which specifications of the products should be developed in the next generation designs of the products.

ÖZET

Yaklaşık 500 yıllık tarihi boyunca geleneksel pişirme yöntemi olan cezvede pişirilen Türk kahvesi için son yıllarda yeni pişirme gereçleri tasarlanmaktadır. Geleneksel Türk kahvesi pişirme yöntemine rakip olan bu makineler temelde yaşadığımız çağın gereği hızı karşılamak amacıyla tasarlanmıştır. Her endüstriyel ürün gibi bu makinelerin tasarımları da müşteri istekleri doğrultusunda geliştirilecektir. Müşteri isteklerini karşılayabilme derecelerine göre başarılı olacaklardır.

Beş bölümden oluşan bu çalışmada, ikinci bölümde kahve bitkisi, kahvenin işlenmesi, kahvenin tarihçesi ve kahve pişirme yöntemleri anlatılmaktadır. Üçüncü bölümde batılı ve doğulu kahve pişirme makinelerinin tarihsel gelişimi anlatılmaktadır. Dördüncü bölümde piyasadaki Türk kahvesi pişirme makineleri çeşitlerinden, üç adet farklı tipe ait makine seçilmiş ve bu makineler Kalite Fonksiyon Göçerimi metodu yardımıyla müşteri isteklerini tatmin bakımından incelenmiştir. Beşinci bölümde bu inceleme sonucunda elde edilen bilgiler ışığında ürünlerin bir sonraki aşamada hangi özellikleri bakımından geliştirilmelerinin gerektiği konusunda sonuçlara varılmıştır.

TABLE OF CONTENTS

LIST OF FIGURES

Figure **Page**

LIST OF TABLES

CHAPTER 1

INTRODUCTION

1.1. Definition of the Problem

1517 was the year when the coffee was firstly started to be drunk in Istanbul, and around 1600 the coffee liquor was known all around the Ottoman Empire. During the passing five hundred years, coffee gained an important position in our social and cultural lives.

Işın (2001) mentions an English traveller named Charles Mac Farlane, who witnessed in Istanbul some of the most tumultuous years of early Ottoman efforts to reform during the reign of Mahmud II. He finishes his observations about the cultural texture of the urban life that was undergoing a metamorphosis with a definite judgement that "The Turks can not live without coffee". As the English traveller observed, Turks still preserve the coffee drinking habit, adapting it to the requirements of the day when considered necessary.

The Turkish coffee, which had been prepared in ibrik for centuries, started to be prepared in special 'Turkish coffee machines' today. New machines are being developed to be used instead of the traditional 'ibrik'. Considering the conditions of our century, one main subject can be determined as the objective of the innovations; to make it easier to prepare Turkish coffee for everyone. As a consequence of this, the Turkish coffee knowledge will spread all around the world and the consumption will increase both in Turkey and in the rest of the world.

It is known that the oldest coffee brewing and drinking style is the 'Turkish coffee' style, but as the coffee consumption in the world is examined, it is obvious that the Turkish coffee is not widely spread. Actually there is no need to go abroad, although in Turkey, except the aficionados and the people having enough time and equipment, people prefer easy-to-prepare coffee types like filter coffee or espresso or instant coffee. These coffee types are easy to prepare because the people, who in the beginning had met the coffee in the Turkish style, developed different styles and machines to make coffee. Today these new Turkish coffee machines are looking for their places among the

other coffee machines, and they are at the outset and will be archetype for the followings.

The Turkish coffee machines were not a requirement for the people before they were invented and manufactured, but as being a new developed industrial product in the market, as it was in the western type coffee brewing machines, new designs will be developed and the designs will be in a continuous progress regarding the customer requirements and the rivals' characteristics.

1.2. Aims of the Study

The main objective of the study is to examine and compare the design of the Turkish coffee machines, which are seeking for a place in the market, from the point of customer requirements and product specifications, and by means of the data obtained from that examination, to determine what the next design steps of the products must be, or in other words, in which direction the development of the products better be. Three Turkish coffee machines of different types are selected from the market to be examined with this purpose. The selected machines are 'Telve' of Arçelik, 'Kahwe' of Arzum and 'Gondol' of Gondol Plastic.

In the second chapter, the coffee plant, the processes that it passed through to be ready for brewing, the most popular coffee brewing methods and the coffee's spread through the world in the history are mentioned. Having the subject about the liquor obtained from the coffee plant, it is aimed to have the knowledge of coffee from these aspects.

In the third chapter, the coffee machines, which were developed in the world until today, are described. As the objective of the thesis is the examination of the design of the Turkish coffee machines, which will remain as the first examples of the new concept 'Turkish coffee machine' in the design history, the machines developed by the people, who were drinking Turkish coffee that was prepared in the ibrik in the beginning, are chosen to be the subject of the third chapter. The aim of the examination of the other coffee machines in the world is to comprehend the place of the newly developed products for Turkish coffee under the general coffee machines heading.

The aim of the fourth chapter is obtaining data to be used in the examination and the comparison of the three products, and making the examination and comparison. In

this chapter firstly the method to be utilized, which could act as a guide having the necessary tools to achieve the necessary data enabling the examination and comparison is determined, then data about the traditional Turkish coffee brewing is collected in order to have sufficient knowledge about the details of the process, thirdly the method chosen was applied by adapting to the requirements of the study, and finally the products are examined and compared by utilizing the data obtained which are the customer requirements and the product requirements.

In the fifth chapter, by means of the data obtained from the fourth chapter, determinations are done about in which direction the development of the products be in order to achieve the objective of the study.

1.3. Method of the Study

Considering the aims and the problem that are defined above, the study is constructed on five chapters.

The first chapter is the introductory chapter comprising the definition of the problem, aims and method of the study.

The second chapter consists of the definition of coffee plant, explanation of the processes that coffee plant passes through to become ready to be brewed, the coffee's and the coffee drinking habit's spread in the history and the most popular coffee brewing methods. The third chapter compromises the development of coffee makers in the west and in the orient in history. These two chapters were formed by means of the documentation obtained by the literature review and expert questioning.

The fourth chapter consists of a brief description of the QFD method, the description of the traditional Turkish coffee brewing and the factors affecting the quality during the process, and the examination and comparison of the three products from the point of customer requirements and product specifications by utilizing some sub-matrices of the House of Quality matrix of QFD method. To form this chapter, the documentation obtained by literature review, questionnaire, expert questioning and observation is used.

The fifth chapter, which is the conclusion, comprises the evaluation of the examination done in the fourth chapter and the suggestions in the context of evaluation.

CHAPTER 2

AN OVERVIEW ON THE LIQUOR "COFFEE"

Coffee is; 1. Any of several trees of the genus *Coffea*, native to eastern Asia and Africa, bearing berries containing beans used in the preparation of a beverage; especially *C. arabica*, the chief commercial source of these beans. 2. The seeds or the beans of a coffee tree. 3. An aromatic, mildly stimulating beverage prepared from coffee beans... (The Grolier International Dictionary Vol.1 1984).

2.1. Coffee Plant

The coffee bean is the seed or the pit of the round, red 'cherry' fruit of a tropical evergreen shrub (Figure 2.1) (WEB_1 2004). The small, shrublike coffee tree blooms with jasmine scented white flowers, and at the same time it bears ripe and unripe fruit (Figure 2.2). Inside each of these fruits or 'cherries' two seeds grow. Resembling a cranberry in size and shape, the cherries have sweet pulps and two flat-sided seeds. These seeds are protected by a silky opaque covering, called the silverskin, and a parchment-like husk (Perry 1991).

Figure 2.1. Coffee cherries
(Source: WEB_2 2004)

Figure 2.2. Coffee blossom
(Source: WEB_2 2004)

Coffee belongs to the botanical family Rubiaceae. It has 500 genera and over 6,000 species. Most of them are tropical trees and shrubs which grow in the lower parts of forests. Other members of the family comprise the gardenias and plants which yield quinine and other useful substances, but coffea is economically by far the most important member of the family (WEB_3 2004).

Originally it grew wild in the tropical highlands on the eastern side of Africa (Bramah E.and Bramah J. 1995). It grows up in the tropical regions (Figure 2.3). It does not grow up at the regions where the temperature declines under +5°. Some varieties of coffee tree typically grow over 30 feet. But, in cultivation, for ease of picking of the coffee berry, the coffee tree is seldom allowed over 2 meters (Baytop 2001). Each hectare of coffee produces 86 lbs of oxygen per day, which is about half the production of the same area in a rain forest (WEB_4 2004).

Figure 2.3. Coffee cultivation in the world
(Source: WEB_2 2004)

The annual yield of a medium sized coffee tree is approximately a half or a quarter kilogram of grinded coffee, and a half-kilogram of grinded coffee is obtained from 4000 green coffee beans. On the average it takes five years before a young shrub bears a full harvest and it keeps bearing for fifteen years. Nine months after the blooming its fruits become ready for harvesting. The coffee beans do not mature at the same time and because of this a coffee tree is harvested three or four times a year. On the average 45-90 kilograms of coffee fruits are picked a day. 90 kg of them is equal to 22,5 kg of green coffee beans and 17,5kg of roasted beans (Güçlü 2002).

Since coffea was first correctly described by Linnaeus in the mid 18th century, botanists have failed to agree on a perfect classification system. Botanical classification of coffea is seen in Figure 2.4. There are probably at least 25 major species, all native to tropical Africa and certain islands in the Indian Ocean, notably Madagascar. Difficulties in classification and even in designation of a plant as a true member of the coffea genus appear because of the great variation in the plants and seeds. All species of coffea are woody, but they range from small shrubs to large trees over 10 metres tall. Their leaves can be yellowish, dark green, bronze or tinged with purple (WEB_3 2004).

Family	**Genus**	**Species (many including:)**	**Varieties (examples:)**
Rubiaceae	Coffea	Arabica	Typica
		Canephora	Robusta
		Liberica	

Figure 2.4. Botanical classification of coffea
(Source: WEB_3 2004)

The two economically most important species of coffee are Coffea arabica (Arabica coffee), which accounts for over 70% of world production and Coffea canephora (Robusta coffee). There are two other species which are grown on a much smaller scale are Coffea liberica (Liberica coffee) and Coffea dewevrei (Excelsa coffee) (WEB_3 2004).

Coffea arabica - Arabica coffee

Coffea arabica was first described by Linnaeus in 1753. It was first found in Yemen. It is the sole species of quality beans and is the most wildly cultivated coffee plant (Perry 1991). The best-known varieties are 'Typica' and 'Bourbon'. From these many different strains and cultivars have been developed, such as caturra (Brazil, Colombia), Mundo Novo (Brazil), Tico (Central America), the dwarf San Ramon and the Jamaican Blue Mountain. The average arabica plant is a large bush with dark-green oval leaves. It is genetically different from other coffee species. It has four sets of chromosomes rather than two. Its fruits are oval and mature in 7 to 9 months; they usually contain two flat seeds (the coffee beans). When only one bean develops it is called a peaberry. Arabica coffee is often weak towards pests and diseases, therefore resistance is a major goal of plant breeding programmes. Arabica coffee is grown throughout Latin America, in Central and East Africa, in India and to some extent in Indonesia.

Coffea canephora - Robusta coffee

The term 'robusta' is actually the name of a widely grown variety of this species. It is a robust shrub or small tree. It grows up to 10 metres in height, but with a shallow root system (WEB_3 2004). Being discovered in Africa toward the end of the nineteenth century, robusta is relatively new to the coffee industry but its role is important. Because of its hardness, high yield, and ability to grow at lower altitudes, its beans are cheaper to produce. This makes it ideal for blending with arabica and for use in instant coffee. Robusta coffee have twice as much kick as arabica has. Its flavor tends to be harsh and pungent (Perry 1991). The fruits are rounded and take up to 11 months to mature; the seeds are oval in shape and smaller than those of C. arabica. Robusta coffee is grown in West and Central Africa, throughout South-East Asia and to some extent in Brazil, where it is known as Conillon.

Coffea liberica - Liberica coffee

Liberica coffee grows as a large strong tree, up to 18 metres in height. It has large leathery leaves. Its fruits and seeds (beans) are also large. Liberica coffee is grown in Malaysia and in West Africa, but only very small quantities are traded as demand for its flavour characteristics is low (WEB_3 2004).

Since the discovery of coffee in Arabia, it has become one of the world's most popular agricultural products. In terms of trade volume, coffee is second only to oil in worldwide trade. It is one of the most labor-intensive food products, passing more than 15 processing steps from the cherry to the coffee cup (WEB_1 2004).

2.2. Coffee Processing

Coffee undergoes some processes from the time of being picked to it can be brewed. These processes respectively are reaping, the extraction of coffee bean from the coffee fruit, checking coffee, roasting the coffee bean, grinding the roasted coffee, and blending.

Reaping

Today the mechanical harvesting machines are not developed enough to substitute for the people, consequently the coffee cherries are picked by hand as they were in the past. To pick only the ripe fruits means to harvest the same tree more than once a year, and this causes some difficulties in the big plantations. To be considered as high quality beans and sold with high prices, the producers bear these difficulties of the handpicked coffee beans. Instead of being picked one by one, by hand, in Brazil the coffee beans are scraped from the branches of the tree. The disadvantage of this method is that the ripe and the unripe beans are processed altogether, and this causes a decline in the quality and the price of the coffee (Heise 2001).

Extraction

After the ripe cherries are picked, the beans must be extracted from within the cherry. There are four layers, which wrap up the bean, and separate it from the outer cherry. They are the tough shiny outer skin, the sticky mucilaginous pulp of the fruit, the stiff parchment casing and the thin delicate silverskin, which cling to the bean (Figure 2.5).

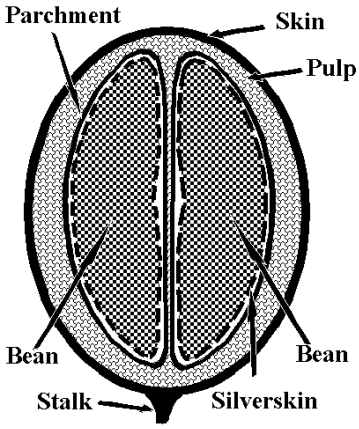

Figure 2.5. Coffee cherry
(Source: WEB_4 2004)

There are two methods used to extract the beans. One of them is 'the wet or washed process' and the other one is 'the dry process'. The availability of fresh water, which is one of the most important determinants of coffee flavor, largely determines the method used (WEB_1 2004).

The wet method is used with handpicked, fully ripe, quality beans. These are the washed beans carried by specialty stores (Perry 2001). This method comprises mechanically removing the pulp from the beans. Top quality wet-processed coffees are transferred to large fermentation tanks after removing the pulp. The sticky fruit swells and releases from the beans inside in the fermentation tanks. Many first time plantation visitors are surprised to discover that these tanks of coffee smell like new made wine. Depending on atmospheric conditions and the nature of the coffee itself, fermentation lasts 12 - 36 hours (WEB_1 2004).

The transformation from ripe to rotten is short. If this stage is not stopped at the exact moment fermentation is complete, entire amount of coffee can be ruined. The beans are washed free from the loosened fruit when the fermentation is complete. The coffee beans, with the undamaged parchment layer, are left to dry on large patios or in commercial tumble dryers. The beans must be mixed and thereby turned several times every day to ensure even drying (WEB_1 2004). After drying, they are patiently graded by size, shape, and quality by men and women, and are shipped to roasters around the world (Perry 2001).

Washed coffees are brighter and offer cleaner, more consistent flavours than those processed by the dry method. Not surprisingly, the wet method is common in Latin America, the very region whose coffees we associate with these characteristics. In

more industrialized coffee-growing countries like Costa Rica, a variation called aqua-pulping is replacing with the traditional wet processing. The coffee is just depulped, rinsed, and dried in this method. Such coffee can't express the high notes and varietal charm characteristic of traditionally washed beans (WEB_1 2004).

The dry method is the oldest, the most natural and also the cheapest method. The fruit either dries on the tree, or the tree is shaken or stripped and its ripe and unripe fruit spread out to dry and shrivel in the sun. To make sure that they dry evenly workers harrow the beans several times during a two to three week period. They put them through a milling machine to separate the debris from the beans, then grade them and ship them off to roasters.

In certain countries where inferior harvesting methods are practiced, and trees are shaken or stripped instead of handpicked, underdeveloped or imperfect beans are collected along with ripe ones. This creates inferior coffee, and it also injures the trees. Despite most inferior coffees are processed using the dry method, there are high quality coffees processed dry in areas where water is scarce like Indonesian and Ethiopian coffees (Perry 2001). In general dry processed coffees are heavier bodied and more variable in flavor than wet processed coffees (WEB_1 2004).

Checking Coffee

To obtain the ideal mixture from various coffee types a special coffee control is required. The specialists called 'cuptester' do these controls by tasting the coffee samples. The raw coffee beans types are classified according to the international standards, and there are hundreds of these. The place of origin of the coffee, the harbour where it is loaded to the ship, and for the beans of good quality the plantation where it is cultivated are mostly explained (Heise 2001).

Roasting

Roasting is a chemical process by which aromatics, acids, and other flavor components are either created, balanced, or altered in a way that should augment the flavor, acidity, aftertaste and body of the coffee as desired by the roaster (WEB_5 2004). Unlike fragrant wine grapes or scented tealeaves, raw coffee beans conceal their flavor. The only way to liberate the flavor and the aromas is roasting. The principle of roasting coffee is simple; beans are heated between 380° and 480°F. Each variety of beans has its own ideal roasting time. (Perry 2001).

It is believed that using traditional methods in coffee roasting came about in the fourteenth century. It came about with the use of iron. The connection was too quick between roasting the beans and the development of iron roasting bans.

Coffee roasting was prevalent in Turkey in 1540's. It is thought that roasting began around Damascus because Damascus iron was easily able to handle the thermal characteristics, which were required for roasting. The first iron roasters were more like frying pans with a lid. In many countries, the frying pan works great still today. Frying tends to sear the bean and doesn't give an even roast (WEB_6 2003).

Although roasting coffee domestically has largely been abandoned, a number of small home roasting devices are available like stovetop models resembling old-fashioned popcorn poppers or small electric roasters. Roasting is now usually left to specialists who can adjust the roast according to the customer requirements.

Most roasting machines used in the industry look like clothes dryers (Figure 2.6). A revolving cylinder lets beans to roast uniformly. The heat inside the cylinder reduces moisture so the volatile aromatic oils can emerge. These oils give the aroma and flavor of the coffee. Once the beans have reached the desired roast, they are rapidly cooled to avoid over-cooking. It is mentioned that there are two different types of this process. If air jets are used for cooling the beans, it is referred to as a dry roast. If water jets are used, it is referred to as wet roast.

(a) (b) 

Figure 2.6. (a) 'Torrefattore' Coffee roaster (Source: WEB_7 2004)
(b) Another industrial coffee roaster (Source: WEB_5 2004)

As the beans roast, distinct stages of appearance and flavor occur. Due to their longer roasting times and greater loss of soluble oils, darker roasts have less caffeine than the lighter varieties. The roasting stages can be referred to as 'light or pale roast', 'medium, city, or American roast', 'full, high, or Viennese roast' and 'espresso or

Italian roast'. Light roast is the roast, which is typically used for canned or institutional coffee. It is also used for delicately flavoured beans. The beans have a dry, cinnamon coloured surface and often brewed as a morning coffee and served with milk. Medium roast is the all-purpose roast. The beans have a medium-brown coloured dry surface. Full roast is the roast with the taste, which strikes an even balance between sweetness and sharpness. The beans are chestnut brown coloured and show patches of oil. Espresso roast is the darkest roast. The beans are almost black in colour and have a shiny, oily surface. Its pungent flavour is a favourite of espresso lovers (Perry 2001).

Grinding

Nowadays, coffee can be bought roasted and ground to suit the method of brewing, but there will always be people who prefer to grind their own (Bramah 1995). There are basically three types of grinders, 'the mortar and pestle', 'the hand mill', and 'the electric grinder'.

In the beginning, for centuries, the mortars and pestles were being used to grind the roasted coffee beans. Later the hand mills were being used (Figure 2.7). Based on the same principle as a millstone, invented by the Turks in the fifteenth century to grind flour, hand mills come in two basic designs: a box or lap grinder and a wall-mounted version reminiscent of a fancy meat grinder. The beans are grinded by feeding into the top of the box. A funnel or slotted screw drops the beans between two corrugated steel discs, one stationary, one rotated by a crank. When the crank is turned the beans are crushed between these discs and fall into a drawer at the bottom of the grinder. The fineness of the grind is determined by adjusting the space between the discs (Perry 2001). The first hand mills used in Europe resemble the Turkish ones. They were made of metal, wood or porcelain carrying the characteristics of their era (Alyanak 2001). Nowadays electric grinders are used with the ease of handling (Figure 2.8). They work much like kitchen blenders. With a central stainless steel blade rotating at high speed, they chop the beans into little pieces. The length of time the blade is run determines the grind's fineness. There is one disadvantage that is the grinder's tendency to overheat the beans, so that the flavour is lavished on the air.

Figure 2.7. Brass hand mill
(Source: Catalogue 2001)

(a)

(b)

Figure 2.8. (a) Bosch 'MKM6000UC'and 'MKM6003U' coffee grinders
(Source: WEB_8 2004)
(b) Bodum coffee grinder (Source: WEB_9 2004)

The coarseness of the grind is a matter of preference and has to suit the method of brewing. There are four types of coffee grinds, which are named as 'coarse', 'medium', 'fine/espresso' and 'pulverized'. The ground coffee, which has large granules, is called the coarse grind. It is suitable for the jug or plunger, and is also used in the pumping percolator, which has large filter holes. The medium grind resembles sugar granules. It is used primarily with vacuum and flat bottom drip makers, and it is suitable for all brewing methods except espresso and Turkish coffee. The fine/espresso grind has a texture like cornmeal. It works with drip and filter brewing methods, and also with espresso machines and Neapolitan flip-drip. The pulverized type ground coffee is as fine as flour. It is exclusively used for Turkish coffee (Perry 2001).

Roasters and grinders have always been very important in the process of coffee making since if anything goes wrong during these two stages, the brew is doomed from the beginning.

Blending

After the roasting process, roasted 'pure' coffee is obtained from a certain type of bean, but all coffee brands of the international market are mixtures of different coffee types. Their quality of aroma, colour and density is higher than the pure, unblended coffee. The flavour and the quality of the raw coffee can change every harvest. Preserving the same quality of aroma and flavour for years is possible by blending (Heise 2001). Although the modern coffee industry presents already-blended coffee to the consumer, the consumer himself/herself can also prepare a blend of his/her own taste.

The Decaffeinated Coffee

Depending on the type of coffee and how it is prepared a small cup of coffee contains between 50 and 150 milligrams of alkaloid. Research was undertaken to find ways of removing caffeine from coffee beans and to avoid certain effects that were once believed to be caused solely by caffeine. Ludwig Raselius, a scientist, had the idea of using steam to make the beans porous. Then it would be easy to extract the caffeine released through the porosity by using organic solvents. There are three decaffeination methods commonly used by the coffee industry.

The first method is 'decaffeination using water' ('Swiss' method). It is based on the natural capacity of water to solve caffeine. Water extracts all of the soluble components on the raw coffee as well, like the aromas. Nevertheless, the characteristics of the bean do not change. A sophisticated technological process makes it possible to return the extracted aromas to the coffee in a subsequent phase, once the caffeine has been eliminated, thus giving it back most of its original flavors and aromas. There are two advantages of this method; the coffee comes into contact with water only, and the richness of aromas and flavors in the blend is not much altered.

The second method is 'decaffeination using pressurized carbon dioxide'. The raw coffee beans are moistened with steam and water during the CO2 decaffeination process and put into an extractor in contact with the gas in supercritical condition. The carbon dioxide in supercritical condition acts as a selective solvent for caffeine, and makes it extractable.

The third method is 'decaffeination using a solvent'. As a consequence of the health concern issues raised a few years ago, this method is no longer widely used. Certain organic solvents that are selective for caffeine are used. To make the surface of

the raw coffee beans more permeable, they are moistened with steam. Thus the caffeine can be extracted more easily when the solvent comes into contact with the coffee (WEB_10 2003).

2.3. The History of Coffee

The coffee had crossed the Red Sea from Ethiopia to Yemen and there it began to acquire its own legends. There are various legends about the discovery of coffee, but three of them will be mentioned here.

The best-known story is the story of Kaldi, the goatherd who noticed that his goats became particularly lively after eating cherries from the coffee bush. He found that these cherries had the same effect on him, and told the monks in the local monastery that used coffee to stay awake through their long devotions. By this way coffee was recognized as a good thing (Bramah E.and Bramah J. 1995). The Arab and the Turk versions of this story are basically the same but in the Turk version the goatherd tells to some Sufi dervishes [that he noticed a tree spreading a good scent after being struck by light. Thus the coffee roasting was discovered (Heise 2001). The Muslim version of the story appears to elicit greater credibility. It must be said that there is greater inherent logic to be found in comprehending why Muslims would be the first to encounter coffee since, unlike the Christians who solved their problem of pleasure by imbibing the blood of Christ in the symbolic form of wine, Muslims were highly motivated to discover an alternative source of such pleasure since wine was proscribed for them (Batur 2001).

The second story is about a person called Omer. In the thirteenth century he was convicted and banished to a desert where there was nothing to eat. He found a bush and picked its berries, and boiled in water and drunk. He became active immediately. He gave it to some leprous men walking around, and they got better. After the miracle was heard, the caliph decided that Omer was innocent. He went back to his country and was rewarded.

The third story telling the discovery of coffee is related to the Prophet Muhammed. He prohibited the stimulant beverages and he should recommend another beverage to substitute for them. The easterner story tellers tells that the Archangel Gabriel gave him a dark and hot liquid to drink when he had a merciless illness, and the prophet immediately got well (Heise 2001).

Since the earliest times, coffee was considered a food. Ethiopian tribesmen mixed wild berries with animal fat, rolled them into balls, and ate them during their nomadic journeys (Perry 1991). On this basis, the habit of drinking coffee is not nearly as old as the habit of eating it. And it is precisely here, at the point where coffee was transformed from a food into a beverage, that the mythological adventure of coffee begins. How did that transformation take place? Who invented drinkable coffee?

The answer to those questions is provided by a mystical discourse that binds the mythological roots of all sociocultural phenomena of medieval Islamic culture. There are several versions to the story but all of them associate the discovery of coffee as beverage with the healing powers of religious figures. According to a story related by Ebu Tayyib al-Gazzi, the first person to brew coffee as a therapeutic beverage was Solomon (Işın 2001). One of his long journeys, Solomon came to a town whose inhabitants were all suffering from an unknown affliction. In a dream, he was commanded by Gabriel to collect the seeds of a particular tree, roast them, and from them brew a thick beverage that he was to distribute to the sick. The tree of course was the coffee tree (Çetinkanat 1997). Another version of this story attributes the discovery to Ibn Sina (Avicenna), but like the first, it does not agree with known historical facts. Yet another version, which is widely believed to be true even today at the popular level, links the beverage to Islamic mysticism. According to the version, the inventor of beverage coffee was Ebu'l-Hasan Ali aş-Şazeli, the founder of the Şazeli order of dervishes. Although the story contradicts itself in a few places, it does account for the widely acknowledged repute of coffee in Sufi circles. And by attributing the diffusion of the habit to a holy man who, in his lifetime, traveled all across northern Africa from Morocco to Egypt and whose mystical teachings were propagated along the pilgrimage routes, it provides us with our first clues about how the coffee drinking habit got started and spread.

Around the beginning of the fifteenth century, dervishes were certainly drinking coffee for a functional purpose. After his exile to Mocha by Emir Sadeddin, Ali Ibn Ömer eş-Şazeli, who died in 1418, introduced coffee to his circle of acquaintances, resulting in the spread of the beverage among members of the order. The main reason why coffee gained popularity in the culture of mystical orders stemmed from the ability of caffeine to stimulate the mind and fend off sleep. By keeping dervishes alert, especially in the prolonged assemblies where litanies were chanted, it enabled them to experience the feeling of mystical ecstasy more profoundly. At the outset, coffee served

such practical purposes as this but in time, it became the creator of a complex system of ceremonies that spiritually complemented the order's core rituals. What that mean in plain terms was to bind the act of drinking coffee by a series of mystical rules. At the same time, coffee owes its emigration from Ethiopia and rapid dissemination throughout nearly the entire Near East to the dervish orders. These mystical groups provided the most suitable platform for the spread of coffee for they were organized in such a way as to appeal not simply to those like themselves but also to individuals who came broad segments of the population and who might take an interest in their religious teachings. In other words it was not only the dervishes who acquired coffee habit but also the people who visited them in their lodges. They in turn carried the taste for the pleasure that this substance gave to the human soul with them into a widening succession of new regions. This process continued throughout the fifteenth century. Radiating from the dervish lodges and spreading along pilgrimage routes, coffee became an integral part of sociocultural and daily life.

The pilgrimage routes that traverse the Islamic world from north to south and from east to west were also the routes plied by trade caravans and this fact sheds light on the geographical spread of the coffee habit. Looking at it from another angle, that spread also provides us with reliable information about the channels through which the trade in coffee moved. The earliest information we have on this subject is from the sixteenth century and shows that, by that time at least, coffee had become a staple item of merchants' stock in trade.

After emerging from Ethiopia, coffee's first stopping-place was Yemen. From there, it spread into the interior of the Arabian peninsula. In 1511 it was prohibited in Mecca –evidence that authorities were already thinking it to be a problem. Following the trade routes, it spread rapidly throughout the Red Sea basin, from which it penetrated the Nile valley and made it to Cairo. When the Ottomans defeated the Egyptian Mamluks (Memlük) and took control of Cairo in 1517, it is quite likely that they had what amounted to their first real encounter with coffee in that important trading center. The pilgrimage route linking Cairo to the holy cities remained one of the most important arteries of the coffee trade for centuries to come. Another was the caravan route via Damascus that provided the Ottomans with their connections to the Hejaz. The introduction of coffee into the cities of Anatolia was largely thanks to the transit trade taking place along this route (Işın 2001).

The sixteenth cetury should be regarded as the period in which coffee first created the geography of its habituation. According to the book 'Tarih-i Yemen ve San'a' written by Ahmed Raşid, the person who brought coffee from Ethiopia to Yemen was Özdemir Pasha (Toros 1998). But the most reliable source of information for this period is provided in 'Umdetü's-safve fi hilli'lkahve', a work by Abdülkadir Ibn Muhammed el-Ceziri, who died some time after1568. According to him, the man who first brought coffee to Yemen was Cemaleddin Ebu Abdullah Muhammed Ibn Said, also known as 'ez-Zebhani' (Işın 2001). In 1454, that Sufi man living in Aden had brought the coffee beans and established coffee gardens in Yemen (Heise 2001). While residing in Aden, Yemen's commercial port, he was closely associated with members of the city's religious orders and played a leading role in spreading the habit of coffee drinking. At this juncture however, the lifestyles of those who had become habitues of caffeine as well as their relationships with the rest of society were still quite remote from the view of the general public (Işın 2001).

Between 1470 and 1500 the Arabians brought coffee bean to Mecca and Medina (Heise 2001). The first great wave of public interest in what had been essentially an item of Sufi esoterica was triggered when coffee was banned in Mecca in 1511 by Hayr Bey. The events that took place in that city are worthy of detailed attention insofar as they reflect an underlying mentality that will be seen repeated in the prohibitions against coffee that were later to be imposed in Hejaz and Istanbul. El-Ceziri is quite detailed in his account of what took place. The first point that immediately draws one's attention is the severe reaction of the ulema to the process of socialization which had been generated by confabulatory get-togethers held for the purpose of drinking coffee and which was quite beyond the control of authorities. Orthodox ideology prescribed rules defining the religious and cultural reasons why and places where people might come together in a social context and it strove mightily to control new lifestyles which, as in this case, were prime candidates to slip beyond the boundaries of those rules. Nearly all of the arguments that were developed as religious grounds for prohibiting coffee were, without exception, to be put forward in subsequent efforts to frustrate its consumption. Nevertheless the coffee bean was able to fend off its opponents and continue to reign by taking refuge behind the enormous commercial potential that it possessed and the huge revenues that it generated for the state treasury.

Around the same time that coffee was drawing the wrath of the ulema in Mecca, in Cairo it was becoming a fad that was spilling out into the city's streets and was being

openly bought and sold. This suggests that what was once a clandestine stimulant had now become an ordinary commercial commodity. In 1517, Selim I added Cairo to the Ottoman domains. This teeming metropolis had long been the mirror of all the sociocultural, political, and commercial transformations took place in the eastern Mediterrenean and, henceforth, what transpired here would have an impact on the imperial capital, Istanbul as well. According to Ibn Abdulgaffar, one of el-Ceziri's sources, coffee was first consumed in Cairo around the beginning of the sixteenth century by Yemeni students in their section of the el-Ezher medrese. This observation provides an extremely valuable clue concerning the social context in which the coffee habit would subsequently become entrenched when it reached Istanbul. The first point that deserves attention here is the religious nature of the setting in which this coffee was being consumed. The second is the social profile of the travelling dervishes who would have frequented the school that these students studied and lived in. Both setting and social profile were imported wholesale into Istanbul after the 1550s, where we find coffeehouses which not only neighbour mosques, medreses, and dervish lodges but also, as was the situation in Cairo, whose clientele was drawn overwhelmingly from the city's middle classes.

In view of subsequent developments, it is ironic that the consumption of coffee in sixteenth century Cairo should have gotten its start in el-Ezher, a venerable institution that was the very citadel of the ulema. It did not remain confined to the holes of academe for long. From there it was a only a short step away to the Kasaba district of Cairo, the city's commercial centre, where it was to muster in new social forces on the historical stage. The coffee trade would have big benefits for the Ottoman fisc. Indeed before very long, the economy of Cairo became the sole Mediterranean representative of a wealth that was generated exclusively by the trade in coffee. Of the 200.000 quintals of coffee that passed in trade during the seventeenth century, nearly half of it was sold through Cairo. Henceforth coffee was to assume a new countenance: no longer just a pleasant stimulant, it became an actor on a Mediterranean political stage where conflicting private, class, and imperial interests repeatedly came to blows. Local revenue-farmers gained control of the coffee customhouses and were so enriched as a result that they were able to revitalize the old Mamluk aristocracy. Their newfound wealth enabled them to seduce, to their own side, the Janissery forces that should have been looking out for Ottoman interests. So emboldened, they undertook the first acts of rebellion against the Ottoman provincial governor and centralized system of Ottoman

administration that he represented. The coffee trade had disrupted the status quo in the Mediterranean and, by doing so, it ultimately delivered a severe blow to Ottoman interest in its southern provinces.

At the outset at least, the interest that the Western world took in coffee was entirely the product of a scholarly or scientists interest. European travellers infatuated with the exotic Orient first encountered coffee in Aleppo and Cairo, as did European botanists seeking new plants to add to their collections. Leonhart Rauwolff, an Ausburg physician and botanist, is believed to be the first European to mention coffee in writing. In Aleppo during his journey between 1573 and 1578, he witnessed men were drinking a hot, dark coloured beverage that was as black as ink. Another botanist Prospero Alpinus, a Paduan, who served for a time as a sort of scientific consultant to Giorgio Emo, Venice's consul in Egypt in 1580-1583, made a similar observation. While doing a survey of the flora of the Mediterranean, he remained in Cairo for a time and there had a chance to examine a coffee tree. In 1592 Alpinus published his 'De Plantis Aegypti Liber', abook that is regarded as the first scientific reference introducing the coffee tree to Europe.

The seventeenth century was a period in which the fever of international trade was sustained by the demand for coffee as ships set sail Amsterdam, Marseilles, and Venice bound for the eastern Mediterranean to reach the sources of the goods that would satisfy a burgeoning market. For Europe, coffee was becoming much more than a scientific curiosity: its discovery by Europeans was transforming it into a new commodity for which there was a seemingly insatiable demand, similar to that for spices in the Middle Ages. This mysterious beverage, which introduced to the world of post-medieval European exotic culture of pleasure, had the potential to invigorate the by now increasingly moribund trade between East and West by infusing it with the fresh blood that it so desperately needed.

A flotilla of ships of the East India Company that weighed anchor and set out for Yemen in 1610 also initiated the expansion of the traditional map of coffee consumption. In 1616 the Dutchman Pieter van den Brocke was in Mocha buying up a huge amount of coffee. In a short time, all of Yemen's ports along the Red Sea were witness to a lively surge in trade, to newly- formed companies seeking to take part in it, and to a new social context created by European merchants doing business with local producers and factors.

In the seventeenth and eighteenth centuries, the coffee trade was one of the principal economic elements that determined European political balances. English, French, and Dutch companies were engaged in cutthroat competition for market share with one another but the wealth that they generated in the process brought about a number of momentous changes in European social and political life. Venice, which was one of the richest economies in the world in medieval times but lagged seriously behind its rivals in the coffee trade. Holland, which had the excellent foresight to establish its own coffee plantations in Java and use the coffee that was produced there to undercut the European market by a substantial margin while also causing considerable economic pain for its rivals- especially the English. Meanwhile the stream of silver from the New World mines had turned into a torrent that flooded into the eastern Mediterranean in search of goods to buy.

The Dutch experience in the eastern Mediterranean was the demonstration that the monopoly that Yemen had, as late as the eighteenth century, over coffee could be broken. Henceforth coffee plantations would be established everywhere else in the world where the right climatic and soil conditions obtained (Işın 2001).

There were problems occurring in the supply of coffee because of the great increase in demand. Most coffee was imported from the Middle East and in particular Yemen. Export of seed was forbidden (Bramah E. and Bramah J. 1995). To maintain tight control of their profitable coffee trade, Arab traders sold only boiled and roasted beans. Coffee beans that could germinate and grow into fruit-bearing coffee plants were not allowed out of Arabia. It was not until the early seventeenth century that a Moslem pilgrim smuggled the first fertile beans into India. Baba Budan was reputedly the fellow who snatched seven seeds and tied them around his waist before continuing his holy pilgrimage to Mecca. It is said that when he returned home, he planted the seed and nurtured his prolific bushes and started the cultivation of coffee in India (Perry 1991). Although the first smuggling seemed to be a religious case, the following enterprises that were similar should be related to the trading politics of the European countries.

For the first time a coffee bean was brought from an agricultural area directly to the northern Europe, Amsterdam, by the Dutch in 1616. In 1658 coffee agriculture had started in Sri Lanka. The seedlings were being brought from Amsterdam. In 1699, a Dutch man succeeded in sending the coffee plant from Malabar to Java and cultivating it. Afterwards the Dutch people spread the agriculture of coffee systematically through

the islands they owned, respectively Sumatra, Bali, Timor and Celebes. Dating from 1718 coffee was cultivated in Surinam in America (Heise 2001).

The French people also wanted to have the coffee plant in their country, but they could not accomplish. By the 1700s the Dutch were reaping but the French had no coffee plant for a seed even in the 'Jardin des Plants' in Paris. They tried to cultivate a plant taken from Amsterdam but their attempt was not successful. In 1714 King Louis XIV of France was presented with a little coffee tree as a favor from the Dutch. This little tree thrived and beard fruits. The seeds taken to the French colonies by the years had big effects on the French coffee agriculture. Thus after 1715 in Haiti (Santo Domingo) and after 1716 in Bourbon French coffee was cultivated.

Transportation of the seedlings was a big problem for the applicant coffee producers. The colonist officers or the captains who transported the plants made history. The most famous of them is the French captain Gabriel Mathieu de Clieu. In 1720 he brought a coffee seedling from 'Jardin des Plants' to Martinique by the Atlantic Ocean. This incident takes place in the French history books. By means of the Caribbean Islands' convenient conditions for coffee agriculture, the seedling brought thrived.

Brazil, which is known as the world's coffee garden today, surpassed its rivals in the nineteenth century. Formerly sugarcane was being cultivated there. After 1752 an intensive coffee agriculture had started.

In 1730 the British people, who started to be interested in coffee, brought it to Jamaica. In 1740 the Spanish Jesuit brought it to the Philippines, and in 1748 coffee reached to Cuba from Santo Domingo. It was cultivated in Guatemala beginning from 1750. After 1755 in Puerto Rico, after 1784 in Venezuela, after 1790 in Mexico and Colombia coffee started to be cultivated, and in 1840 in India, in 1787 in the Middle Africa, and after a while in the East Africa the British people started a large scale coffee agriculture, and in 1876 the coffee agriculture reached in Australia (Heise 2001).

Today the coffee agriculture is being done in over seventy countries in the world. Some of them only with the aim of exportation, and most of them to cover their own requirements are cultivating coffee (Heise 2001).

The coffee beverage was brought to Paris as a vogue, to Vienna as a war spoil and to London as a medicine (Toros 1998). The beverage, which was introduced to Europe by the Turks, firstly took root in Venice.

The Europeans who shared what remained to them of the Mediterranean coast eyed the conspicuous splendours of Suleyman the Magnificent. Coffee was made

known by all the ambassadors, merchants, explorers and adventurers through the ceremonial courtesies extended to them, and mention of coffee, or some word recognizably similar, flits through correspondence and writings of the time. At this period, coffee, which was still inseparable from the Oriental ambience surrounded it, made slow progress into Europe. In the sixteenth century, it was found dangerous to be seen drinking such a Muslim beverage as coffee at a time when even to be the wrong kind of Christian could be punished by death in some countries (Bramah E. and Bramah J. 1995).

According to Alyanak (2001), the pleasures of the Turkish lounge were imported into Italy by the great merchant communities of Venice and Genoa in 1615. They modified it into their own style of coffee house, rather than the merits of the drink, which had to compete in the Christian with wine and ale (Bramah E. and Bramah J. 1995). The Christian world was sceptical about the pagan brew, and Pope Clement VII decided it required papal review. After one sip, His Holiness knew the drink was worthy of baptism. Sanctified, coffee no longer required an apothecary's prescription. Instead, it became the social beverage of Europe's middle class and was hawked alongside lemonade on every street corner. (Perry 1991)

Coffee was brought into France firstly by French travellers and introduced to Parisian society as a novelty in the 1650s says Bramah (1995). In Heise (2001) the date is given as 1644 and in Alyanak (2001) as 1643. By 1660 it was well established in Marseilles among merchants who traded with the Turkish Empire. It was deployed to apothecaries who sold it to the public and in a short time coffee beans in bales began to be imported from Egypt. The merchants of Lyons and the great trading cities of Southern France picked up the fashion. They wanted to grow coffee near Dijon, but their attempt was not successful. Meanwhile coffee was coming to Marseilles from the Levant by the shipload to supply the increasing demand.

The Turkish ambassador from Mohammed IV arrived in Paris in 1669 at the court of Louis XIV. He brought a large quantity of coffee with him for himself and his suite. A great deal of interest came into existence, although Suleyman Aga left after less than a year, the custom of drinking coffee remained behind. An Armenian named Pascal, believed to have once been in the service of the Turkish ambassador, did a smart business serving coffee from a kiosk at the St. Germain Fair in 1672. After the fair was closed, Pascal continued selling coffee. He sent boys round the Latin Quarter of Paris

calling ‘Café! Café!’ selling door to door from large urns which were heated by lamps or portable charcoal braziers.

Coffee is not made by gentlemen, but is made by gentlemen’s servants. So beginning in the seventeenth century, a chance combination of the occasional traveller setting his Levantine servant up in business combined with the expanding consciousness of new worlds and cultures, resulted in coffee houses appearing in England and continental Europe where they soon became a vogue (Bramah E. and Bramah J. 1995). In 1637, the first European coffeehouse opened in England, and within thirty years coffeehouses had replaced taverns as the island’s social, commercial, and political melting pots. They were called ‘penny universities’- places where anything might be discussed and learned for the price of a cup of coffee (Perry 1991). Coffee houses became important in London as meeting places for businessmen and men of letters. They were the places where great financial institutions such as Lloyd’s and the Stock Exchange grew from. Members still remember and treasure its coffee house origins even though it is now in the most modern of buildings. At Lloyd’s, there is a huge dealing space, which is still called ‘the room’ where transactions take place in and the messengers are still ‘waiters’.

The attractions of the early English coffee houses were limited because they did not serve alcohol. This rather restricted view of what should be offered to customers was matched until quite recently by the public houses and the ale houses which rarely provided coffee. Continental cafés took a broader view of what the public wanted and the result was a much more pleasant environment. In Paris, the first coffee houses were Turkish in style and appealed mostly to students and foreigners, but they were soon followed by more spacious and elegant establishments, which began to be patronised by men of fashion and intellectuals who had been accustomed to the salons of Parisian Society.

Meanwhile coffee had been reaching Central Europe by a different way. Western Europeans sent ships to the Levant for their coffee. Turks themselves had brought them to Viennese (Bramah E. and Bramah J. 1995).

The army of Muhammed IV encircled Vienna in 1683 and they desperately needed to get a message through the Turkish lines to the King of Poland, appealing for rescue. Only someone who spoke Turkish could be a chance of success. The man who swam the Danube and successfully delivered the message was Franz Georg Kolschitsky and the siege was raised. Twenty-five thousand tents, ten thousand oxen, five thousand

camels, a hundred thousand bushels of grain, a great many sacks of coffee were left behind the retreating Turks. The gold and oxen perhaps even the camels, quickly found a home. The coffee was given to Kolschitsky since he seemed to be the only man who knew what to do with it, having spent several years living among the Turks. He opened a café called the 'Blue Bottle'. Although at first the traditional Turkish coffee with its thick sediment of fine powder at the bottom of the cup was refused to be accepted by the Viennese. When Kolschitsky strained it and added milk and honey, they took to it with enthusiasm (Bramah E. and Bramah J. 1995). Although Bramah (1995) and Toros (1998) mention that coffee was brought to Vienna by the army of the Turks in 1683, according to Heise (2001) the first coffeehouse of Vienna was opened in 1638 and people had been drinking coffee for at least twenty years.

2.4. Coffee Brewing Methods

There are various ways of making coffee. It is both a ritual and a practical part of life. Unlike tea or cocoa, coffee lends itself readily to many different ways of making the infusion. All of the methods share the basic principle, which is to use hot water, to extract the caffeol, the natural essential oils that give coffee its wonderful aroma and flavour, from the ground beans. The resulting brew, or liquor, is a coffee infusion (WEB_11 2004). For over three hundred years people have been inventing all kinds of methods to obtain this liquor. The most popular methods will be described subsequently.

The Open Pot

Cowboy, or hobo coffee is one of the oldest and simplest ways to brew coffee. The things needed are water, coarse-ground coffee, heat and a container (Figure 2.9). The coffee and water in the pot are combined and brought just to a boil. The container is removed from the heat, and is covered and allowed to steep for five minutes. Then the coffee is strained or the grounds are allowed to settle at the bottom. In England an egg white was dropped into the coffee as it boiled to seize the floating debris. In Scandinavian countries fish skins were employed, but the best method is to add a tablespoon of cold water into the brewed coffee. The cold water pulls the grounds to the bottom of the pot (Perry 1991).

Figure 2.9. The Open Pot
(Source: Perry 1991)

The Jug Method

This is the simplest method of all. The coffee should be quite coarsely ground and then the hot water added. It is like the plunger method, but it does not have the convenience of the plunger to separate the coffee grounds from the infusion. Although the jug is always a serviceable stopgap method, it is not widely used today (WEB_11 2004).

The Plunger Method

This is the traditional French method and also is known as ‘french press’. It generally produces a 'heavy', full-flavour coffee and is quick and easy (WEB_12 2003). It is a more recent version of the jug method, a glass cylinder with a top, which has a plunger rod passing through it. There is a metal filter, which the rod is attached to, that fits securely inside the cylinder (Figure 2.10) (WEB_13 2004).

Figure 2.10. The Plunger Pot
(Source: Perry 1991)

The pot is warmed. The coffee, which is coarsely ground, is placed in the bottom. Perry (1991) recommends to use fine to medium ground coffee. Hot water is

added to the grounds and stirred. Then it is allowed to steep for three to five minutes. Then the plunger is pushed down to separate the coffee grounds from the coffee infusion. This method is only slightly less convenient than the filter method. It is today one of the two fastest growing ways to make fresh ground coffee (WEB_11 2004).

The Filter Method

The drip or filter method is possibly the most popular brewing method used today. It is the way to brew a clear, light bodied, fragrant cup of coffee. Finely or medium to fine ground coffee is placed in a paper or metal filter placed in a cone-shaped holder and nearly boiling water poured on top (Figure 2.11). For best results, a small quantity of water should be poured on first to wet the grounds. This will speed up the release of caffeol and insure maximum taste. The resulting brew filters through the unit into a pot or mug and is ready to drink. The coffee grounds remain in the cone (WEB_12 2003). Paper filters make it easy to discard grounds and have a clean coffeepot. The only disadvantage to using disposable filters is the flat papery flavour that sometimes slips into the brew. (Perry 1991). There are electric versions automating this process, which include heating the water, and in general make a better or more consistent cup of coffee than the manual version (Figure 2.12). They offer the convenience of electric percolators but they produce a better tasting cup of coffee (WEB_11 2004).

Figure 2.11. The manual filter pot
(Source: Perry 1991)

Figure 2.12. Braun KF 580 E filter coffee machine
(Source: WEB_14 2005)

The Vacuum Pot Method

This is possibly the most elegant way of brewing good coffee (Perry 1991). The vacuum method produces an excellent, sediment-free cup of coffee by using only glassware with no metal products in contact with the water or coffee. It is composed of two glass globes (Figure 2.13). Ground coffee held by a filter is placed in the upper globe. According to Perry (1991) the coffee should be medium-fine to finely ground. Cold water, poured into half of the lower globe leaves pressurised air in the other half. By heating the lower globe the air forces the water up a glass tube into the upper globe (WEB_12 2003). The pot is removed from heat after steeping for a few minutes. A vacuum forms as the temperature drops in the bottom globe, and the coffee is then sucked back into the lower globe through a screen. The lower globe is removable to pour (WEB_13 2004).

Figure 2.13. The Vacuum Pot
(Source: Perry 1991)

The Percolator Method

Water is boiled in the percolator, and it is forced up a metal stem into a filter basket containing coffee grounds, then it drips back into the bottom section of the percolator, circulating until the correct strength is reached (Figure 2.14) (WEB_13 2004). The resulting beverage should never be boiled, reboiled or recirculated through the coffee grounds. Only the water used to brew the coffee should be boiled before applying it to ground coffee, but unfortunately, this is the way that percolator works (WEB_15 2004).

Figure 2.14. The Percolator
(Source: WEB_15 2004)

Espresso

Espresso is simply another method by which coffee is brewed. In an espresso machine, hot water is forced through coffee at high pressure to obtain maximum flavour (Figure 2.15). The coffee should dribble out slowly. A crema, which is foamy and golden brown coloured, is the sign of a good cup (WEB_12 2003). Espresso coffee is also the basis for specialty drinks like cappuccino, cappuccino scuro, cappuccino chiaro, cappuccino freddo, skinny, tall, doppio, ristretto, lungo, caffé americano, macchiato, corretto, con panna, caffé freddo, caffé latte, latte macchiato. The specialty drinks' detailed descriptions can be seen at WEB_16 (2003).

Figure 2.15. A home version espresso machine
(Source: Perry 1991)

All the other methods involve a 'natural' form of infusion, but espresso does not (WEB_11 2004). Espresso coffee is prepared by a special extraction method. It produces a very concentrated, strong coffee in a short amount of time. At high pressure (about 9 atmospheres), softened water at a temperature of 90-95 Degrees C is forced through finely ground and specially roasted coffee. The contact between the water and the coffee varies from 25 to 35 seconds. The amount of ground coffee per cup varies from 6.5 to 7 grams. The coffee beans must be finely ground after being roasted to a medium to dark colour. This produces a cup of espresso with a volume of between 10 and 20 millilitres (WEB_17 2003).

The Moka Express Method

In addition to countertop espresso machine, there is a stovetop espresso pot. It is a double beaded, three-section stovetop pot combining the characteristics of espresso and percolator coffee (Figure 2.16) (WEB_11 2004). For some sources they are not espresso machines in the modern sense of the word. If used properly they produce a good coffee, but they solely rely on steam pressure to make the coffee (WEB_18 2004).

Figure 2.16. The Moka Pot
(Source: Perry 1991)

To make espresso with a moka pot, firstly the top section of the moka pot is unscrewed from the bottom section, the filter funnel is removed, and the bottom section is filled with cold fresh water right up to the brass safety valve. The funnel is packed with a finely ground espresso roast, and placed back in the bottom. The top section is firmly screwed onto the bottom and the moka pot is placed over medium heat. As the water in the base begins to boil, the hot water is forced up by the resulting vacuum through the middle-mounted filter holding the coffee, and then through a tube into the top section, from which the coffee is poured. The water extracts their rich, strong essence. When a gurgling sound is heard, the espresso is ready (Perry 1991). By far the method of choice of most Italian families, the 'Moka' pot makes a very aromatic and full-bodied coffee, not quite as strong and concentrated as a 'real' espresso, but extremely satisfying nonetheless (WEB_19 2003).

The Neapolitan Flip-Drip Method

The Neapolitan Flip-Drip, which is also known as 'Napoletana', has two metal cylinders sections and a filter basket fitting snugly between them (Figure 2.17). The top section has a spout and pours, and the bottom section acts as a boiler (Perry 1991). The filter basket full of drip-grind Italian-roast coffee goes in the middle, surmounted by an upside-down pot. The whole pot is flipped over to let the water filter through the coffee when the water boils, so that the top section is on the bottom. Although the blend used, which is typically a very dark roast in true "Neapolitan" traditions, ground quite fine,

yields a coffee that has definitely more robust flavor than a filter/drip method, the resulting brew is generally quite mild (WEB_19 2003).

Figure 2.17. The Neapolitan Flip-Drip
(Source: Perry 1991)

The Ibrik Method

The ibrik is a pot, which can be made of brass, copper, steal, aluminium etc. with a long narrow handle, which is the traditional vessel of making Turkish coffee, which is also known as Greek or Arab coffee (Perry 1991) (Figure 2.18). To brew Turkish coffee, for each cup of water two level-to-rounded teaspoons of finely-ground coffee and one level teaspoon of sugar for every teaspoon of coffee are added into the ibrik. This makes the coffee called 'medium-sweet'. There are three other sugar alternatives of Turkish coffee. If one and a half level teaspoon of sugar is added for each teaspoon of coffee, the coffee is called 'sweet'. If half level teaspoon of sugar is added for each teaspoon of coffee, the coffee is called 'light-sweet'. If no sugar is added, then it is called 'plain coffee'. The mixture is stirred to dissolve sugar if added, and the heat is turned on medium to high. After a while, the coffee begins to boil gently. It is left to continue boiling, but watched closely to avoid overflowing. Eventually the froth, which should have a darkish crust on top and which is the most important peculiarity of the Turkish coffee, starts to rise in the ibrik. When the froth fills the flare at the top of the pot, and at the point of overflowing, the ibrik is taken off the heat. Avoiding spoiling the froth, the coffee is immediately poured into the cups, filling each cup halfway first. Then the ibrik is brought to boil again to add some froth, and the rest of the coffee is poured into the cups eventually.

Figure 2.18. The Ibrik
(Source: Perry 1991)

The 'Myrrh' Brewing Method

Myrrh is a strong coffee, which belongs to the southeast region of Mardin, Urfa and Diyarbakır (Kayaoğlu 2001). Its name comes from Arabic, and derived from the word 'mur' which means 'bitter'. It is presented with ceremonies in hosting, 'sıra' nights, wedding feasts, condolence etc.

Myrrh is not prepared from a specific coffee. On condition that being of good quality every type of coffee can be used. At first the green coffee beans are roasted in a big paddle. At the same time they are being mixed with a special spoon. When the roasting finishes, the beans are grinded with a wooden mortar called 'dibek'. The ground coffee beans should be a bit coarser than the Turkish coffee. Although the coffee, which is grinded by dibek is acceptable, today mills and grinders are being used instead of dibek to grind the coffee. Myrrh is boiled again and again since it gets the favourable consistency. The coffee is boiled with water until it turns into telve, and then it is mixed with water to prepare the mixture called "sherbet".

A coffee jug, which is specially designed for myrrh is filled with this sherbet, and after adding two to three kilos of coffee it is again boiled. To avoid overflowing it is brought near and taken away, and after getting the favourable consistency it is taken from the fire. The coffee is poured to another jug called 'mutbak' after getting cold, before the coffee mix with the sediment at the bottom, and again some sherbet is added into it. This mixture again is poured to another mutbak after being completely boiled and before mixing with the sediment. The coffee in the mutbak is boiled for a while, and taken from the fire and left to cool. After cooling the coffee is poured to the biggest of the coffee jugs which are specially designed for myrrh and have lids over their

spouts, and lastly it is poured to the biggest zinc ibrik (Figure 2.19). If the myrrh in the ibrik, which has the solidity of grape molasses, colour the cup it is poured, it has reached the favourable consistency (WEB_20 2005).

Figure 2.19. The Equipment of Myrrh Brewing
(Source: WEB_20 2005)

Actually the brewing method of myrrh is opposed to the basic principles of coffee brewing. It is said that coffee should not be boiled but myrrh is being boiled for hours; six to seven times. Myrrh is prepared in big amounts and saved, and consumed in days or weeks, although it is said that coffee should not be saved. Although it is said that coffee should not be reheated, myrrh is reheated and drunk for several times (WEB_21 2004).

The Dutch Coffee Concentrate

The coffee and water are mixed in a glass and left to soak for twelve to twenty-four hours according to the strength wanted. By the help of a cheesecloth a funnel is lined and the funnel is set into a glass jar. The mixture of coffee and water is poured through this funnel and left to drain. After the complete drain the mixture is refrigerated. To make a cup of coffee, one to one and a half tablespoons of the mixture added to hot water (WEB_13 2004).

The Instant Coffee

In 1901 Japanese-American chemist Satori Kato of Chicago invented the first soluble ‘instant’ coffee. It was marketed commercially with the launch of Nescafe in 1938. It requires a spoon, a cup, and some hot water. It is prepared by adding the hot water into the cup containing the instant coffee and stirring it with a spoon.

Instant coffee has advantages over fresh brewed coffee like ease and convenience. It is hard to damage the flavour. It stays fresher longer, and most of all it is fast, cheap and clean. Instant coffee is manufactured, just like any other coffee, from ground beans. The first stage involves the preparation of a coffee concentrate from which the water is removed, either by heat, known as spray dried, or by freezing, to produce a soluble powder or granules (WEB_11 2004). Mostly poor to mediocre beans are used to make instant coffees. They are brewed in industrial size percolators until the grounds have been over extracted. Much of the aroma and taste has gone right out the smokestack, aromatic oils are then added back into the granules (Perry 1991).

The Flavoured Coffees

It is an interesting and fast growing area of the market. Over 100 different flavoured varieties are available today. Flavouring coffee is an old trick. The practice of adding cinnamon has been widespread in Mexico for many years, while it is traditional to add cardamom to coffee in the Middle East. The growth in popularity of flavoured coffee is proof of coffee's versatility and strength. The flavours are added directly to the beans by roasting them, then spraying them with a carrier oil and then the particular flavouring. Also adding a syrup to hot brewed coffee is another way to make a cup of flavoured coffee (WEB_11 2004).

CHAPTER 3

DEVELOPMENT OF COFFEE MAKERS IN THE HISTORY

The people who first brought coffee to Europe are said to be the merchants of Venice and Genoa in 1615. Coffee would be brought to Holland in 1625, to England in 1637, to France in 1643, and to the other countries in the following years, and according to Toros (1998) in 1670 the Spanish people who had met the coffee in the seventeenth century like the other Europeans brought it to America (Alyanak 2001). It would be considered as a 'Muslim drink' in the places it reached and would be compared with wine and ale. As the years pass, the coffee drinking habit and the coffeehouses would slowly gain their own place in the social life.

In the beginning, the preparation of this liquor of new taste and pleasure was like it was done in the countries from which it was brought. After being roasted and ground, coffee was boiled with water and then served with its thick sediment of fine powder at the bottom of the cup. The liquor, which was served in little handleless cups, was brewed in the ibrik as it was learned from the Turks. Later it was adapted to the tastes of the people. The sediment was strained, and milk and honey were added into the liquor preferably.

Varied customs and tastes seen in different cultures brought out new coffee makers, and had effected the designs of them which were developed to protect the aroma and the flavour of coffee as far as possible and to make use of the stimulating peculiarity and the pleasure of coffee.When the designs of the coffee makers from ibrik to the recent ones are examined, except the instant coffee which was developed in the beginning of the twentieth century in Chicago by a Japanese chemist called Santori Kato, it is seen that all of them are a part of a ritual (Alyanak 2001).

Apart from the oriental coffee brewing methods, three basic coffee brewing methods, which are filtering, percolating and espresso methods, are seen in the designs of the coffee makers which were developed till today. In the following of this chapter, the coffee makers of the orient that are brewing Turkish coffee and the coffee makers,

which were developed subsequent to them, or in other words, developed in the occident bringing new brewing methods, will be described.

3.1. Western Coffee Makers

3.1.1. The First Infusion Pots

In Europe the first coffee brewing method was to boil coffee and water together which was the way of brewing Turkish coffee. It was a new fashion and when the enthusiasm of it began to disappear, many people found the coffee of this method too bitter. In the coffeehouses, before being transferred into serving pots coffee was made in large containers over a fire and strained. Straining the grounds from the liquor worked but the big improvement was attained when the infusion method first appeared around 1710 in France. A clothbag, which was suspended by a string, was used to contain the powdered coffee in the large coffee maker. The boiling water was poured over it, and a milder liquor was obtained. Soon boiling method was largely abandoned in France and infusion method replaced it. In 1763 a French tinsmith named Donmartin added a ring to the bag, which fitted into the top of the pot.

In England and Holland this method of infusion remained popular longer than it was in France, and the reason was that it was very similar to making tea. Early eighteenth century coffee pots some of which with serving taps, many standing on three feet to leave room for a heater have survived (Figure 3.1, Figure 3.2). These bulbous pots resembling an oriental coffee maker, the Baghdad boiler in shape, seem to have been more fashionable than the tall silver coffee pots for a part of the eighteenth century.

Figure 3.1. Late eighteenth century Dutch coffee pot
(Source: Bramah E. and Bramah J. 1995)

Figure 3.2. Dutch painted pewter urn
(Source: Bramah E. and Bramah J. 1995)

Merchants brought with them the bulbous oriental ewer with its long curved spout and narrow neck, when coffee was first introduced into England during the reign of Charles II. They were actually intended to contain water or wine instead of coffee but the knowledge belonging that time shows that these oriental pots were being used for coffee in coffeehouses.

The first examples of the domestic coffee pots of English manufacture appeared in the late seventeenth century. They were made of metal because the way of producing porcelain and china was not discovered yet. The typical coffee pot of 1680 was in a plain lantern shape with a circular base, tapering sides and a handle at right angles to the spout. It had a conical lid that was attached to the handle by a hinge. The shape described here is also basically the shape of the ibrik which is an oriental coffee maker used to make Turkish coffee, an example of which can be seen in Figure 3.15. The similarity is that they both have circular bases with tapering sides, and handles at the right angles to the spouts. In fact they do not comprise the same components, and the shape of each common component are not similar, but the arrangement of common components are exactly the same. In Figure 3.3 a silver coffee pot of Benjamin Pyne, which was produced in 1704, is seen. This pot has the properties described of the typical coffee pot of 1680.

Figure 3.3. Silver coffee pot of 1704 by Benjamin Pyne
(Source: Bramah E. and Bramah J. 1995)

The examples seen in Figure 3.4, Figure 3.5 and Figure 3.6 have the same similarity with the oriental coffee makers in handle-spout arrangement and the tapering shape of the body, which was mentioned above. Also the bulbous shape of the coffee pot seen in Figure 3.5 resembles another oriental coffee maker, the Baghdad boiler, an example of which can be seen in Figure 3.16. These coffee pots belonging to different years are chosen to show the inspiration of the European coffee pots from the oriental coffee makers.

Figure 3.4. Three copper coffee pots of early nineteenth century
(Source: Bramah E. and Bramah J. 1995)

Figure 3.5. Coffee pot by Jean Baptiste Leroux, Lille, 1764
(Source: Bramah E. and Bramah J. 1995)

Figure 3.6. Silver coffee pot by R. Timbrell and B. Bentley of 1714
(Source: Bramah E. and Bramah J. 1995)

Going back to the late seventeenth century, at that time coffee pots, metal tea pots and chocolate pots were similar in shape. Later teapots, by having rounder forms, imitated the teapots imported from China, and chocolate pot handles remained at right angles to the spout while coffee pot handles changed its place to be opposite.

With the new century the design was changing, abandoning the severity. The curved spouts replaced the straight ones and domed lids became pointed in 1709. The handle had not changed yet; it was still at right angles to the spout. By 1720 the silver coffee pot had reached a peak of elegance. It had an octagonal base, a straight-sided body, a domed-lid, and a superbly balanced spout and handle. The handle placed to the opposite the spout and the thumbpiece that was a feature of the earlier handle

disappeared. Figure 3.7 to Figure 3.8 are chosen to show examples of metal coffee pots from different years that have handles placed opposite the spout (Bramah E.and Bramah J. 1995).

Figure 3.7. English copper coffee pot, 1820
(Source: Bramah E. and Bramah J. 1995)

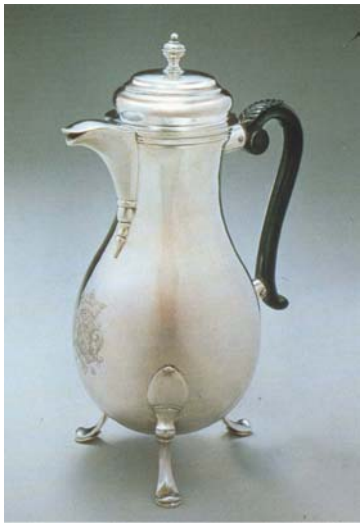

Figure 3.8. Coffee pot by Johann Georg Klosse, Ausburg, 1755-1757
(Source: Bramah E. and Bramah J. 1995)

3.1.2. The Ceramic Coffee Pot

Quantities of porcelain were brought from China to the west thanks to the expansion of trade, particularly of the British and Dutch East India Companies. The components and the production of this new substance were not known in the West yet, but an extensive industry in ceramics was created at the end of the discovery studies and

imitations, and the new ceramics completely transformed the quality of life for ordinary people in a few years.

Until the seventeenth century, the material used in plates and drinking vessels was wood or metal or heavy earthenware and sometimes glass. With the ceramic industry's development and the rapid spread of cheap ceramics, many homes had possessed these colourful products that were previously known only to the rich. These new cheap ceramics were highly decorated. While the manufacturer's choice of models were the best Chinese ones, European porcelain makers and various royal factories developed their own styles and patterns that were then copied by the potters. Four examples of ceramic pots of eighteenth and nineteenth century are seen in Figure 3.9 to Figure 3.12. The Chinese pot seen in Figure 3.11 is added among the European examples on account of its striking design, having the handle and spout at the right angles.

Figure 3.9. Ceramic pot, Weesp, 1765
(Source: Bramah E. and Bramah J. 1995)

Figure 3.10. Worcester coffee pot by Robert Hancock, 1765
(Source: Bramah E. and Bramah J. 1995)

Figure 3.11. Chinese pot with Imari pattern
(Source: Bramah E. and Bramah J. 1995)

Figure 3.12. St. Amand Nord coffee pot of mid-nineteenth century
(Source: Bramah E. and Bramah J. 1995)

Tea and coffee had an extraordinary increase in their popularity in the eighteenth century. The reason was that there were products to drink them from and brew them in. Tea had no problem that a big tea trade graded it, exported it from China and educated

the public what to expect from its taste. The public accepted the tea trade's standards and remained loyal to the teapot, the efforts of processing tea through a machine always failed. However, the coffee had no trade to give assistance, there was no consensus of opinion about its quality, and there were uncertainties of the process that the green coffee bean passes to be a pleasant drink. At this point, being experimented by a lot of people was not a surprising case. People searching ways of coffee brewing firstly found that it can be satisfactorily brewed in large quantities unlike tea, and the ideal coffee makers for this were biggins and urns (Bramah E.and Bramah J. 1995).

3.1.3. Biggins

It is said that the biggin started to be generally used in about 1817 through the efforts of a Mr. Biggin. The word might come from a Dutch word 'beggelin' which means to trickle. One certain thing about it is that the construction idea for it came from France, from the Donmartin's strainer bag holding the coffee onto a ring fitted inside a metal container. Biggins ,which were made in both earthenware and metal, could have a perforated metal container or a cloth bag inside (Figure 3.13, Figure 3.14, Figure 3.15).

Figure 3.13. Mid-European brass coffee biggin from the middle of the eighteenth century with an infusion bag on a ring and a spirit lamp inside the detachable base
(Source: Bramah E. and Bramah J. 1995)

Figure 3.14. English copper biggin and strainer bag from about 1840
(Source: Bramah E. and Bramah J. 1995)

Figure 3.15. Two copper German style biggins of mid-nineteenth century
(Source: Bramah E. and Bramah J. 1995)

Biggins were commonly used during the Victorian era in England and Holland. Variations occasionally occurred on their internal construction. The Evans apparatus of 1820 has a bag to contain the coffee that is suspended from a float.

Having a simple concept, biggins usually did not have patents. Nevertheless there is an interesting biggin that is from the mid-Victorian period. A coffee roaster man of St. Paul's Churchyard in London, who was called William Dakin, applied for a patent on his roasting plant in 1847. Before his patent was processed, he died. In 1848, his widow Elizabeth Dakin including in it a biggin with a rammer and screw, which forced the water through the grounds and the cloth into the body of the pot, took the patent. Her drawing shows the typical coffee pot shape of the time (Figure 3.16).

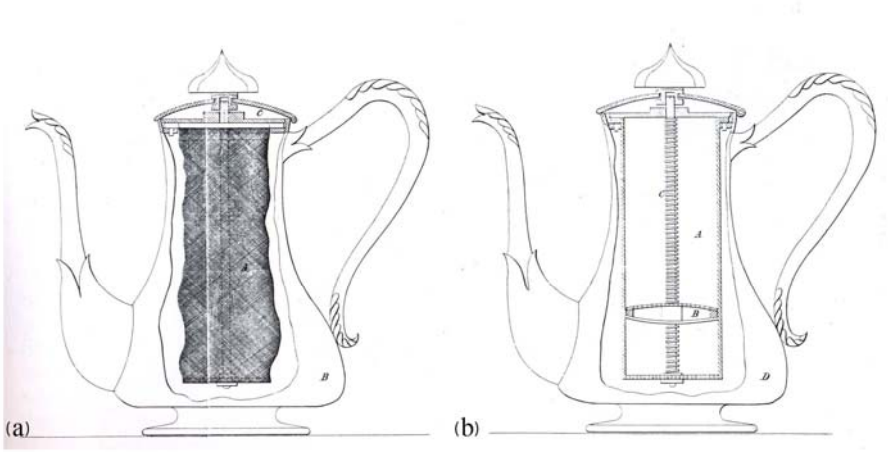

Figure 3.16. Patent drawings of Elizabeth Dakin's biggin of 1848
(Source: Bramah E. and Bramah J. 1995)

In the drawing (a) of Elizabeth Dakin, there is a cloth bag holding the coffee grounds, which has a central screw passing into the base plate. Boiling water is poured into the bag, the screw is turned by a key and the bag is collapsed upwards, squeezing out the liquor. In the drawing (b) another version is seen. In this version a solid cylinder with a perforated base replaces the bag. The coffee and boiling water are put in with the perforated diagram B at the lower end of the screw. As this diagram is wound up, the grounds rise with it and the liquor is strained into the body of the pot. In the United States, forty years later, this idea turned up as the Etruscan Biggin (Bramah E. and Bramah J. 1995).

3.1.4. Urns

Almost as long as the civilization, urns have been around as containers. They just were adapted as coffee makers. As early as 1690s, they were fitted with taps and heaters. In the eighteenth century when an internal chimney was added to them, they became similar to samovar.

When looking at the patent of Lancelot Palmer of 1786, it is perceived that the urn was by no means an uninteresting and unchanging object (Figure 3.17). It was capable of infinite complexity and adapted very easily to changing styles of decoration and outer form. It was most popular in the north of Europe as a coffee maker. In Netherlands and Germany where it reached its peak of variety, was manufactured by families who sometimes followed a tradition lasting for six or eight generations.

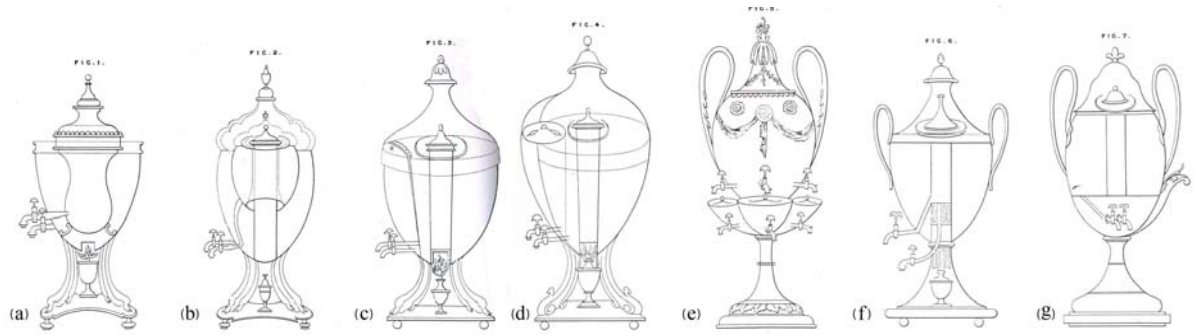

Figure 3.17. Lancelot Palmer's series of drawings for his patent of 1786
(Source: Bramah E. and Bramah J. 1995)

Lancelot Palmer's drawings illustrate the way that the chimney was used to carry the heat up the middle so that a considerable volume of liquid was affected. Also a variety of different internal constructions are seen in the drawings. The water jacket in (a) and (b) was insulating the coffee in the interior and also could be drawn off to dilute the liquor or to make tea. They were heated by a spirit lamp. The shapes and decorative styles, which were vogue during the last quarter of the eighteenth century, are seen in their designs.

There are various kinds of elaborate urns for dispensing the coffee, including some that dispensed coffee from an inner chamber and hot water from an outer jacket, which also served to keep the coffee warm. Indeed many innovations of the era were designed to keep the coffee hot either by employing an insulating jacket of water or air surrounding the pot, or a spirit lamp located in the base or both or a metal ingot located down the middle of interior or a charcoal brazier in the base of the urn.

At the end of the eighteenth century and beginning of the nineteenth century, there was a fashionable, tall, cylindrical boiler sitting on top of a square, fretted fire box, which was not immediately apparent as an urn. It was usually of tin, japanned in brilliant colours and exotic designs copied from oriental lacquer objects being imported from China and Japan. These, particularly early ones made at Pontypool of the work of Algood family, are rare but large number of the urns of the period has survived. In Figure 3.18 a group of japanned urns of the late eighteenth century are seen. They are examples of the Algood family showing the influence of the oriental lacquer-ware being imported at that time. Japanning of this quality was a slow and expensive process but easily withstood the heat from the charcoal brazier in the base of the urn.

Figure 3.18. A group of japanned urns from the late eighteenth century
(Source: Bramah E. and Bramah J. 1995)

In Figure 3.19 a single two-tier Sheffield urn of 1795 is seen. It is for making coffee and tea. The water fed from a tap that is in the revolving top into three separate infusers in the base. Also these infusers, which were for coffee, green tea and black tea, each had its own tap. The letter ‘c’ indicates the tap for coffee. There was a heated metal ingot in a jacket in the upper section, and the boiling water was kept hot by the help of it.

Figure 3.19. Single two-tier Sheffield urn of 1795 for making coffee and tea
(Source: Bramah E. and Bramah J. 1995)

Figure 3.20 is a nineteenth century English urn with classic shape. It is heated by an iron ingot in a jacket down the middle of the interior.

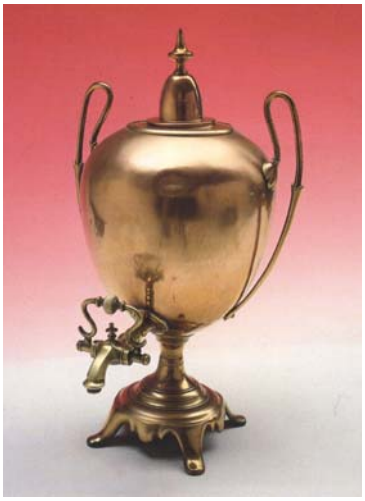

Figure 3.20. Nineteenth century English urn
(Source: Bramah E. and Bramah J. 1995)

In Figure 3.21 there are three patented urn drawings. (a) is George Sharper's urn dated 1827. The purpose of this improved table urn was to supply boiling water from one point and at the same time coffee from another part. (b) is John Tucker's urn of 1835. There is a second vessel added within the ordinary urn, by means of which hot water can be added as and when needed. (c) is William Padley's urn dated 1877, which has an air jacket (Bramah E. and Bramah J. 1995).

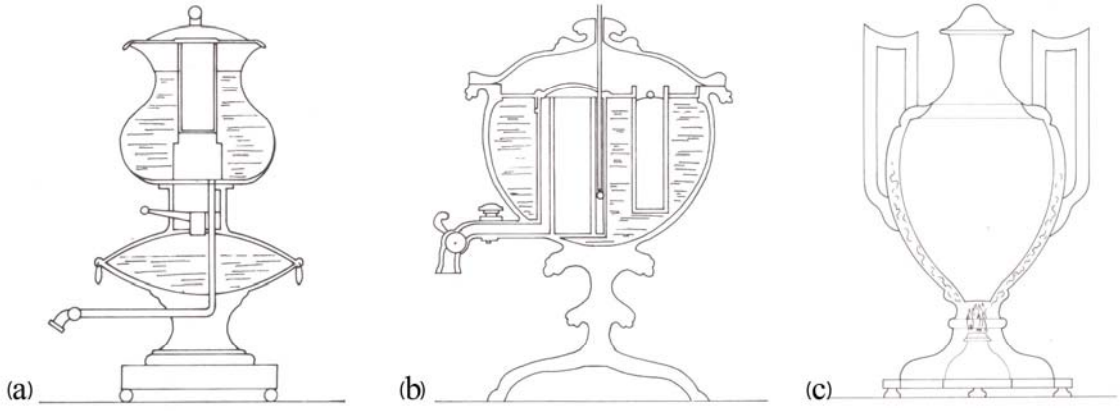

Figure 3.21. Patent drawings
(Source: Bramah E. and Bramah J. 1995)

3.1.5. The French Drip Pot

The first step towards the creation of the French drip pot was taken by Donmartin. When he put a cloth bag onto a ring and fitted it into a pot in 1763, he took the first step of a classic coffee maker, which is present today. In England, in 1795, drip pots were being produced in Sheffieldplate. In France, probably they were known before the French revolution, and was brought across the Channel by French refugees.

Archbishop of Paris, Jean Baptiste de Belloy is known as the person who first popularised the drip pot and even designed it. He gave the device his name. During his long life between 1709 and 1808, he would have been able to influence a lot of people with his opinions. It was about this time in Europe that the notion that coffee should never be boiled was gaining acceptance, and he influenced people that coffee should not be boiled that otherwise the flavor would be ruined. The two-tier de Belloy pot has a strainer as the base of the upper part and a spout with a stopper in the lower part (Figure 3.22). Coffee powder was put into the top section and pressed down with a rammer in order to prevent the water passing through too quickly and having a failed liquor without qualities of the coffee. The resistance of the air trapped in the bottom by the stopper delayed the filtering process. When the powder was thought to be saturated completely, the stopper was removed to let the liquor filter slowly through the compacted coffee into the pot.

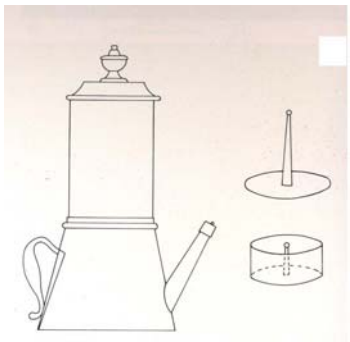

Figure 3.22. Section drawing of the de Belloy pot of about 1800 with filter basket and rammer (Source: Bramah E. and Bramah J. 1995)

In France, drip pot soon became very popular. Apart from the public, to be easily manufactured in base or precious metals or ceramics it became popular among the manufacturers. It could be small and gold-plated or large and tin-plated, and it could be chased, engraved and fretted (Figure3.23). The exterior of the drip pot changed as the

fashions changed. In Germany it was fitted into the Biedermeier style and was suited to the classic straight lines of the time of Napoleon I in France. The English never took to it. When compared with the fat teapot that they were used to, it had an alien look, and Napoleon did something similar for coffee drinking in England to what the Boston Tea Party did for tea drinking in the United States. Coffee, for the general public, became associated with the traditional enemy across the Channel, for the ones who drink coffee there were the simple silver or ceramic coffee pot.

Figure 3.23. French drip pots in metal
(Source: Bramah E. and Bramah J. 1995)

Although the flavour of the coffee prepared by drip pots were excellent, the liquor was tepid because of the metal loosing heat during the time taken by filtering process. There were solution like to reheat the drip pots on a kitchen stove or fitting with heat and a spirit heater like the one in Figure 3.24, but applying direct heat spoiled the brewed coffee. Another solution was insulation. In 1806 a tinsmith named Hadrot taken out a patent for a drip pot for filtering coffee without boiling and bathing it in air.

Figure 3.24. Superb drip pot on a stand with heater, Weber, 1831
(Source: Bramah E. and Bramah J. 1995)

The Hadrot drip pot was a double-skinned pot with a metal mesh for the filter. It also had a rammer with holes which stayed in place when the boiling water was poured in and spread it so that the powder was evenly saturated. Although it was a big development, an eccentric American adventurer named Thompson, who was better known as Count Rumford and living in Europe, improved it yet again in 1809.

Count Rumford invented the Rumford coffee pot in order to increase the consumption of coffee, and this rework of an existing object, became the only thing which he is still remembered (Figure 3.25). As he seems to be a competent coffee taster, his opinion was that coffee and water should not be boiled together, and the aromatic vapour rising from the brewed coffee should be returned into the liquor and not be allowed to escape. According to him, the essences, which make the liquor good, were contained in highly volatile oils, and reheated coffee was the worst of all.

Figure 3.25. Section drawing of Rumford pot
(Source: Bramah E. and Bramah J. 1995)

The water jacket surrounding the inner container, which was in fact a variation of the bain-marie commonly used for making sauces, was the special feature of the basic Rumford pot. The water jacket filled with hot water insulated and kept the coffee warm, and also if heated on a stove, avoided the coffee to be applied directly to heat.

In Germany and Austria the drip pot was widely adopted. It acquired a milk heater as a third tearsitting on top as it is seen in Figure 3.26. In this arrangement, the spirit lamp was put one storey up the base of the pot to get the most efficient use of heat. The spirit heater heats the water in the middle container. There is an internal chimney which takes the heat up to the milk warmer. When the water boils, it is

released through the coffee powder that is in a strainer into the bottom which becomes the coffee pot.

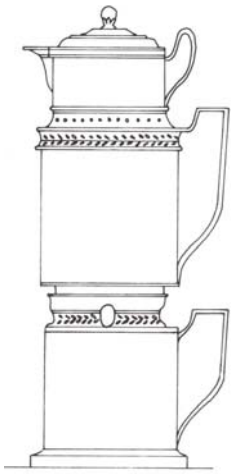

Figure 3.26. A type of three tier drip pot which was popular in Germany and Austria, 1838
(Source: Bramah E. and Bramah J. 1995)

Patent drawing of Hubert-Felix Palluy who was a Paris lampmaker is seen in Figure 3.27. The date of it is 1828. It was a two-tier pot. The spirit heater was in the space between the two sections in this example. There was a knob next to the handle, which was used to release the water over grounds and into the lower pot when the water boils.

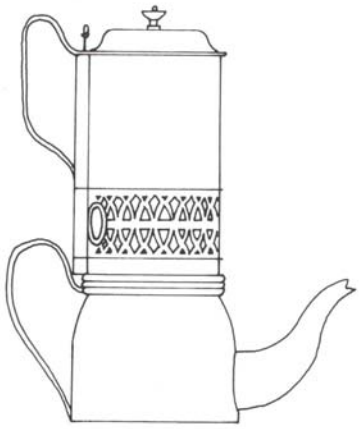

Figure 3.27. Patent drawing of 1828 two-tier pot by Hubert- Felix Palluy
(Source: Bramah E. and Bramah J. 1995)

In Figure 3.28 the patent drawing of Alexandre Lefranc is seen. It was a coffee maker of 1829 of Paris. It would have been silver or gold-plated. The special feature of this pot it had a spirit lamp on a pivot so that it remained upright when the coffee was being poured.

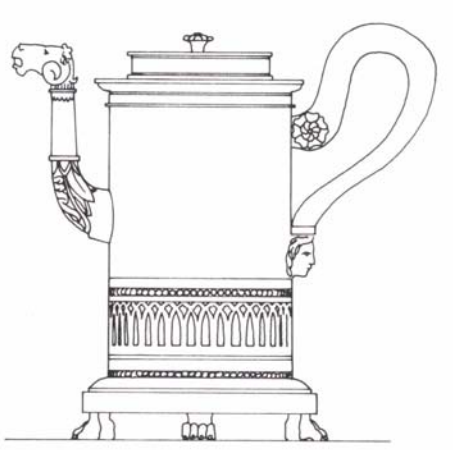

Figure 3.28. 1829 patent drawing of a coffee maker by Alexandre Lefranc
(Source: Bramah E. and Bramah J. 1995)

Back in Paris in 1819, reversible versions were developed by Morize. The bottom section of the drip pot was the boiler and the top section was the coffee pot, which was attached by means of bayonet fastenings upside down. The whole coffee maker was turned upside down when the water boiled. The water passed through the two filters that were holding coffee powder, across the middle. Then to leave the coffee pot boiler and the filters were detached.

The drip pot was the transition product between the coffee pot and the later coffee machines. As the consequence of the experiments done till that date, in which heated water behaves had been learned, and the next development would be to send boiling water up a tube to make coffee automatically in what was the first percolator (Bramah E. and Bramah J. 1995).

3.1.6. The First Percolators

Percolating and filtering are the same processes, but generally a percolator is supposed to have a different action from a filter pot. There is a hollow tube in the percolator through which hot water passes and pours over the grounds. When water in the percolator is heated, its volume increases and the air above it expands more, and has to go somewhere so it goes up the tube. There are two basic kinds of percolator. Their action is described as follows:

1. If a hollow tube is put into an open container of water which is heated from below, the hot water will rise through the tube in small amounts and out

through the top. Because the container is not tightly closed, the action is gentle and continuous.

2. If a hollow tube is put into a hermetically closed container of water, the pressure of heated air pressing on the heated water will cause the whole volume of water to pass through the tube in a single action (Bramah E. and Bramah J. 1995, p.70).

The coffee percolator was invented by a Parisian metalsmith named Laurens. It was the first type of the pumping percolator and the first coffee machine that boiled its own water (Figure 3.29). It took several years to establish itself which was an important departure from the familiar drip pot, and the true pumping percolator or the circulating percolator would be developed later and could get its universal popularity in the twentieth century, when it arrived from America as an American invention.

Figure 3.29. Lauren's French percolator of 1819
(Source: Bramah E. and Bramah J. 1995)

In 1820 another version of percolator, which was between the first type and the true pumping percolators, was introduced by Gaudet. His pot had two filters confining the coffee. They were in an inner canister and each of them had a short pipe extending upwards from the middle (Figure3.30). These formed a tube when they were fitted together. The bottom of the pot was filled with cold water through this tube until the level reached the bottom of the lower filter. The water rose up the tube and over the coffee when the pot is heated on a stove. The water also saturated the coffee from below. The pressure was increased by a stopper in the spout of the pot. There was a filter cloth over the metal mesh for straining the powder from the liquor. Using filter clothes solved one problem of the drip filters, which was that the grains escaped through the holes in the filter according to the coffee grind. They were being used until the arrival of the commercial filter papers.

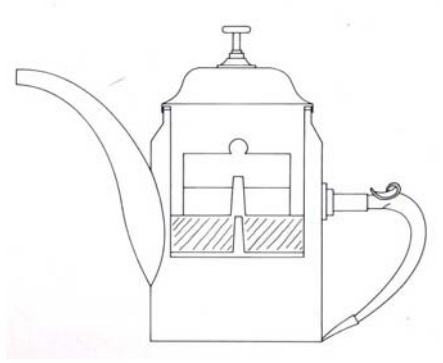

Figure 3.30. Gaudet's pot of 1820
(Source: Bramah E. and Bramah J. 1995)

Lauren's and Gaudet's percolators were of the first type. What was needed was a percolator of the second type that would boil the water and send it up and over the coffee to return it as liquor to the bottom. The machine should be removed from the heat otherwise the process would be repeated when the liquor boiled. In 1827 Nicholas-Felix Durant, a manufacturer, designed such a machine with a self-extinguishing spirit lamp, but unfortunately it was far too complex (Figure 3. 31).

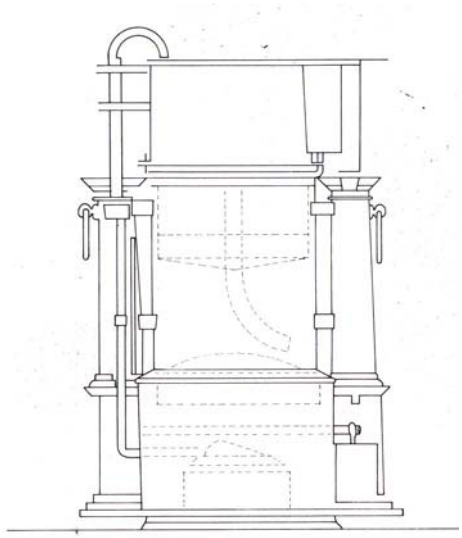

Figure 3.31. Durant's percolator of 1827
(Source: Bramah E. and Bramah J. 1995)

The French had become the masters of automation while the English were developing engines to power the Industrial Revolution. The musical boxes and the mechanical toys were the products of eighteenth century's step-by step mechanism. Durant's coffee machine was of this tradition. The idea of the pot is the lid of the spirit lamp to be hold open when the circle starts. When the water boils, it passes up through the tube to the top of the machine and drops of hot water activate a complicated arrangement of spring, valves, hooks and triggers which release the lid of the heater so

that it springs shut. The water filters back into the boiler through the coffee when the hot air cools. Durant realised that it was fallible at too many points and was not going to work as soon as it was patented out, and he made it over to a Parisian lamp-maker, Louis François Capy.

Capy studied on its components, and turned them into a conceivable machine. He made the lid of the spirit lamp held open by the weight of the cold water in the boiler. When the heated water passes up the tube, the empty boiler rises on springs to release the lid. Capy's machine was the first completely automatic machine.

In London, Mr Jones of the Strand was selling a rather simpler machine at the same time (Figure 3.32). This machine had the tube taken outside the pot and then in again through the lid to a top container. The boiling water passes through a valve in the base of this and then through the coffee.

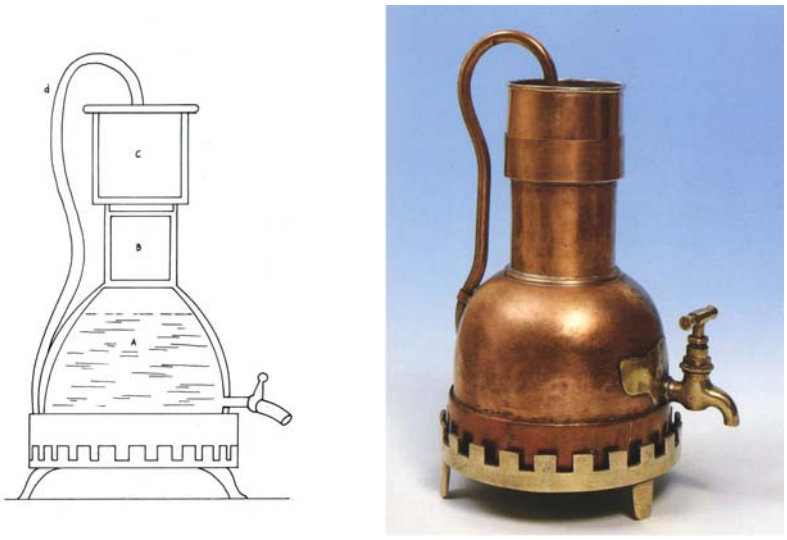

Figure 3.32. Mr Jones's percolator
(Source: Bramah E. and Bramah J. 1995)

There also was another French patent, which has a valve between the top two sections. It was Jacques-Augustin Gandais' patent dating from 1827.

Coffee without boiling was provided by this first generation of percolators that were crafted in copper and bronze, but they were not the only machines on the market. There were steam pressure machines which were preparing stronger coffee (Bramah E. and Bramah J. 1995).

3.1.7. Steam Pressure Machines

Dr. Romershausen in Germany first brought out pressure machines in the second decade of the nineteenth century (Figure 3.33). While percolators raised water up a tube by means of the pressure exerted by hot air and allow it to fall down, pressure machines forced the boiling water through the grounds by means of steam pressure. In 1822 Dr. Romershausen's pressure machine design was patented in England by Jean Louis Rabaut (Figure 3.34).

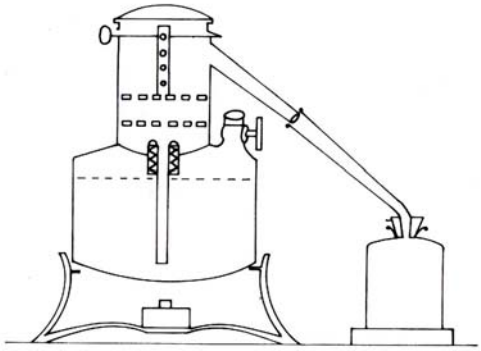

Figure 3.33. Design drawing of Dr. Romerhausen's pressure coffee machine
(Source: Bramah E. and Bramah J. 1995)

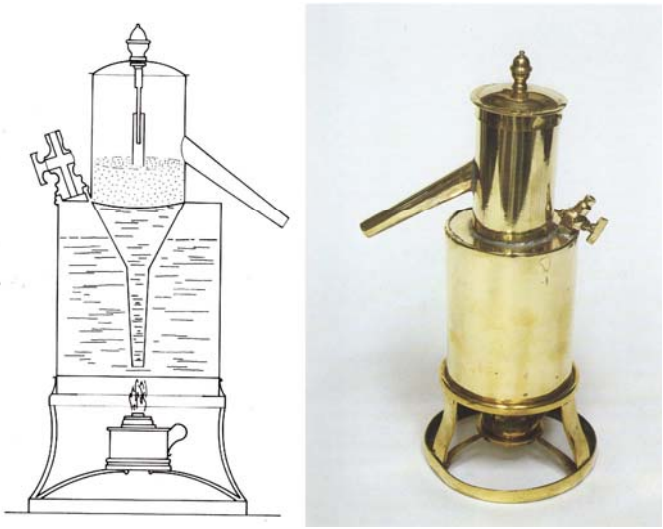

Figure 3.34. Rabaut's patent drawing of 1822 and the brass version of his pressure coffee machine
(Source: Bramah E. and Bramah J. 1995)

There were several journals launched in Europe, which involved inventions of the European inventors and inevitably told the inventors what their rivals were doing. Also by these journals it was easy to steal and use the ideas. Dr. Romershausen's

extraction presses' drawings were printed in Dingler's Journal in 1821, and Rabaut might have copied his coffee machine from such a drawing.

The Romerhausen extraction machine was very powerful that required the boiling water to force its way through the coffee basket into the upper chamber and then out through the exit pipe into a coffee pot, while percolators which heated the water in closed containers allowed it to flow unimpeded through the exit tube. The coffee obtained was very strong because of another physics principle added; under pressure, the heat of boiling water is above 100°C so that the grounds were not only boiled but really over-extracted. These machines producing a harsh and bitter brew were very economical, and less coffee was needed.

A great respect for steam power was required to operate this machine and the pressure machines to follow. To put the cold water in, the screwcock at the top of the boiler should be loosened. Then it should be tightened to make the boiler airtight and create pressure. To avoid an explosive build-up of steam, as soon as the boiling water had raised the heater should be extinguished. The lid should be fitted to ensure a hermetic seal. The coffee should be properly compacted between its two filters, and the safety valve should be checked. Although the action was sudden and by modern standards was dangerous, it was adopted and adapted to many subsequent machines.

In 1824, a French version by Caseneuve followed the Romerhausen's and Rabaut's (Figure 3.35). It had a few additional features to their design, and that was successful enough for its patent to be kept in operation for five years.

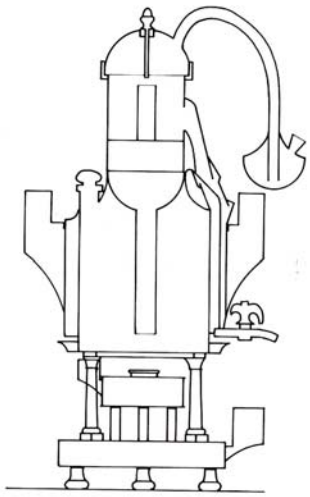

Figure 3.35. Caseneuve's pressure machine of 1824
(Source: Bramah E. and Bramah J. 1995)

Caseneuve's pressure machine worked in the same way with the precedents. The difference was it had a tap at the end of the exit pipe to hold the coffee liquor. The tube at the top of the machine acted as a safety valve. The small vessel of water was to prevent air getting in to mix with the precious coffee steam.

In 1833 an English brazier named Samuel Parker developed this system into a completely new design. The design of his machine was very English having a sturdy style without being elegant when compared with its French contemporaries (Figure 3.36).

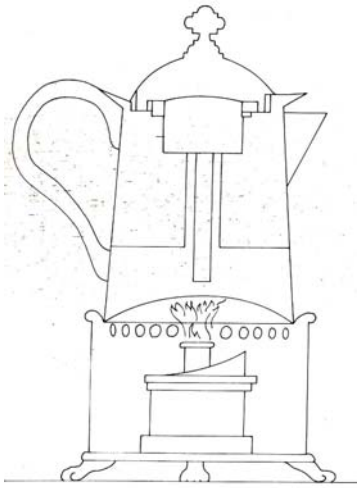

Figure 3.36. Samuel Parker's Steam Fountain's patent drawing of 1833
(Source: Bramah E. and Bramah J. 1995)

Parker's pressure machine works with the principle of forcing water upwards through a container of coffee grounds. Steam pressure sends the boiling water up to the tube from the bottom compartment through the container of the coffee grounds. The force of the steam is so strong that the liquor passing through the grounds hits the lid and flows back into the upper compartment. To quote Parker's words, "I cause the whole operation, except the application of the heat, to take place within a vessel of the shape of an ordinary coffee pot instead of making extract in one vessel and causing it to flow thence into the coffee pot or some other receptacle, as is the case in Rabaut's apparatus". His earliest machines were made of metal including the lid, but in his later models the lid was made of glass making the coffee brewing process seen, and it became known as 'Parker's Steam Fountain'.

After years the design reached the Continent, to Germany and Austria where it was adopted and developed. It had evolved into the 'Vienna Incomparable' in the nineteenth century, and it reached even to the United States (Figure 3.37). For a long

time it appeared in the catalogue of the Army and Navy Stores in London. It could be in different sizes, sometimes having a pouring lip and sometimes with a serving tap. It survived well into the 1900s.

Figure 3.37. A version of Parker design which is known as 'Vienna Incomparable'
(Source: Bramah E. and Bramah J. 1995)

In 1838 Alexandre Lebrun of Paris invented a coffee maker using the steam pressure downwards rather than upwards (Figure 3.38). The cold water is poured on top. The coffee is put in a filter box in the bottom of the pot. The lid is screwed down and the spirit in the saucer heats the pot, and coffee is automatically dispensed into a cup within four minutes. The Lebrun pressure pot spread to Italy, Germany and Austria. It was copied , improved and patented by local manufacturers, and it stayed popular for decades.

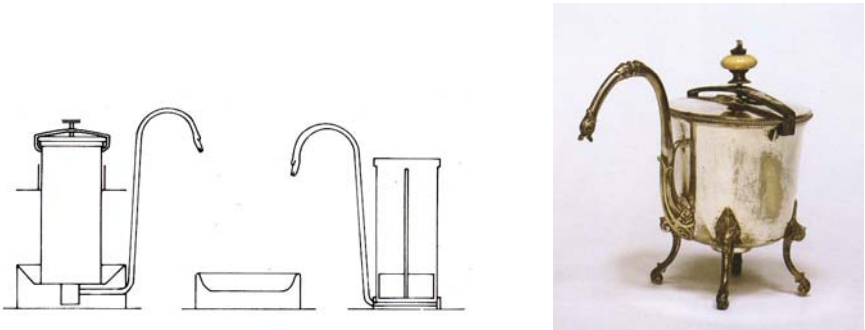

Figure 3.38. French patent drawing of Lebrun coffee pot of 1838 and a late nineteenth century English version of Lebrun's design
(Source: Bramah E. and Bramah J. 1995)

The Cordier patent of 1844 had the Lebrun pot's varieties. The Figure 3.39 is one of Cordier's drawings. In this pot, the boiling water is transferred through the coffee grounds into a pot. It is possible to make a greater quantity of coffee with this pot, and it has a later version in the century, which allows using any pot of suitable size as the coffee container with the pot

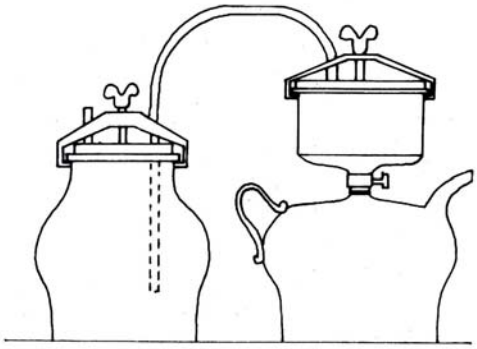

Figure 3.39. One of the Cordier's pressure pot drawings of 1844
(Source: Bramah E. and Bramah J. 1995)

Now, new inventions had syphon tubes as standard components, and syphon tubes became very important in balancing or vacuum syphons. Glass started to be used to make the coffee makers a fashionable furnishing and designing coffee makers became a game that anybody could play (Bramah E. and Bramah J. 1995).

3.1.8. The Glass Balloon

Glass coffee makers had been used in Germany for some years and during 1830s they started to be used in the rest of Europe. Glass became popular to be affordable and fashionable. Efficient new furnaces, which were using coal instead of wood, were producing great quantities of pressed and blown tableware.

The first glass used coffee makers of France had a metal boiler. The boiling water in the metal boiler was raised by the steam pressure to pass upwards into a glass flask and mixed with the grounds in it. When the heater was removed and the air in the boiler condensed, a partial vacuum was created. This vacuum drew the coffee liquor back through a filter.

In 1838 there was a patent taken out by a French man named Richard. The design was entirely of glass (Figure 3.40). It was exactly copied from an inventor from Berlin. The principle is as defined above; after being heated in the lower part, the cold

water rises into the upper part, and mixes with the coffee and when the machine is taken off the heat, the liquor filters back through the strainer into the bottom part again.

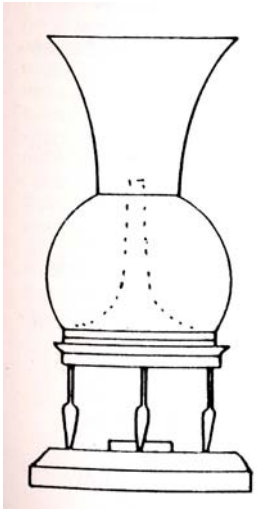

Figure 3.40. A design by Loeff of Berlin which was copied by Richard in a French patent (Source: Bramah E. and Bramah J. 1995)

Although it behaved like a percolator, its internal arrangement has an interesting feature that instead of having a straight central tube, it had an inverted funnel that collects the heated water from almost the whole base of the boiler. It never became as popular as the straight tube. The vase-shaped top of the pot was characteristically German and a milk heater could be set there.

In Figure 3.41 the vase-shaped flask of Benaut of Alsace is seen. In Figure 3.42 an England version, which was manufactured by Mority Platow, is seen. The Platow machine was successful and survived for many years. It has various sizes and it is usually made of copper and brass, sometimes with the vase in copper instead of glass, and some of them were japanned. The flavour of the liquor obtained was very good because of two reasons. First reason was that the boiling water rose and mixed the grounds instead of being forced through them. Second reason was that the temperature was below boiling point when the liquor was strained back. It had a method having all the merits of the pressure machine while leaving its disadvantages.

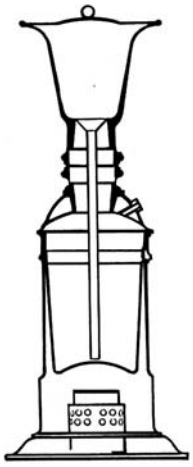

Figure 3.41. Beunat of Alsace's patent drawing of 1837
(Source: Bramah E. and Bramah J. 1995)

Figure 3.42. A Platow machine
(Source: Bramah E. and Bramah J. 1995)

A more fragile coffee maker that was obviously originated in a laboratory was coming into use. It was employing the same principle with the contemporary ones. Two glass flasks connected by a cork and a glass tube extending down from the upper to the lower flask constituted it, and it was mounted on a stand. In 1841 Madame Vassieux who was apparently familiar with the double glass flask machine improved it. She added a crystal connecting stopper to replace the usual cork one, a little coronet to decorate the lid, and a tap to the lower flask of a double glass machine so that the coffee could be drawn off without disassembling the machine (Figure 3.43).

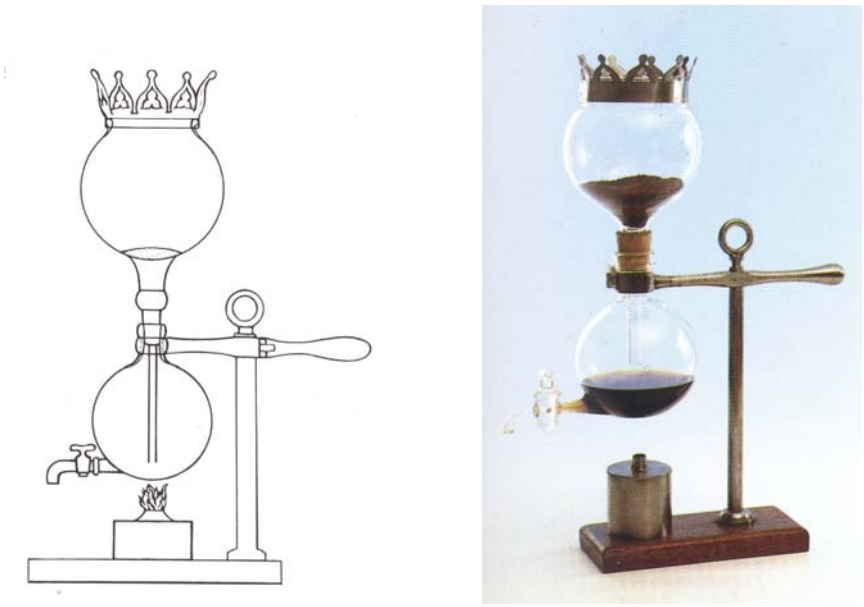

Figure 3.43. Madame Vassieux's patent drawing of double glass cafetiere of 1841 and its replica (Source: Bramah E. and Bramah J. 1995)

On 24th January 1842, three days after her patent was granted Madame Vassieux had new improvements. She thought that it would be helpful to have some device to follow how much water was left in the bottom flask during the brewing process. She added a hollow glass tube rising from the outlet pipe (Figure 3.44). Because the lower flask was often made of metal and unless the spirit lamp was removed as soon as the water passed up out of it the neck of the upper glass flaks would shatter.

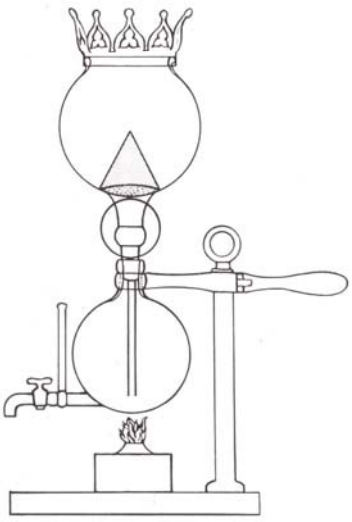

Figure 3.44. Madame Vassieux's patent drawing showing the improvements (Source: Bramah E. and Bramah J. 1995)

The level of the water in the tube fell as the water rose into the upper flask and the water in the bottom flask fell. She called this tube ‘manometer’. Later, to give a big area of surface and to have more holes on the filter she changed the shape of the filter.

There appeared a completely different arrangement of flask in 1842. The design was of Rosa Galy-Cazalat from Paris. She placed the spirit heater round the neck of the machine. After being heated in the upper flask, the water passes through the coffee into the lower flask. To extinguish the flame, steam is redirected back into the lamp.

In Figure 3.45 one of her coffee machine drawing is seen. The top flask is filled first because the cold water starts its operation here. The other parts are then assembled upside down on top of it. The machine is then reversed, the spirit poured in and lit. The water is forced by the steam into the top of the central tube, then downwards through the box shaped filter into the lower flask.

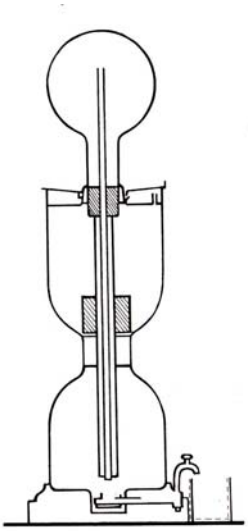

Figure 3.45. Rosa Galy-Cazalat’s coffee machine drawing
(Source: Bramah E. and Bramah J. 1995)

Miss Galy-Cazalat added more improvements a year later to her coffee machine which was intended to be manufactured commercially like Madame Vassieux’. These Frenchwomen’s success was remarkable that it was obtained among an intense competition. While the dominance of the metalsmiths in coffee making was demolished, also everything could be assembled from components. The coffee makers started to be seen in the dining room tables or sideboards rather than kitchens.

In Figure 3.46 an example of 1842 by Bastien is seen. In this example flasks are differently arranged. It consists of two laterally arranged flasks and a perforated

canister, which holds the ground coffee, attached by a bayonet clip under the lid of the receiving flask.

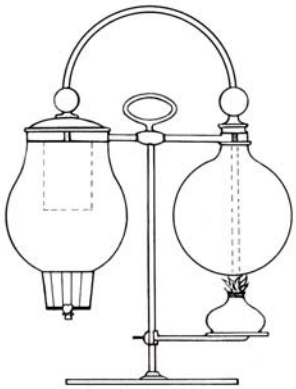

Figure 3.46. Bastien's lateral arranged flasks of 1842
(Source: Bramah E. and Bramah J. 1995)

In Figure 3.47 Fortrant's patent drawing is seen. This example has a different way of extinguishing. There is a self-extinguishing mechanism, which opearates when the liquor rises and pushes the float up and slackens the chain. Then the lid fall onto the flame. The coffee filters back when the air in the lower flask cools.

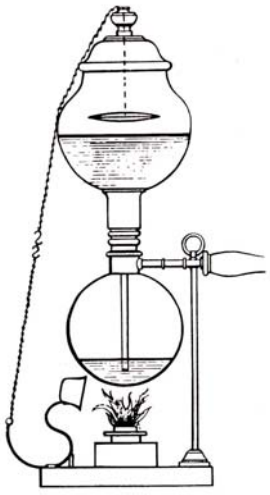

Figure 3.47. Fortant's patent drawing
(Source: Bramah E. and Bramah J. 1995)

Within about eight years, all-glass machines reached the limit of their practical variations. Then they had lost their popularity and dominance to be resurrected in America fifty years later with the advantage of toughened glass and enjoy a new vogue. Having passed into the repertoire of the coffee makers, the two-tier glass machines did

not disappear entirely but they were modified. The bottom flask was made in metal and the stand disappeared as the nineteenth century progressed. When the designs became boring, the two-tier coffee machine became one of many alternatives and the world moved on something new (Bramah E. and Bramah J. 1995).

3.1.9. Push and Pull Coffee makers

Inventors had tried ways to get boiling water quickly through the coffee. There were possibilities like forcing the water through by steam pressure or drawing it through using the force of a partial vacuum. These two processes had disadvantages that they were sudden and uncontrolled, and a new device was designed to get a good liquor in a reasonable time under the control of the user. That was the pneumatic pump.

In Figure 3.48 one of Dr. Romershausen's extraction presses of 1820 is seen. A hand pump was used to send water through coffee as an alternative to steam. The manual force obtained by the hand pump can work in two ways, pushing or pulling. A plunger is used for pushing and a syringe like thing is used for pulling. In England pulling method or exhaustion pump were preferred mostly.

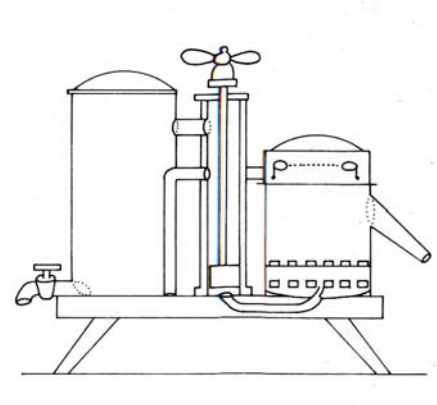

Figure 3.48. One of Romerhausen's extraction machine drawings of 1818
(Source: Bramah E. and Bramah J. 1995)

In Figure 3.49 Brain's vacuum or pneumatic filter of 1835 is seen. It had two parts with a mesh in between. Making a tight joint, the mesh was covered by a closely woven cloth or chamois leather. The piston of the exhaustion pump was pulled out to draw the liquor through after the coffee and then the boiling water were put into the top section.

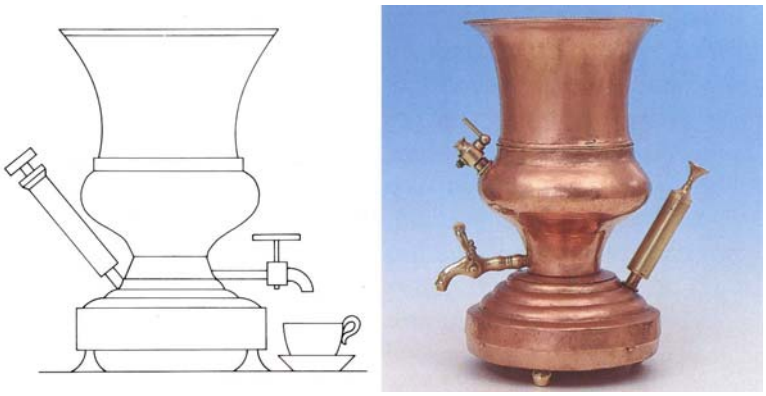

Figure 3.49. Brain's machine of 1835
(Source: Bramah E. and Bramah J. 1995)

In Figure 3.50 a more interesting pneumatic coffee pot is seen. It is Whitehead's French patent of 1840. It has the pump in the lid, and also it has a syringe, which draws the boiling water through the coffee. It could also be used for making tea. The same exhausting pump appeared on Tiesset's French patent of 1842 in Figure 3.51.

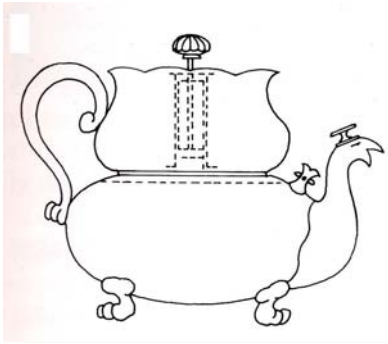

Figure 3.50. The drawing of John Whitehead's pot
(Source: Bramah E. and Bramah J. 1995)

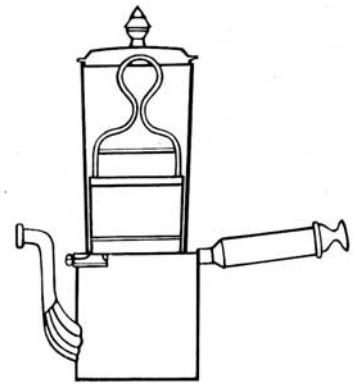

Figure 3.51. Tisset's patent drawing of 1842
(Source: Bramah E. and Bramah J. 1995)

The exhaustion pump's counterpart was the piston. In 1838 Robert Beart designed a machine, which one of the first of these (Figure 3.52). It was a machine that was efficient like the pump and that was more remarkable for strength than elegance. It was made of strong tin or brass. It had a perforated piston in the diameter of the inside of the cylinder and there was a piece of chamois leather fitted over the under side of it. That provides resistance while letting water to pass through slowly.

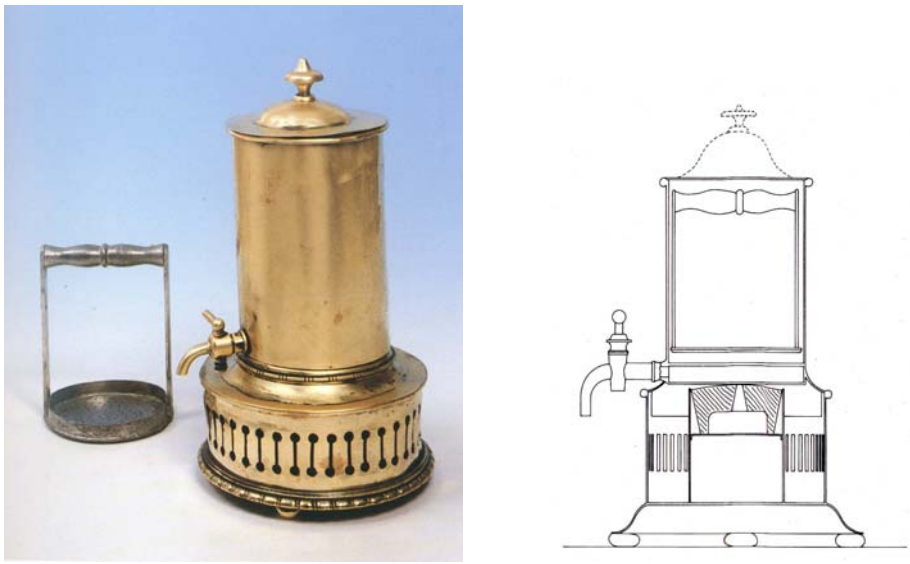

Figure 3.52. Robert Beart's piston coffee maker of 1838 and its patent drawing
(Source: Bramah E. and Bramah J. 1995)

The piston of the Beart's machine stayed at the bottom at the beginning of the operation. The coffee was put in and the boiling water was added, then by means of a handle the piston was raised. The vacuum that developed between the bottom of the pot and the rising piston, pulled the liquor through.

Several versions of Beart's machine could be found like a large one using a winch to raise the piston down, and another little one made of brass or copper intended for the dining room. The disadvantage of the design was that the piston was left in the raised position unwillingly. Designing a smaller piston was one solution, and in 1841, William Ward Andrew's achieved this (Figure 3.53). He put the piston next to the handle of the pot, in a separate column. The piston pushes the boiling water, which was put into the column, through the coffee into the body of the pot.

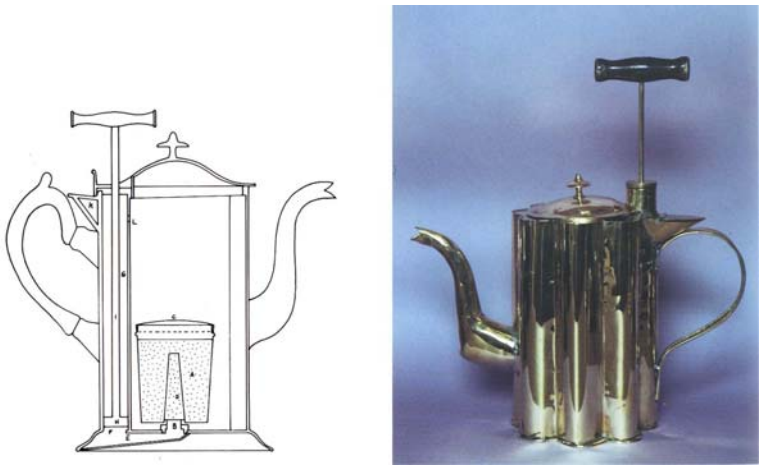

Figure 3.53. Ward Andrews' piston coffee pot of 1814
(Source: Bramah E. and Bramah J. 1995)

In 1873 there was a patent which was an attempt to combine the biggin with a coffee pot (Figure 3.54). It was the patent of Lavater's machine which was a drip pot having a rubber diaphragm that was pressed several times to add a little vacuum power to speed up the filtering action of the liquor. The top section contained a bag to hold the coffee grounds while they infused.

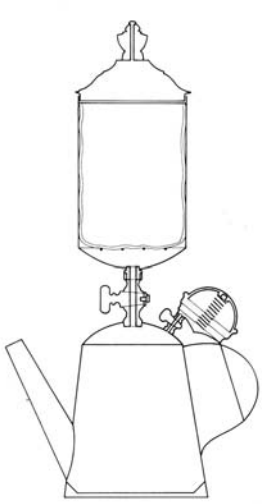

Figure 3.54. Lavater's patent drawing of 1874
(Source: Bramah E. and Bramah J. 1995)

It had disadvantages like to be complicated to manufacture, not to offer many opportunities to craftsmen and not to be automatic like the other machines, but it stood in the competition. During that period it had a rival, which was the classic British coffee maker throughout nearly the whole of the reign of Queen Victoria, the Napierian (Bramah E. and Bramah J. 1995).

3.1.10. The Napierian

It was the most enduring and typical of all nineteenth century English coffee makers. During the 1840s a marine engineer designed it, but it was not patented before it was really made up of standard laboratory equipment and did not have the artful little valves and stoppers. The inventor of the Napier coffee machine was James Napier.

The Napierian, as it was called, did have a medical look which did not however prove a handicap to its success, and was not complicated in its original form (Figure 3.55).

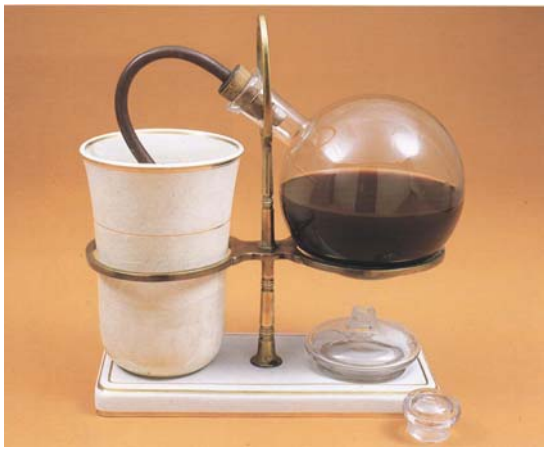

Figure 3.55. The basic Napier machine
(Source: Bramah E. and Bramah J. 1995)

The operation was simple. A little boiling water was put into a globe and some boiling water was poured over coffee grounds in a jar. Because it was not a fully automatic machine that boiling the water itself, the water was boiled separately. There was a metal tube connecting the two vessels, and it passed through a stopper in the neck of the globe to make an airtight joint. There was a strainer at the jar end of this tube. The machine was mounted on a stand with a spirit heater under the globe. The small volume of water that was in the globe boiled and created steam which passed through the tube and agitated the coffee and kept the temperature. Then the spirit heater was taken away, and the air in the globe condensed forming a particular vacuum. The coffee liquor was drawn back by means of this vacuum leaving the grounds in the jar. The brewing action was very fast. The stopper was taken and the globe became the coffee pot. The globe mostly was made of glass, and the jar could be made of glass, ceramic or metal.

The popularity of the Napierian continued for more than sixty years, and its silver plated examples still exist today. Some examples that followed the Napier's machine will be mentioned below.

In 1870, silversmiths called Thomas Smith & Son made the machine of silver under James Napier's personal direction. It is seen in Figure 3.56.

Figure 3.56. T. Smith & Son's silver-plated Napier machine
(Source: Bramah E. and Bramah J. 1995)

Although Napier did not patent his machine, other people registered their improvements. In Figure 3.57 a patent drawing from 1890, which belonged to Robertson, is seen. Robertson added a serving tap to the glass flask.

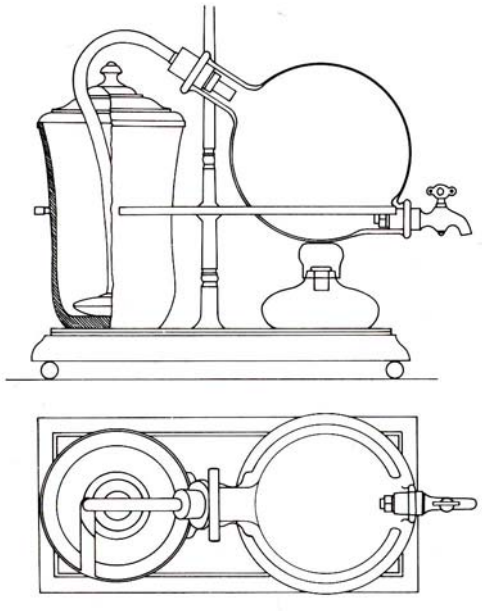

Figure 3.57. Robertson's patent drawing of 1890
(Source: Bramah E. and Bramah J. 1995)

In Figure 3.58 another example of Napier machine with serving tap, which is silver-plated and engraved with the willow pattern is seen. This late Victorian machine was made by William Padley & Son of Sheffield (Bramah E. and Bramah J. 1995).

Figure 3.58. Late Victorian Napier machine of William Padley & Son of Sheffield
(Source: Bramah E. and Bramah J. 1995)

3.1.11. Balancing Syphons

The enormous interest in coffee making in the early 1840s had its own inevitable consequence that fashionable Paris moved on to something new. In 1842 a man named Bastien took out a patent for a machine, which was the link between the two-tier machine and the next fashion. It was the balancing syphon. The machine had two glass flasks, which were arranged side-by-side instead of one above another. The boiling water is forced through a filter box containing the coffee into the second flask fitted with a tap. A crosspiece held the necks of both flasks. This provided more stability and also made the heater and the serving tap put at the same convenient level. The only thing it lacked was an automatically extinguishing heater, which would very soon be added.

Balancing syphons, which are sometimes described as 'Viennese syphon machines', combined maximum efficiency with maximum visual appeal, and became popular all over Europe. The exact moment when they first appeared could not be determined as in the case of the glass double-flask machines. The documentary evidence begins when they are improved. Louis Gabet took out a patent in 1844 in France where they were often known as a 'gabet'.

The lid of the spirit lamp was held open by the weight of the cold water in the right hand container that was usually made of ceramic. When the water passed over into the glass flask, the empty jar, which was assisted by the counterpoise action of the weight attached to the ring around the flask, rose. Then the released lid extinguished the flame. The air in the jar cooled, a partial vacuum occurred and it drew back the coffee. Then the filled jar descended again. The machine in Figure 3.59 works on the Gabet principle. It is an ornate silver-plated English balancing syphon from the late nineteenth century.

Figure 3.59. English balancing syphon
(Source: Bramah E. and Bramah J. 1995)

The balancing syphon was completely automatic, and was fairly safe. Manufacturers of metal stands, painted china and gilded glass had great opportunities by means of balancing syphons. Lots of balancing mechanisms improvements and syphon tube arrangements were done the people of the era.

In Figure 3.60 an example of balancing syphon which consists of a syphon with gilded support frame and a porcelain jar painted with sprigs of flowers is seen.

Figure 3.60. Balancing syphon with porcelain jar
(Source: Bramah E. and Bramah J. 1995)

The patent drawing of Turmel is seen in Figure 3.61. This quite late patent drawing of 1853 is demonstration of the possibility of making a really simple design very complicated. A system of valves and vents equipped the connection between the tube and the upper part of the flask. The serving flask is put on a shelf that is raised by a hydraulic lift.

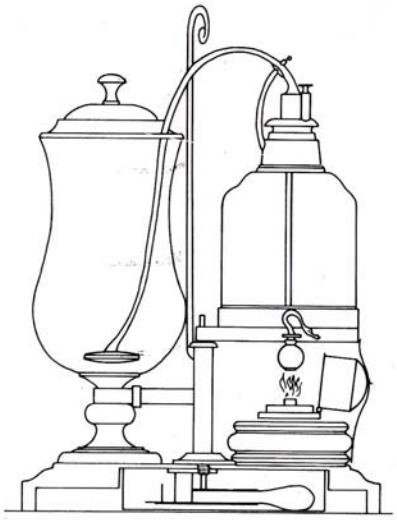

Figure 3.61. Patent drawing of Turmel's balancing syphon of 1853
(Source: Bramah E. and Bramah J. 1995)

The balancing syphon even came to England. Apoleoni Pierre Preterre le Havre has a patent of 1849 (Figure 3.62). He copied Godet's simple counterpoise.

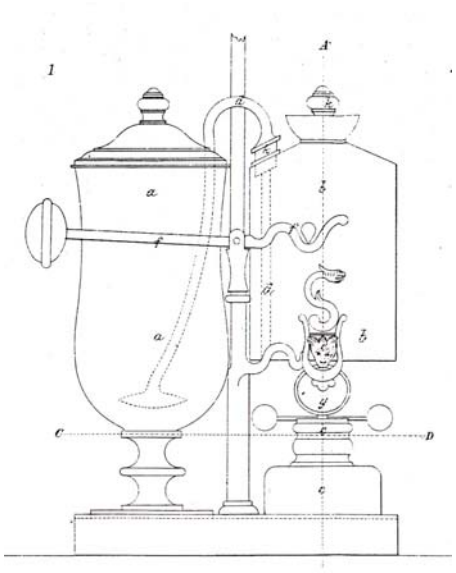

Figure 3.62. Patent drawing of Apoleoni Pierre Preterre le Havre's balancing syphon of 1849
(Source: Bramah E. and Bramah J. 1995)

Preterre's alternative balancing syphon in which the two flasks are positioned one above the other is seen in Figure 3.63. The heater is in between. The upper flask holds the lid open when it is full of water. The cold water is heated and forced by steam pressure through the tube into the bottom to mix with the coffee. The top flask then rises on a spring in the stand, which holds it, the air inside cools and the coffee is drawn back (Bramah E. and Bramah J. 1995).

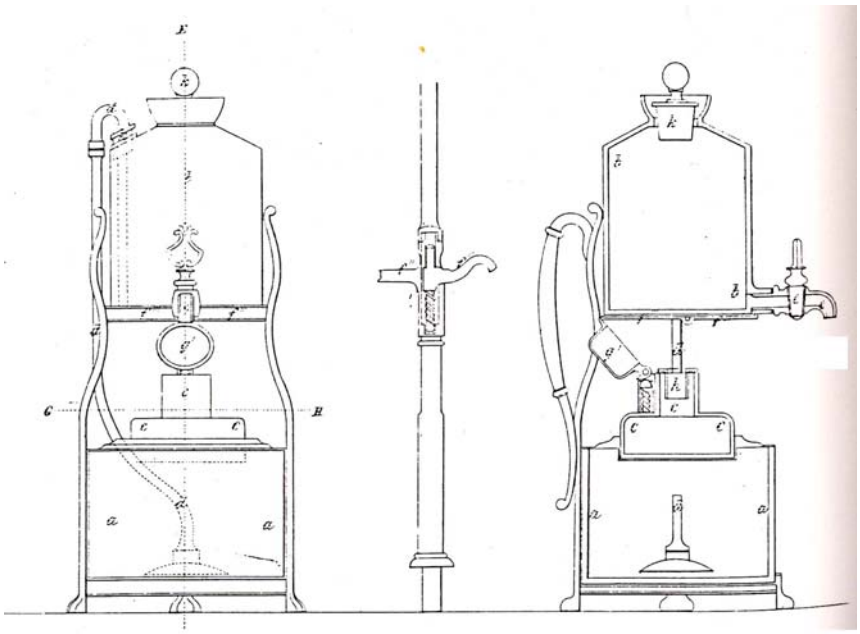

Figure 3.63. Preterre's alternative balancing syphon
(Source: Bramah E. and Bramah J. 1995)

3.1.12. The Hydrostatic Percolator

Since the end of 1840s it must have seemed that every possible method of brewing coffee had been tried. There were various kinds of coffee makers which were made of metal, glass or ceramics on sale all over Europe. Most of them were difficult to operate novelties and were soon left. The Eduard Loysel de la Lantais' machines, which were similar to a dozen others in the beginning, achieved great success when he found a new principle. This provided being capable of producing coffee on the grandest scale. In 1854 he drew together all his hydrostatic coffee machines into one massive patent and registered in both England and France.

The hydraulic system is all about the natural pressure of water. If two containers, one of which is narrow and the other is broad, are put side by side and connected at the base, the water level in both will be the same. If an amount of water is added into the narrower one, it will push up the heavier weight of water in the broader one until the water level in the two vessels will be same.

Figure 3.64 shows Loysel's patent drawing. The lid became a funnel, and the weight of boiling water in the column is sufficient to push it upwards from the base through the grounds. The later models may have separate dishes and the lid is merely a lid. The liquor passes through the grounds for a second time as it is drawn off.

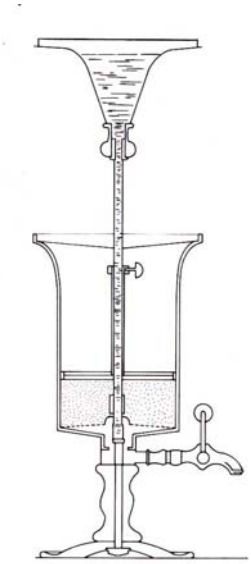

Figure 3.64. Patent drawing of Loysel's hydraustatic percolator
(Source: Bramah E. and Bramah J. 1995)

There was a stove at the base of the Loysel's machine, and Loysel always emphasized that the stove at the base of the machine created steam pressure only to raise the water. The water was forced through the grounds by the hydrostatic pressure. There were double versions of the machine, and to produce greater quantities of coffee, which requires greater amount of ground coffee, multiple filters were used.

There were various kinds of machines from kitchen models, dining room percolators to catering sizes that were capable of serving two thousand cups an hour among Loysel's designs (Figure 3.65). His smaller machines had a long tube that was hand-filled with water. The larger ones, which required increasingly complicated arrangements of pipework, valves and stopcocks, had longer lengths of tube to provide the water pressure that is the basis of the hydraulic principle (Bramah E. and Bramah J. 1995).

Figure 3.65. Three Loysel's percolators showing lids and filling dishes
(Source: Bramah E. and Bramah J. 1995)

3.1.13. Coffee Makers in America

The first person that sold coffee in American colonies was Dorothy Jones having a licence issued to her in 1670. The first regular coffee trade was seen in 1683 when William Penn of Pennsylvania bought supplies of green beans on the New York market. Coffee houses in America appeared in Boston, New York and Philadelphia during the 1700s, but coffee drinking was almost non-existent outside the major cities and in 1776, when the War of Independence began, such supplies as there were seriously interrupted.

By the end of eighteenth century there appeared a differentiation in between the coffee trades of America and Europe. The capitals such London, Amsterdam and New York had coffee exchanges where shipments and lots were sold to the domestic markets by the green bean importers. In America, at the same time, big firms of coffee roasters like Jabez Burns and Benjamin Green Arnold grew up. Large commercial roasting and grinding machines grew into factories. It was said that the facilities in and around New York by 1845 was alone to roast as much as coffee as was consumed in the whole of Great Britain. An inevitable extension of this development automatic packing occurred, and the home roasting which was still common in Europe during the nineteenth century, virtually disappeared. Since this was the income source invention concentrated on this aspect of coffee making.

In America, while the families, which were rich and established, used coffee pots of European eighteenth century style and made of American silver and copper, the immigrants who arrived from Europe in the nineteenth century did not use coffee pots. They boiled the coarsely ground coffee in a pan for fifteen minutes to half an hour on a stove or open fire. This was the ‘cowboy pot’, which was familiar from western films and the universal coffee maker.

New and better methods of coffee brewing could not spread rapidly because of the distances and lack of communication in America. Cookery books instructed the new generations of American housewives and tried to convert them to ‘coffee without boiling’. They advised using a biggin. At the same time, in Europe, especially in Paris and Vienna various coffee makers were being invented, but they were affordable only to the wealthy and the middle classes. The less well-off used copper, brass and Britannia metal pots and good decorated and cheap chinaware. The chinaware was cheap because there were a large number of craftsmen to make them. America had to learn coffee

making almost from the beginning because of the lack of craftsmanship and its requirements that were traditional experience and volume and money, and the lack of material.

In New Orleans, which had a large French population, there were drip filters. The first truly American style emerged with the Pennsylvania pots. They were in enamel or lacquer, and were highly decorated (Figure 3.66). Actually they were the cowboy pots in their plain and undecorated form.

Figure 3.66. Two Pennysilvania coffee pots
(Source: Bramah E. and Bramah J. 1995)

The development of semi-automatic coffee makers in America was not rapid. On the top of the pot they had condensers mounted in order to collect steam and return the vital coffee essences back to the liquor where it was ruined by long boiling. The advice of Count Rumford, which was 'coffee and water should never be boiled together and the aromatic vapour rising from the brewed coffee should be returned into the liquor and not be allowed to escape', had returned to his native land but was only partly understood. In Figure 3.67 typical of the mid-nineteenth century, the Old Dominion Coffee Pot in tin plate is seen. It was introduced in 1856. How it should be used was described as follows, "If the coffee pot be set on the range or stove, or near the fire, so as to be kept hot all night preparatory to boiling in the morning, the beverage will be found in the morning, rich, mellow, and of a most delicious flavour. Coffee used at supper time should be placed on or near the fire immediately after dinner and kept hot or simmering -not boiling- all the afternoon."

Figure 3.67. Copper version of Old Dominion coffee pot
(Source: Bramah E. and Bramah J. 1995)

Nickel-plating started to be commonly used from 1875. Like Manning-Bowman specialist manufacturers began to appear. The French drip pot, which was called a biggin in America, was adapted. A wooden block pressed the coffee grounds and extracted more liquor suitable for the American preference. American preference of coffee was stronger when considered with the European preference. It was inevitable that they would develop the pumping percolator, what the French and Germans did not approve.

The pumping percolator of America started to be accepted in Europe after the twentieth century, but in 1890 there was a Manning-Bowman percolator in America. It sat on direct heat, had a central tube and a glass cover. Its main disadvantage was the coffee brewing time. It would not begin to pump water in less than twenty minutes even with a small water pocket in the base into which the tube was extended. It could safely be left when the pumping started for whatever time necessary. The electricity helped this problem. Meanwhile, there appeared another American coffee maker which consisted of a glass globe or boiler that hanged by means of trunnions from an ornamental stand, the base of which was a spirit lamp (Figure 3.68). The remaining portion of the machine consisted of a funnel shaped vessel, terminating in a long glass tube, and a junction being surrounded with a cork fitting the mouth of the boiler. This coffee maker was the 1840s' double glass balloon machine, and two sisters living in Salem, Massachusetts, acquired the rights to it (Bramah E. and Bramah J. 1995).

In 1915, a vacuum coffee maker was made from 'pyrex', the Corning Glass Work's newly introduced ovenproof glass, and was marketed under the name 'Silex'. The name comes from the phrase, '**S**anitary and **I**nteresting method of making **L**uscious

coffee. It is **E**asy to operate on account of its being **X**-ray transparent.' Two sisters, Mrs. Ann Bridges and Mrs. Sutton, of Salem, Massachusetts who had it manufactured by the Frank E. Wolcott Manufacturing Company, had acquired the rights to the design in 1909. The Silex brewers did not suffer the same drawbacks as their French predecessors with the availability of heatproof pyrex glass, and a new era of vacuum brewing was launched (WEB_22 2004). Enough time had passed for the glass coffee maker to be rediscovered and relaunched as something fresh and modern. A new generation of coffee drinkers quickly accepted it as a typically American invention, and today the name 'Silex' is almost synonymous with any glass vacuum pot.

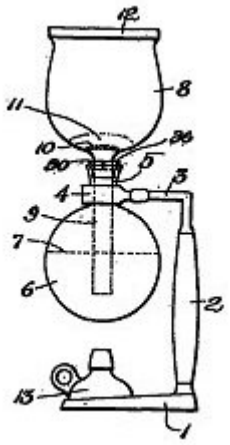

Figure 3.68. Early Silex Vacuum Brewer, nearly identical to the French Balloons of the 1840's (Source: WEB_22 2004)

In Figure 3.69 a range of six popular American coffee makers from the beginning of the twentieth century is shown. (a) is Kin-Hee reversible coffee pot of 1900. (b) is Tru-Bru pot of 1911, improved in 1920. (c) is Tricolator of 1920. Previously it was known as the Make-Right. This was a simple drip pot. (d) is Phylax adaptable coffee filter which could be put on top of any coffee pot and turn it into a drip pot. (e) is Galt vacuum coffee pot of 1914. (f) is Blanke's cloth filter of 1909 (Bramah E. and Bramah J. 1995).

Figure 3.69. Six popular American coffee makers from the beginning of the twentieth century (Source: Bramah E. and Bramah J. 1995)

3.1.14. Late Nineteenth Century and Early Twentieth Century Domestic Coffee Makers

During complex coffee makers were being developed, there was another method of brewing coffee which required simplest of equipment. It was 'cold water infusion'. In the more rural parts of England and Continental Europe and also in America, many people made coffee using this method. All equipment needed was a bowl or pan, coffee ground and cold water. The process was that the cold water was poured onto the coffee and the mixture was left overnight or all day. Before being drunk, the mixture was strained and the liquor was boiled. The chemical reactions of cold and boiling water with coffee are different and thus the characteristics of the resultant liquors were different. Now there is a modern and very complicated Japanese machine for making it (Figure 3.70).

Figure 3.70. A cold water infusion apparatus from Japan
(Source: Bramah E. and Bramah J. 1995)

The main characteristic of the coffee makers of the last half of the nineteenth century was complication. Existing models had a more modern appearance and were nickel-plated. As patents ran out, inventors all over Europe added them new features and appropriated them and the machines were reintroduced as new improvements. The complication and workmanship, which had once replaced with decoration, now went

into mechanism. It was not a good period for style. The additions made coffee makers more fallible instead of making them more efficient. They lost their original, carefree elegance.

In this period there was a great interest in self-extinguishing machines particularly the ones with a boiler that rose when the boiling water passed into the second chamber, but since the people got used to the efficiency and reliability of gas heating and lighting, they did no longer tolerate a machine which was not reliable and also had no particular appealing. Thus they could not live longer.

Invention became an international business. Patents were taken out in countries even though there was no intention of manufacturing there, and there were some ideas which only remained on the drawing board.

Few coffee makers were actually improved. One of them was the reversible pot. It was streamlined into an oval shape and suspended on a stand over a spirit holder. It became popular all over Europe and America and known as the Postdam boiler or Russian egg-shaped pot (Figure 3.71).

Figure 3.71. Two reversible drip pots which known as Postdam boiler
(Source: Bramah E. and Bramah J. 1995)

One little coffee maker without a mechanism heating of its own was the plunger pot. It will be mentioned in 3.1.18. Simple Coffee Makers in detail.

The universal coffee maker of northern continental Europe was the ‘Madame Bleu’. It was a tall enamel pot with a strainer in the upper part (Figure 3.72). It was made in various colours and decorated with spots, stripes and flowers. A short time ago these pots were easy to find, but they are becoming scarcer.

Figure 3.72. The ‘Madame Bleu’
(Source: Bramah E. and Bramah J. 1995)

In Italy, although there was a market for percolators and pressure machines, filter pots were also common. Most of the inventors and the methods came from outside Italy. The espresso machine, which was to be Italy’s outstanding contribution to the history of coffee making, was still some years away. Two popular traditional Italian coffee pots were seen in this period, which were named ‘Napoletana’ and ‘Milanese’. They will be mentioned in 3.1.16 Italian Coffee Makers.

German people also preferred the filter pot, but the more interesting development was the increasing social prominence of the coffee houses. In England, these had reached their peak of popularity at the time when the monarchy was being re-established and the first, organised financial institutions were starting to emerge. When businessmen moved into business premises, the coffeehouses faded away. Men transferred their social life to clubs and coffee itself lost its popularity to tea.

European cafés began as places of refreshment and established their reputations because of their comfort and service. They served generations of novelists, journalists, politicians and philosophers, enjoying particular prominence towards the end of the nineteenth century when new countries and new ideas were emerging. The number of cafés increased greatly when the railway began to move large numbers of people around in what was to become the tourist industry.

The new travelling public had their time confined by timetables. At all times of the day and night, they needed to be supplied with refreshments in a hurry. Urns, which were the traditional way of providing coffee in large quantities, could no longer cope. Specialist manufacturers began to develop a completely new class of coffee making

equipment and also urns were improved. This new equipment soon needed a new source of power. This new power was electricity (Bramah E. and Bramah J. 1995).

3.1.15. The Coffee Makers for Catering

While need of coffee production in large quantities was emerging, the mid-nineteenth century coffee makers which were designed for domestic use were not capable of providing coffee in quantity. Balancing syphon and the double glass flask coffee makers could not be scaled up. A variety of urn or a drip pot, which were used by large households and restaurants, were not sufficient to supply the demands of the new travelling public which required refreshments all hours of day and night.

In 1854 Loysel designed a hydrostatic percolator, which was an important attempt to provide catering machines that could supply any demand up to thousands of cups an hour. Hydraulic power was slow and it was not useful. Gas was becoming widespread in the cities of Europe. It was form of heating which removed the need for stoves or spirit lamps. The heat was easy to control.

At first gas urns superseded spirit lamps and stove heated urns. Later automatic coffee machines for continuous supplies of coffee were invented by means of the convenience of the gas pipe and the reliability of the steady and controllable gas supply. Figure 3.73 shows a Portuguese gas-heated urn for making coffee. The casing is brass and the coffee is held in a ceramic container surrounded by water.

Figure 3.73. Portugese gas heated urn for coffee making
(Source: Bramah E. and Bramah J. 1995)

The growth of railways gave rise to the age of mass catering. From 1850 large numbers of people were using railways. A series of improvements to existing British coffee machines were done by Summerling, and in 1890 a catering coffee machine superseded all and became the standard equipment of cafes and refreshment rooms. It was a machine consisting of double urns, which were supported by a central stand.

Feeding water through the coffee grounds under steam of manual pressure now became something that was on the outside rather than the inside of the machine. The central supply of water could be tapped at several points.

Catering coffee machines, in both America and Europe, were made in brass and copper, stainless steel and nickel-plate. They were put on public view instead of being concealed in the kitchens of coffee houses, restaurants and refreshment bars therefore they were cased, chromed and burnished for the maximum visual effect. They became part of the décor of the establishments being conveniently placed on the bar counter. In Figure 3.74 there are two examples of coffee makers familiar all over France in the early twentieth century (Bramah E. and Bramah J. 1995).

Figure 3.74. Coffee makers from France
(Source: Bramah E. and Bramah J. 1995)

3.1.16. The Electric Coffee Makers

The general public had the means of making use of the electric coffee maker long after the invention of it. In 1881, Gustav Pfannkuche and Robert Dunston

combined an urn with a heating element comprising coils of wire embedded in plaster of Paris and covered by metal casing (Figure 3.75).

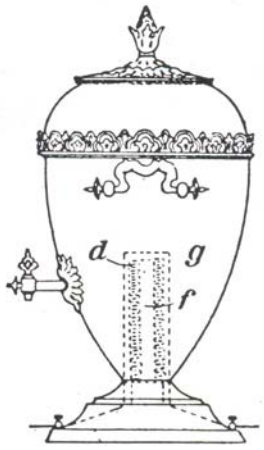

Figure 3.75. Pfannkuche and Dunston's 1881 patent drawing of a coffee urn
(Source: Bramah E. and Bramah J. 1995)

In the early 1900s electric coffee makers began in serious. Heating elements were fitted to existing models. The double flask machine was one of the coffee makers fitted with a heating element. One of the two sisters who owned the American 'Silex' machine asked the 'Torrid' company, which manufactured heating appliances, to make a small electrical stove or heated base for the double flask machine which was now being made in 'Pyrex' glass. 'Cona' and 'Cory' who brought out similar models with both electric and spirit heaters later followed 'Silex'.

Percolator was the other coffee maker which benefited from the new electric element. Manning-Bowman manufactured percolators that were heated on a stove or by a spirit lamp since 1890.They did not begin to pump in less than twenty minutes, neither did the improved ones fitted with an electric heating element (Figure 3.76). A slight change in the design was the solution, which Landers, Frary and Clark did in 1908. It introduced its first electric 'Universal' percolator with a remarkable innovation that they called the 'cold water pump'. In the ordinary electric percolators, which were just beginning to be produced, the principle was that the element had to heat all the water in the pot to nearly boiling point before it would begin to rise up the central tube. In the Universal model, there was a small well or recess in the base around which the heating element was brazed. The small quantity of water started to 'perking' action in only two or three minutes by means of the heat concentrated on it. The cold water pumping percolator quickly took place of all previous models.

Figure 3.76. Two electric percolators based on the American Manning-Bowman Universal (Source: Bramah E. and Bramah J. 1995)

Because of the efficiency of the mechanism, the pumping percolator had a long success and it overwhelmed the criticism that it ruined the coffee. The small quantities of hot water were sent up the central pipe to be sprayed over the basket of ground coffee in the top, filter through and be returned to the bottom to be heated again. The coffee liquor sent through in a continuous pumping cycle became stronger because of being repeatedly boiled. American public, which had been accustomed to boiling coffee, accepted the pumping percolator. Although Europeans were against stewed coffee, pumping percolator invaded Europe and was accepted by them.

While electric percolator was gaining popularity, most of the coffee makers from the previous two generations were being fitted with electric elements. Electric urns, balancing syphons and Vienna Incomparables appeared. They had a brief revival and vanished.

In Figure 3.77 Femoka French electric pressure pot is seen. Steam pressure forces the water up two eternal tubes and down through coffee. A separate pot was used to collect the liquor dispensed automatically.

Figure 3.77. Femoka French electric pressure pot
(Source: Bramah E. and Bramah J. 1995)

In Figure 3.78 a German combined glass and metal vacuum machine is seen. The water was heated in the base by an element and the coffee was brewed in the glass part at the top. When the air in the base cooled and formed a partial vacuum, the coffee was drawn back, but it took a long time for the element to cool (Bramah E. and Bramah J. 1995).

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Figure 3.78. German combined glass and metal vacuum machine
(Source: Bramah E. and Bramah J. 1995)

3.1.17. Italian Coffee makers

In Italy coffee drinking began as early as 1600 but characteristically Italian coffee makers emerged when the many small states united to build a country with all benefits of a single domestic market in 1860. Reversible pots and metal percolators and

pressure pots, which were foreign inventions and all made strong coffee fitting the Italian taste, were copied or imported. The first patented Italian machines were their complicated versions, which were not adopted.

For generations there were two devices most popular with Italians, the 'Napoletana' and the 'Milanese' seen in Figure 3.79. The one on the left is 'Napoletana', which was also known as 'Neapolitan Flip-drip'. It was invented in 1819 by a French tinsmith called Morize. It was a reversible, double, or flip-drip pot, which was adopted by Italians as Napoletana (Davids 2001). It sat on a stove, and when the water was boiled, it was turned upside down to drip the water through the coffee and then through a tube into a coffee pot. The one on the right is 'Milanese'. The coffee was held in a strainer near the top and the body of the pot was filled with cold water up to the strainer. The water seethed through the coffee when it boiled until it was judged to be strong enough. The pot was removed from the heat and the liquor settled back leaving the grounds behind.

Figure 3.79. Two popular traditional Italian coffee pots; 'napoletana' and 'milanese' 1853 (Source: Bramah E. and Bramah J. 1995)

For a country which has always had such an extraordinary artistic reputation, highly decorated coffee pots were few in Italy. The explanation for this was the Italian tradition itself. Italy was the home of art and the Italians of the nineteenth century made their coffee in simple metal machines, but they spent their money on pictures.

Giovanni Toselli was one of the first manufacturers to register an Italian patent. He was the architect who designed the Second Empire coffee making toy locomotives in 1860s. Serious attempts were made by him and his competitors to invade the Italian market. They were joined by Italians with similar machines, but something new was

needed which would bring Italy to the attention of coffee drinkers of the western world. In 1890s something new called ‘espresso’ was invented.

By the end of the nineteenth century people started living lives, which seemed to become faster every year, spending more time in cafes and travelling on trains. Espresso suiting this new modern way of life was ready for a new generation of coffee machines.

The coffee machines of catering type should be simple for the staff to use and at the same time should produce a reliable drink. They were necessity and little attempt had been made to produce a thing of beauty. It was the Italians who created something which was not only admired but also loved. In Germany, Britain and America, by 1880, the large capacity coffee makers were produced with stainless steel or chromium-plated cases. They consisted of a central boiler and several outlet points for drawing off the water to make tea and coffee. While the prime consideration was efficiency, they worked well, and they were as aesthetically pleasing as was possible, but they were just good, well designed mechanisms. The Italians did the designs, which were intended not only to be seen but looked at, and in which the magnificent brass cylinders and fittings surmounted the eagles with their spreading wings (Bramah E. and Bramah J. 1995).

The literal meaning of the word espresso is ‘made on the spur of the moment’. This new brewing method was to overcome the drawbacks of the other methods particularly should take lesser time and the consequent loss of aroma when the coffee was not immediately consumed. This new product should quickly make one or two coffees that the customer could be served in a few moments. To make the water pass quickly through the measured amount of ground coffee, the water was put under pressure. This pressure was provided by the steam, which was regulated by barman by means of various taps (Illy 1992).

One of the first men who were creating this new generation of Italian machines was an engineer from Milan, Luigi Bezzera. In 1904, when he ran out of capital, his company was taken over by Desiderio Pavoni keeping the name Bezzera.

Pavoni’s own “Ideale” model of 1906 could serve a hundred and fifty cups of coffee an hour. In 1909, Pier Teresio Arduino of Turin manufactured “La Victoria” which improved this to a thousand cups an hour (Figure 3.80).

Figure 3.80. The famous Victoria Ardunio made by Pier Teresio Ardunio

Italian steam pressure machines were established all over Europe and had reached the United States by the 1920s. There was no doubt for their efficiency but the coffee that they produced was too bitter even for some Italian palates. Achille Gaggia made the whole concept of coffee brewing by steam pressure obsolete. He designed and marketed in Italy the first true espresso machine 'to work without steam' in 1946.

A specially plated heavy copper pressure boiler which rested on top of the bar counter was covered by the chrome and gold finish on the front and sides of the Gaggia machine. The water was heated to the boiling point and controlled automatically at a pressure of 20 pounds per square inch inside. There were cylinders containing pistons worked by powerful springs fixed to the tank. At the bottom of each cylinder there was a filter holder clamped, containing specially fine-ground coffee. A lever controlling the piston was on top. When the lever was pulled down, water drawn from the bottom of the boiler, to exclude steam, flowed onto the coffee. When the lever was released, the spring drove the piston downwards, forcing the water through the coffee at 60 pounds per square inch, extracting all the good properties from the coffee. In Figure 3.81 a Gaggia machine of 1948 is seen. The design is a complete break from the brass boilers and eagles and recalls the jukeboxes of the same period.

Figure 3.81. A Gaggia machine of 1948
(Source: Bramah E. and Bramah J. 1995)

In Italy the new espresso machines made by many manufacturers were quickly recognised as revolutionary and were soon selling through most of Europe. The pistons, which were required to produce thousands of cups of coffee a day, were subjected to a great deal of stress. A hydraulic system which superseded spring levers was brought out by the Cimbali Company. In the years following the Second World War, Faema was a distinguished name among the firms which established a reputation developing the modern espresso machine. The basic design had a great deal of improvement both in efficiency and in the quality of the coffee. Faema introduced a model which had as its main feature an 'erogazione'. The large reservoir of boiling water contained in a tank had never been entirely satisfactory since the coffee was made with stale water which spoiled the flavour and also furred the pipework of the espresso machine with chemical deposits.

In Faema's machine the water to make coffee was only heated and drawn off in small quantities as required (Figure 3.82). It used the water boiler to keep the working parts of the espresso machine hot. Fresh water then replaced it in the pipe to be heated to the correct temperature within twenty-five seconds ready for more coffee. The copper supply pipe was immersed in the boiler which acted as a water jacket. Also a water treatment unit, which sweetened the water by extracting the chemicals which furred the pipes and boiler, was incorporated by Faema. This eliminated many servicing problems for both owner and supplier.

Figure 3.82. A Faema espresso machine of 1961

People who enjoyed espresso coffee in restaurants demanded something similar at home. Smaller and lighter-weight versions, which nevertheless used all the technology of the bigger commercial ones, were soon available with the characteristic clip-in filter holder. The typical domestic modern espresso machine had the Faema type of erogazione. A small pump, a small boiler keeping the water at a constant temperature by means of a thermostat and a filter with the ground coffee clipped onto the pump was its components. When the machine was in operation, the cold water was transferred to the boiler by the pump, forcing the hot water already there through the coffee. In Figure 3.83 Pavoni's domestic espresso, which has a plastic case and an integral coffee grinder, is seen. It is one of the latest in their series of machines extending over nearly a century.

Figure 3.83. Pavoni's domestic espresso machine
(Source: Bramah E. and Bramah J. 1995)

There were two important differences between the espresso method and nearly all previously mechanisms in domestic coffee makers. It used easily controllable pressure. The older pressure machines had worked in their own time rather than that of the person using them. And also it supplied a cup of coffee at a time instead of dispensing a whole pot of coffee. Thus the designers had advantages of scale. It was not necessary to accommodate a jug and also a boiler of equivalent size anymore. These improvements all took place in 1950s enhanced the international reputation of Italian coffee (Bramah E. and Bramah J. 1995).

In addition to countertop domestic espresso machines, there was a stovetop espresso maker, the 'Moka pot', which according to some sources was not an espresso machine in the sense of the modern word. This aluminium pot with faceted sides was popularised in the thirties by its first large-scale manufacturer Bialetti. It was a pressure pot like the Parker steam fountain or Vienna Incomparable. In Figure 3.84 its original and later designs are seen.

Figure 3.84. Three moka pots from Bialetti
(Source: Bramah E. and Bramah J. 1995)

3.1.18. Commercial Filter Machines

The public wanted to drink a better quality coffee at its place of work as drinks at home. In factories and large offices vending machine was the only alternative to mass catering in company canteens. Hot drinks vending started in the United States in 1950s and spread to Europe. The quality of the drinks of these early machines was not excellent but it improved. There was an overwhelming need for the vending machines so they have survived. There was also a new, growing space for small, easily operated coffee makers which could be used in individual offices and workshops to supply coffee

while people were working. When Americans were disillusioned with the percolator and looked for a better technology, all the new technology was in favour of a filter machine.

The principle of filter coffee machines was demonstrated for centuries. The only thing to do for commercial coffee machine manufacturers was to build a machine as easy to use as an automatic washing machine with the things learned until that day, and there should be improvements in the way of coffee filtering. The same form was used in all the coffee machines to separate the grounds, but always some grounds got through into the liquor. The simple solution was that using the modern disposable filter machine, which was once invented by Frau Melitta Benz.

Frau Benz, who was a housewife, tried linen towels and also blotting paper as strainers, and found the solution in strong, porous paper. Thus the first commercially produced filter papers came about. By 1912 her husband was selling metal pots with paper filters through his company named Melitta. Filters were folded and adapted into the shape of the filter funnel over the years, and filter machines and filters were made compatible to each other.

Filter machines, which are electrically operated, date from the early 1960s and were first developed to be used commercially (Figure 3.85). They were solid, heavy, large, expensive to make, and great deal of experiment and experience was needed to evolve them into the neat, modern domestic filters. Size was the first problem of the filter machine. The amount of fluid had to be accommodated in two places, thus it had to be twice as large as the amount of coffee it produced.

Figure 3.85. An early Bunn commercial coffee filter from the 1960s
(Source: Bramah E. and Bramah J. 1995)

In the earliest eletric filter machines, the water was filled in a reservoir tank which was heated by an immersion heater and kept at the correct temperature by a thermostat. A quantity of cold water was poured in to displace part of the heated water through a tube. Then it passed through the coffee grounds held in a filter to drip through into a flask. The disadvantage was that the water in the machine got stale. By 1968 this method was improved when an aluminium heat block in the top of the machine heated fresh cold water. The water passed through,the holes of the heat block and then onto coffee. This was not the only way to achieve that result. Using a more powerful heating element and a smaller boiler, and adopting the 'flow boiler' which was now being used in the domestic filter machines were two other ways (Figure 3.86).

Figure 3.86. Coffilta coffee machine illustrating the simple mechanics behind the modern automatic filter machine fitted with a flow boiler
(Source: Bramah E. and Bramah J. 1995)

The manufacturers, who had early experience with stainless steel filter machines, produced domestic filter machines in plastic cases with the confidence of improvements in reliability and design in elements and thermostats. One of the first of these was seen in Europe in 1960s. It was the little Philips machine, which used as its power source a heating element in the base which forced the heated water up and over the coffee and also doubled as a hotplate. In Europe and America many manufacturers followed with either combined hotplate elements or flow boiler designs. They all benefited from the latest technology in plastics and glass technology (Bramah E. and Bramah J. 1995).

3.1.19. Simple Coffee makers

To brew coffee in small quantities without any mechanical aid apart from gravity, there have always been devices. Most of them are sorts of filter machine.

In Figure 3.87 a French cone-shaped filter is seen. It is one of the individual forms of coffee filter. It is fitted into the top of a coffee pot. It does not need a filter paper since it has holes or slits to strain the coffee. It was very popular in Europe and in the United States. And ceramic of these appeared in Germany in about 1910.

Figure3.87. French cone-shaped filter in tin plate with hinged lid
(Source: Bramah E. and Bramah J. 1995)

The café version of the cone drip filter is seen in Figure 3.91. It did not have the cone base. It was a little metal can with a metal strainer in the bottom. It had also a lid which doubles as a saucer to put the filter on when the water had passed.

Figure3.88. A silver plated drip pot which sat on top of the coffee cup
(Source: Bramah E. and Bramah J. 1995)

There are modern versions of drip pots in plastics which are much better in retaining the heat and they are the modern disposable coffee pot (Figure 3.89). There is a measured portion of ground coffee confined between two filter papers making up the base. They take the idea of teabag one stage further.

Figure3.89. Disposable one-cup filter in plastic
(Source: Bramah E. and Bramah J. 1995)

A number of coffee makers, which are really light, toughened glass or plastic flask with a plastic funnel which is made to fit, were produced by the convenience of disposable papers. It holds the coffee grounds in a filter paper and simply pouring boiling water on top makes the coffee. An example of this method is seen in Figure 3.90. This is Melitta plastic filter funnel with filter paper that completely eliminates the problem of grounds escaping in the liquor.

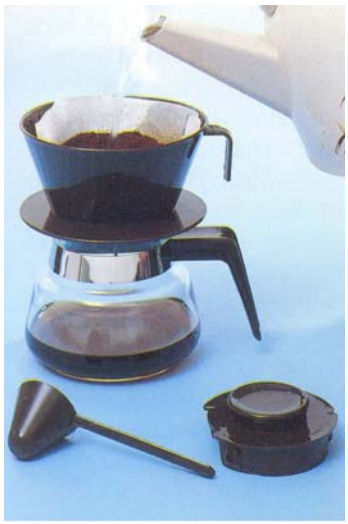

Figure3.90. Modern Melitta plastic filter funnel
(Source: Bramah E. and Bramah J. 1995)

The other major coffee maker, which does not have any source of heat and is basically a filter, is the plunger pot (Figure 3.91). It was developed in Italy during the 1930s, but it gained reputation in France after the World War II when it became a favoured home brewing method and it is also known as 'French press'. It was a device for separating the grounds from liquor after it was brewed. The pot is a narrow glass or metal cylinder, and a perforated plunger fits tightly inside the cylinder. The boiling water was poured onto the coffee grounds in the pot. The perforated plunger was fitted on top and then pushed down straining the grounds and leaving the liquor clear (Davids 2001). Pots of this type often associated with the name Melia who was a German porcelain manufacturer, and the classic Melia pot was a ceramic jar, which retained the heat well, but was adapted to metal and then glass and clear plastic jars.

Figure3.91. Plunger pots
(Source: Bramah E. and Bramah J. 1995)

Another example to simple coffee makers is a manually operated pressure pot from the 1950s, which is seen in Figure 3.92. The hot water in the upper chamber is forced through the coffee when the two 'antennae' are pulled downwards like a sommelier's cork extractor (Bramah E. and Bramah J. 1995).

Figure3.92. Manually operated pressure pot of the 1950s
(Source: Bramah E. and Bramah J. 1995)

3.1.20. Contemporary Coffee Makers

As the most convenient source of domestic power became electricity after gas, machines were developed to clean, wash and cook. While manufacturers of vacuum cleaners and washing machines introduced startling new ideas to the growing market, coffee machine manufacturers were fitting an electric element to a known and tried method of brewing. Every possible internal arrangement of percolator and filter had been explored nearly a century ago. The coffee makers, which were particularly suitable to be adapted to use electricity, were the simple percolator and the pressure pot. They were no longer dependent on stoves and open fires and the modern thermostat meant that they could be safely left. The problem, which had added so much uncertainty to the spirit lamp-heated coffee makers, was solved. The simple percolator in which the coffee has a single cycle disappeared almost entirely. The pumping percolator, which was glamorised by Americans, became the most popular type of the electric coffee maker for a long time.

The pressure pot, which was first introduced by Rabaut to London in 1822 and Caseneuve to Paris in 1824, was improved into a modern electric coffee maker. The ascending tube and coffee box were all contained in a nickel-plated or stainless steel case with a strong metal outlet tube to guide the liquor into a coffee pot. The valves and the spirit heater were taken away. They were very much safer, and it was no longer necessary to understand how it worked, to know how to turn a switch was enough. Pressure pots became popular in the 1930s. They are still manufactured today.

After the war, in 1946, a great deal of Europe was rebuilt and modernised. New ideas came with modernisation. Europeans became aware of American tastes in coffee, and Americans learned about European style of coffee tastes. New materials and technologies were being developed. After a while the Europeans decided that they did not like the pumping percolator's coffee. They were experiencing the new espresso machines that were replacing the older café sets while bringing a new culture. Even the Americans were being persuaded that the coffee should not be boiled. Pumping percolators were boiling the liquor and harming the flavour. Modern pressure machines did not boil the liquor but the pressure raised the temperature of the boiling water above normal boiling point, thus they pressure cooked the grounds as the water passed through to give a high extraction from the coffee. They produce a strong brew.

Since their innovation at the end of eighteenth century, the filter machines had a long journey, and the pressure machines which are newly improved had become a classic.

By the inspiration of the Gaggia coffee bar type espresso machines, many domestic versions of espresso principle that were used in small models were created. The water was heated by the electricity and a single powered piston transferred it through the coffee. Fresh and individually brewed coffee was put forward which the coffee drinkers thought that was what they had always wanted. After some experience with the domestic espresso machines some dissatisfactions appeared among the coffee drinkers. It was boring to have to knock out the grounds after making each cup of coffee. The cups were very small, and actually the taste was not the traditional taste of Germany and northern Europe, they preferred a less strong and a lower roasted coffee. New technology and materials and testing by the catering trade and years of experiments made the domestic filter machine a product to be launched successfully upon the public. The American 'Mr. Coffee', which was launched in 1972 by North American Systems, would be the leader of the market. The cream plastic would supersede nickel, aluminium, and stainless steel. It was used with a white flower printed heat resistant jug.

There was a heating element in the boiler at the top in the original Mr. Coffee. It fed boiling water into a filter funnel and filter paper containing the coffee. The boiling water then passes to a flask on a hotplate. European filter machines put their element into a compartment at the back of the machine and a flow boiler heated the water and fed it up a tube and onto the coffee. Different colours would be used in plastic cases.

Jugs, filter funnels, switches and hotplates would be refined and new mechanisms would continue being developed (Bramah E. and Bramah J. 1995).

In addition to the contemporary coffee maker mechanisms mentioned above, a new preparation system is becoming widespread among the manufacturers of coffee makers in the last two decades. Machines, which use prepacked doses of coffee generally named as 'coffee pods', are being developed. Actually, this new system can be described by classifying into two sub-groups. There are coffee pods belonging to coffee brands in the market like 'Nespresso' of Nestle and 'E.S.E' of Illy, which are produced for use in specially manufactured pump machines, and there are coffee pods and machines which are produced by the same manufacturer to be used together like 'Blue' of Lavazza and 'Tassimo' of Braun (Figure 3.93). Espresso, freshly brewed ground coffee, cappuccino, chocolate and tea can be prepared by using the pods. The common advantages of using one of these pre-packed coffees are that the brew is foolproof, there is no need to measure the amount of coffee, and cleaning up, especially for the espresso, rinsing the ground free filter holder, is simple.

Figure 3.93. Machines using coffee pods
(a) De Longhi EN190 'Nespresso' machine (Source: WEB_23 2005)
(b) Gaggia espresso machine using Illy's E.S.E (Source: WEB_24 2005)
(c)Lavazza'Blue'
(d) Braun 'Tassimo' (Source: WEB_25 2005)

3.2. Oriental Coffee Makers

3.2.1. The Turkish Ibrik

The Turkish ibrik is the coffee pot that is used to brew coffee in the 'Turkish coffee' style which is known as to be the oldest coffee preparation and drinking style (Alyanak, 2001). It is a deep metal boiler with a long handle. Dufour describes a seventeenth century coffee pot as follows:

> In the Levant, for cooking coffee they use a type of kettle made of copper, tinned inside and out, of a rather particular design, which has still not been duplicated in France. They call it an *ibriq*…. I've found it quite suitable for this purpose, since the base, which is broad, receives more of the flame, in consequence of which the water boils more quickly. Additionally, the opening is quite narrow, to better retain the volatile essence of the brew (Hattox 1985, p.86).

The Turkish ibrik comes in a range of sizes and a variety of metals and is still made today by thousands of metal workers from Yugoslavia to Persia, using the same traditional designs and decoration. This makes it impossible to date individual examples unless there is an authenticated history or features of unusual interest (Bramah E.and Bramah J. 1995) The ibrik can also be made of enamel and porcelain as it can be made of various metals like silver, aluminium, copper and steel. Enamel and aluminium are cheap materials so enamel and aluminium ibriks can be bought by everyone, and they are usually used in the places like coffeehouses where coffee is continuously brewed. Although there is no other sample of porcelain ibrik in the history, in 1998 Kütahya Porselen had produced porcelain ibrik. Porcelain to keep the heat for a long time, these ibriks are the most valuable ones for the people who like the aficionado's coffee which is prepared slowly. Having silver or copper ibriks show wealth and the value of coffee. Copper ibriks were the most popular type used during the Ottoman era. They were used in the palaces where the presentation of coffee was a ceremony. Today mostly aluminium and steel ibriks are preferred (Güral 1999).

In Turkish culture, ibriks are produced in various sizes from for one-person size to six people. They are usually accompanied by six small, handleless cups seated in metal containers on a matching tray (Figure 3.94), and also can be obtained individually. They are as conventional and ageless as the European tea sets.

Figure 3.94. Turkish ibrik with handleless cups and a sugar bowl
(Source: Bramah E. and Bramah J. 1995)

In the desert, and indeed anywhere where there was an open fire, coffee was made by boiling water in the ibrik, adding powdered coffee and bringing the mixture back to the boil. To get maximum strength, as soon as the coffee seethed to the top, the ibrik was removed to let the liquid cool a little and then returned to the heat for the process to be repeated. Sometimes cinnamon, cloves and essence of amber were added.

The ibrik narrows from the base to the rim in order that the liquor can be poured leaving the powdered sediment behind. This does not really work and the sediment is an invariable feature of Turkish coffee. This method of treating coffee did not appeal to most European tastes thus they had seek for ways of straining the sediment and for new coffee brewing methods. It is traditional Turkish coffee and strength is of the first importance even though it completely obliterates flavour, and it is drunk all over the Middle Eastern countries, the Balkans and Hungary, not only in Turkey. In the countries that once belonged to the Ottoman Empire it tastes delicious, but the Turkish ibrik never found favour in Western Europe.

3.2.2. The Baghdad Boiler

The Baghdad boiler is the other oriental classic coffee maker. Although it was not mentioned by Bramah E. and Bramah J. (1995), the Baghdad boiler is similar in shape with the coffee jugs that is used in ‘Myrrh’ brewing, which was described in the second chapter. The Baghdad boiler had a great influence on the style of European coffee pots and was extensively copied in silver and ceramics.

By the middle of the seventeenth century it had acquired a lid, a curved handle and a characteristic beaklike spout (Figure 3.95). It had been discovered that the bulbous base retained at least a proportion of the coffee grounds and the extended beak was ideal for pouring by trial and error and natural evolution. The boiler not only had a lid but also a hinged flap, which covered the pouring spout, retaining the heat. The boiler was wrapped in a wet cloth to clear the liquor and to induce some of the grounds to settle before the coffee was served. It was also customary in Mecca and some other Arabian cities to put a bunch of herbs in the spout to strain off more grounds (Bramah E. and Bramah J. 1995).

Figure 3.95. The Baghdad boiler
(Source: Bramah E. and Bramah J. 1995)

3.2.3. The Ewer

Although the Turkish ibrik and the Baghdad boiler have been the main means of brewing coffee, the ewer should also be mentioned. It is regarded as a characteristically Persian shape and was known in Europe from the time of the Crusades as a container for wine or water. It was not used for brewing coffee, it was used to contain it, but it reached London as the first oriental coffee pot in the middle of the seventeenth century. The curved spout was incorporated into the first English coffee pots and its sinuous form appeared on tokens, which were used in the early English coffee houses (Bramah E. and Bramah J. 1995).

3.2.4. Contemporary Turkish Coffee Makers

In addition to Turkish ibrik, which is the traditional coffee brewing product and the most common way used; in Turkey manufacturers are launching new products. The common purpose of these products that have to compete with the ibrik is to provide people alternative solutions to obtain Turkish coffee. Differing from the western coffee makers' development, which was simply aiming at producing a new liquor and consequently a new way of brewing, the development of these coffee makers do not have an aim at producing a new liquor, but producing Turkish coffee considering the requirements of the era.

The first and the simplest and also the cheapest examples of new Turkish coffee makers are the 'plastic coffee makers' which are produced by many plastic product manufacturers. They generally consist of a monoblock water reservoir up to a capacity of six to eight cups with a handle and a spout, a plastic spoon, a hinged lid on top, an electric cord and a metal heating plate inside. They look like small kettles in shape and work on the same principle; the metal heating plate heats water. Before plugging in, the water, coffee and sugar are put in the coffee maker and stirred. It takes one or two minutes to boil depending on the amount of water. When the water boils, the coffee is ready and plug is taken out of the socket to stop boiling. The difference between the traditional process of Turkish coffee brewing and the plastic coffee maker is that the water comes to boil more than once in the traditional method, and some people add coffee and sugar into water after the water warms a little. The metal heating plate in the reservoir is bare allowing the electric current, therefore wooden or plastic spoons are recommended to use avoiding the electric shock. As a consequence the plastic coffee makers are simple to use products but they are dangerous.

In Figure 3.96 two plastic Turkish coffee maker examples from the market are seen. (a) is 'Gondol', which has a distinguishing detail that its spoon is attached on the reservoir. It is launched by Gondol Plastic. (b) is 'Doğuş', which is launched by Doğuş Plastic. A perforated plastic layer is placed above the metal heating plate of this product.

(a) 

(b) 

Figure 3.96. Plastic Turkish coffee makers

In 1995, a manufacturer named Bayıner launched 'Kahveset', which is a more developed product to brew Turkish coffee (Figure 3.97). The machine consists of ABS exterior, a water reservoir up to a capacity of 2,5 litres which is equal to approximately thirty cups of coffee, china and chrome (CrNi) stainless steel mobile brewing compartment with the capacity of 0,15 litre, a waste water compartment, coffee and sugar reservoir made of glass, polycarbonate transparent upper lid, a serving tap, a touch control panel, on/off switch and visual and audio signal systems. The appropriate amount of ground coffee and sugar for one cup are put in the glass reservoirs. The brewing compartment is automatically filled with sufficient cold water. Coffee, sugar and water are mixed by the mixer system. The brewed coffee is automatically poured to the cup from the mobile brewing compartment. The Turkish coffee is ready to be drunk in thirty seconds. The water is pre-measured according to the size of cup and the brewing time is adjusted according to it. If the water in the water reservoir is insufficient to operate, visual and audio signals are activated to warn the user. Also when the water reservoir is filled with sufficient water, an audio signal is given to warn the user. The coffee brewing is done by electroshock and the heat control is done with electronic circuit as current control.

Figure 3.97. The first Turkish coffee maker of Bayıner A.Ş. 'Kahveset'

In 1999 the firm launched 'Kahveset' with a new outlook and with some improved technical specifications (Figure 3.98). The machine consists of a water reservoir up to a capacity of 1,25 litres, stainless steel based hidden heater, on/off switch, coffee and sugar reservoirs and a serving tap. As it is in the first Kahveset model, the appropriate amount of ground coffee and sugar for one cup is put in the coffee and sugar reservoirs. The machine mixes the coffee and sugar with the cold water which is automatically drawn, brews the Turkish coffee and pours to the cup in thirty seconds. The differences between two models are seen in the design of the exterior, in the heat control systems and in the mixing system. While the first Kahveset has sharp edges, the second Kahveset has a design of rounded edges. The touch control panel, which is located on the front side in the first model, is not located on the front side in the second model. The difference in the heat control system is that while the first machine's heat control is done with electronic circuit as current control, in the second machine it is done with electronic circuit but in two different ways as steam sensor and electronic heat control. The difference in the mixing system is that while in the first model a mixer is used to mix the coffee, sugar and water, the mixture is provided without use of any mixers in the second model by a new heater design for which a patent is taken out by Bayıner.

Figure 3.98. 'Kahveset' automatic Turkish coffee maker of Bayıner
(Source: WEB_26 2005)

In 2002, the same manufacturer launched a new product brewing Turkish coffee. The product was 'electric ibrik' (Figure 3.99). It consists of a monoblock water reservoir with the spout having a capacity up to four cups that is 0,4 litres, maximum water level mark inside the reservoir, a concealed heating element, a handle with on/off switch, a hanging ring and an electric cord. It also has a security thermostat avoiding operating without water. Coffee, sugar and the water are put in the reservoir and the switch is turned on. When the water starts boiling, the switch is turned off to stop boiling, and the coffee is ready. The maximum brewing time is two minutes. The coffee brewing process of 'electric ibrik' is similar to the traditional Turkish coffee brewing method. The product is also similar with ibrik in shape. The only difference is the source of energy to heat the water. The heating element is hidden therefore it is safe to use, and its advertisement attributing to the plastic Turkish coffee makers mentions that metal spoons can be used without the risk of electric shock.

Figure 3.99. 'Electric ibrik' of Bayıner
(Source: WEB_26 2005)

In 2004, Bayıner launched the stainless steel version of electric ibrik (Figure 3.100). It has slight differences when compared with the preceding version. While the first electric ibrik narrows from the base to the rim, the stainless steel version expands from the base to the rim. Furthermore the new electric ibrik is settled on power base unit, and does not have a maximum water level mark. The rest of its components and features are the same with its plastic version, and also the brewing process is the same.

Figure 3.100. Stainless steel version of electric ibrik of Bayıner

According to the information gained from a competent authority of Bayıner A.Ş., the firm had produced a prototype in 2004, which can measure the required amount of coffee and sugar to use, and exhibited it at Züchex 2004 Fair. The machine automatically takes the amount of coffee and sugar according to the user's choice, and again according to user's choice it prepares one or two cups of Turkish coffee at once. And he added that the firm is developing a new Turkish coffee maker to be launched around the end of this year. The machine differs from the previous products (KahveSet) of the firm by means of allowing the user to select from between one to four cups of coffee to be prepared at once.

In 2004 Arçelik launched an automatic Turkish coffee maker, 'Telve', which won the 2005 IF Design Award in product design category (Figure 3.101). During its manufacturing process, eight different international patent applications were made.

Figure 3.101. ‘Telve’; the Turkish coffee maker of Arçelik

It consists of an illuminated water reservoir with the capacity of 1 litre, two coffee brewing reservoirs, which can be used independently and each with the capacity up to two cups, a button for the adjustment of water amount offering three alternatives, two buttons for determination of the number of cups to be brewed, the sugar reminder signs settled on the handles of the brewing reservoirs, illuminated socket of brewing reservoirs, the cup settling space on top of the body, warning lights of water reservoir and brewing process, vocally warning of the brewed liquor, start button and a measurement spoon.

The user puts the amount of coffee and sugar required in the brewing reservoir, and pushes the button according to the number of cups to be prepared. The machine automatically draws the amount of the cold water required from the water reservoir and sprays it spinning over the coffee and sugar in the brewing reservoir, mixes them homogenously and starts brewing the coffee. When the coffee starts to rise, the machine perceives and stops brewing. The brewing period is connected with the overflow of the coffee, therefore, when the froth over the coffee starts to rise, the coffee is considered to be ready. When the liquor is ready to pour into the cup, it warns the user vocally until the brewing reservoir is taken from the brewing socket.

Telve has CookSense technology, which measures the height of the coffee by the help of infrared rays. When the coffee reaches a specific height, which means that it is rising, it is perceived and the warning, which reminds that the coffee is brewed, comes. It has AntiSpill technology which avoids overflowing. After the warning of the

coffee is brewed, the heater, which is located under the brewing reservoir socket, is pulled down. That is because unless the heater is pulled down, even though the electricity of the heater is out, it continues heating the reservoir with its own heat and cause the coffee to overflow. Thus the brewing reservoir is no more heated and the coffee does not overflow. Telve also has SpinJet technology, which sprays the cold water spinning on the coffee and sugar in the brewing reservoir and mixes them homogenously. By means of these technologies, which are patented by Arçelik, Telve eliminates the problems like overflowing and the requirements like stirring the mixture, adjusting the brewing period and waiting by the side of the coffee maker until the liquor is brewed.

Telve can brew one cup of Turkish coffee in 1,5-2 minutes, and two cups of Turkish coffee in 2,5-3,5 minutes. Two different types of Turkish coffee can be brewed at once. With the space for settling of the cups on the top of the body, it provides saving space. It automatically draws the water according to the amount determined suiting the size of the cups used. The amount of coffee and sugar used is left to the user's choice. Its water reservoir can be half opened to be filled easily and can be totally got out in case of cleaning. When it is compared with the other Turkish coffee maker examples of the market, Telve is a fairly developed product. The target customer group of Telve is firstly the little cafés and restaurants, the domestic use is among the secondary target group.

In 2005, another manufacturer, Arzum, launched a new coffee maker, 'Kahwe' (Figure 3.102). The product consists of a water reservoir with the capacity up to three to four cups (250 ml), stainless heating plate and hidden resistance inside, a folding holder, a removable lid with filter, an indicator light, power base unit allowing the reservoir to turn around 360° and including the on/off switch and the cord storage area, and a coffee measuring spoon. The coffee brewing process is similar with Bayıner's electric coffee makers'. Coffee, sugar and the water are put in the reservoir and the switch is turned on. When the water starts boiling, the switch is turned off to stop boiling, and the coffee is ready. Kahwe has similarities with the Bayıner's stainless steel version of electric ibrik, and has some additional properties. The folding handle, and the cord storage area, which provide ease of storage are its additional properties. It also has a lid and a measuring spoon, which the Bayıner's does not have.

Figure 3.102. ‘Kahwe’ Turkish coffee maker of Arzum

In the following chapter three of these Turkish coffee makers, Telve, Kahwe and Gondol will be examined and compared in the context of customer requirements, technical requirements, customer perception and in the conclusion their subsequent development will be discussed.

CHAPTER 4

THE COMPARATIVE STUDY ON DESIGN OF 'TELVE', 'KAHWE' AND 'GONDOL'

The success and the acceptance of a product in the market are fairly related with how it meets the customer requirements, and the customer requirements appear in the form of specifications in the product. The success of a product is also related with the value attributed to the product among its competitors by the customer, which can be named as the customer perception of the product. The examination of the design of the Turkish coffee brewing machines in this context, which are being launched in the last years and which have to compete with the traditional Turkish coffee-maker in the context of preservation of a ritual, is the subject of this chapter.

In the market, during the last decade, there occurred an increasing tendency in designing new Turkish coffee makers to substitute the 'ibrik'. The common feature of these new gadgets is to prepare the Turkish coffee faster than the traditional ibrik. At this point, the main reason behind this tendency can be mentioned to be the lack of time problem of the people of the era. The lack of time is a comprehensive definition of the possible reasons, and it can be divided into sub-groups having different scenarios including different customer requirements. In some circumstances, the traditional preparation process of the Turkish coffee does not fit the requirements of the people. Because of lack of time and gadget, in some cases, especially at work, brewing Turkish coffee can not be possible for the people. Also the lack of time can be considered from another aspect; the preparation of Turkish coffee for crowded groups in a restaurant or at home takes long time which is not desired. Nevertheless, it is known that the Turkish coffee, which is brewed slowly, has the best flavour. Also, consequently, the brewing should be on low heat to be slow and to obtain the best flavour. (In addition it should be remembered that the flavour of the coffee has other variables like the coffee and the water used, and the taste of the person.) When the customer requirements and the good Turkish coffee's requirements are compared, there occur contradictions between the subjective and the objective measurements. Also a contradictory case occurs between the requirements of the ritual of five hundred years with the requirements of the era.

Since the main objective of this thesis is to evaluate the current attitude of the three Turkish coffee machines by examining and comparing and to suggest any improvement, which make these products better meet the customer requirements, to be the matter of the products' development process, the study is planned to be realized in two phases. The first phase is the examination of the products, and the second phase is the suggestions for the products. The first phase is going to be described in the following of this chapter while the second phase is going to be realized in the conclusion.

In this chapter, being aware of the contradictions between the ritual of Turkish coffee and the new requirements of the era, and the confusions appear in minds, but accepting and respecting the requirements of the case, three of the new Turkish coffee machines are going to be examined and compared. The machines are selected from the three different types of the new Turkish coffee machines which are seen on the market. They are 'Telve' of Arçelik, 'Kahwe' of Arzum and 'Gondol' of Gondol Plastic, which have different product specifications that are developed to satisfy the possible customer requirements. The products are going to be examined and compared in the context of customer requirements, product specifications and customer perception of the product. The study conducted, which is the subject of this chapter, can be described in four steps.

The first step was to find a method, which could act as a guide having the necessary tools to achieve the necessary data that enables examination and comparison. Consequently, the method chosen to be utilized was the Quality Function Deployment. The main reason of choosing this method was the coincidence of the objectives. The method was adapted according to the requirements of the study.

The second step was to collect data about the traditional Turkish coffee brewing. Considering that the function of the examined products was to brew traditional Turkish coffee, the way and the details to obtain a desirable traditional Turkish coffee were searched.

The third step was the application of the method chosen by adapting it to the requirements of the study. The first seven steps of the House of Quality matrix of QFD, which included the constitution of the 'correlation matrix' and the 'relationship matrix', were utilized in this study.

The fourth step was the examination of the three products, by means of the charts created using the findings in the third step. The deficiencies and efficiencies of

the design of the products in meeting the customer requirements were evaluated considering their specifications under the name of product requirements.

4.1. Brief Description of Quality Function Deployment Method

The method chosen to be utilized in this study was the 'Quality Function Deployment'. Therefore it is going to be described in the following.

QFD is a 'Total Quality Management' process, which uses four main matrices to convert the 'customer requirements' to quality design and production compulsions to ensure the total customer satisfaction (Akbaba 2000).

QFD was born in the late 1960s during an era when Japanese industries broke from their post-World War II mode of product development through imitation and copying, and moved to product development based on originality. In this environment it was born as a concept or method for new product development under the Total Quality Control (Aslan 2005).

The demands of the era, which arise from the increasing competition conditions, the increasing customer requirements, and the decreasing manufacturing costs and product development durations, require systematic product development processes. To use QFD in a product development process provides developing products in the direction of the customer requirements, and minimizes the engineering changes, the product development durations, the product costs and the service problems. The QFD method can be implemented in various areas like the process of a new product or service development, the improvement of an existing product or service, the process management, investment planning and the politics management. The input of the QFD process is the customer opinions and its output is the determination of the subjects of priority to improve the customer satisfaction (Güllü and Ulcay 2002).

QFD allows customers to prioritize their requirements and benchmark the manufacturer against the competitors. Then, QFD directs the manufacturer to optimize those aspects of the products and services that will deliver the greatest competitive advantage.

According to M. Martin and K. Ishii, Quality Function Deployment is a product development tool that acts as a set of planning and communication routines. It focuses and coordinates commonly used product development processes (benchmarking, market

research, etc.). The basic idea is that the customer needs are carried (deployed) throughout the entire design process and that this will help create a quality product.

For the design process, the QFD is one of the new design methods. Any identifiable way of working within the context of designing can be considered as a design method, which are a number of distinct kinds of activities that the designer might use and combine into an overall design process. They are complementary aspects of a systematic approach to design. The main purpose of the new design methods, which are unconventional, is to bring rational procedures into the design process. The new design methods try to overcome problems like the errors made with the conventional way of working. They also try to create a better product. Different design methods have different purposes and they are used in different stages of the design process. Since the general body of the design methods can be divided into two groups to be named as 'creative methods' and 'rational methods', QFD is one of the rational ones.

The QFD is a comprehensive method that matches the customer requirements to the engineering characteristics of a product. It is essentially concerned with translation of customer requirements into engineering characteristics. The objective of the QFD method is to determine targets to be achieved for the engineering characteristics of a product in order to satisfy customer requirements.

It is recognized that design for quality has an important role in determining the commercial success of a product. The person buying a product is the most important person in determining the commercial success of that product. The product, even though a well-designed one, can be a commercial failure unless the customer buys it. Because of that, the customer requirements have priority in determining the products attributes.

Customers often compare the product attributes with other competitor products. To be successful in a competitive market, a product has to satisfy the customer requirements better than the competitor products. It is through the adjustment of the parameters of the engineering characteristics that the designer influences the performance and the customer's perception of the product (Cross 2001).

This methodology, integrating the customer requirements and competent product specifications into the industrial design process, enables the final product to capture a reasonable customer attraction on the market.

QFD should be taken as a tool for guidance to produce an effective development project, and it must be utilized with a number of other technical and management tools

like strategy planning, rapid prototyping, design of experiments, design for assembly, etc.

QFD method consists of 4 different matrices, which are formed by utilizing the collected data. These four matrices, which are 'House of Quality, 'Parts Development', 'Process Planning' and 'Production Planning', allow the voice of the customer to flow down to the actual production requirements. The first matrix, which is called the 'House of Quality', is the most important step of QFD method since it captures the customer requirements and the benchmarking information for the project. The areas, which constitute this matrix, are referred to as "rooms", and the matrix itself is referred to as the "house" because of the shape formed. Generally, most people only use this matrix, and QFD is synonymously referred to as the "House of Quality". Using all four of the QFD matrices is a powerful concept, but it is often difficult to achieve because of the time and resource constraints. The QFD method's the House of Quality matrix is seen in Figure 4.1.

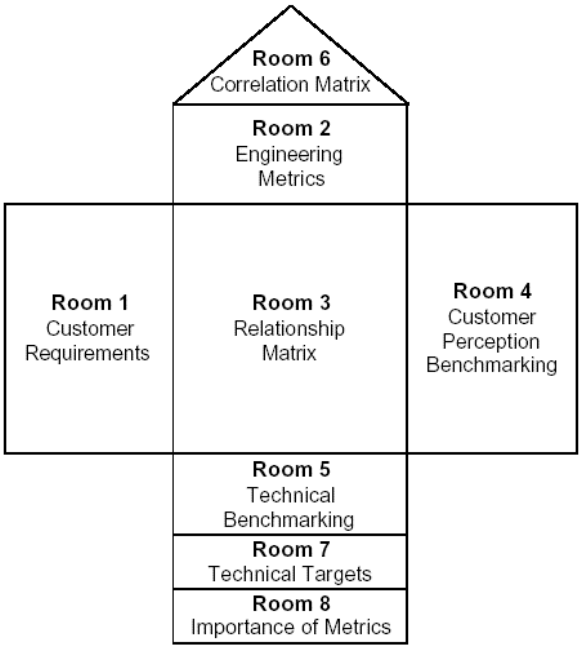

Figure 4.1. House of Quality Matrix
(Source: Aslan 2005)

The application of QFD method's House of Quality matrix consists of nine steps as described below.

The first step includes determining the target customers and the competitive products on the market.

The second step includes identifying the customer requirements. To identify the customer requirements various ways can be used. In their study, Holt et al. (1984) mentions 27 different methods of assessing need related information classifying these into three categories, which are 'utilization of existing knowledge', 'generation of new information' and 'provision of need information by other methods'. 'Customer Information', 'Competitor Information', 'Experts' and 'Trade Fairs' are of these methods to give (Aslan 2005).

The third step includes the classification of the customer requirements determined and weighting of the relative importances of that requirements to the customers. The classification of the requirements enables an orderly examination. To determine the relative importances of the requirements, questionnaires and interviews with the customers are utilized. The importance of any of the customer requirements is calculated by dividing the sum of the importance weights, which are given by each customer to that requirement, to the number of customers. According to the results, the customer requirements are scored identifying their importance. Various rating ways are used for scoring. One of them is to score on three-point scale, in which a '9' means very important, a '3' means moderately important, a '1' means somewhat important. They have a mathematically impact on the Relative Weight calculation of the technical requirements. The customer requirements and their relative weights constitute the 'room 1' of the House of Quality Chart.

The fourth step is the customer perception benchmarking. The attributes of competing products are evaluated. Determining the customer requirements is not enough for a realistic product or service development. This step involves collecting information from consumers to determine how the product compares with the competition. Thus the strong and weak attributes of the competitors are determined. The customer perception benchmarking constitutes the 'room 4'.

The fifth step is the determination of the technical requirements that influence one or more customer requirements. The technical requirements should be measurable characteristics that are directly related with the customer requirements. They are

determined by brainstorming meetings of the design team. The technical requirements constitute the ‘room 2’.

The sixth step is the indication of the relationship between the customer requirements and the technical requirements. Here it is determined that which technical requirement affect which customer requirements, and how strongly these subjective and objective measurements are related. These relationships are estimated by the team and are given a 9/3/1/0 rating. ‘9’ means strongly related, ‘3’ means moderately related, ‘1’ means somewhat related and a blank means little or no relation. Sometimes symbols can be used instead of rating numbers. The important thing is to emphasize the technical requirements that have strong relationship with the customer requirements. The large scores among these values enable the design team easily to identify where the adjustment of technical requirements will have a big influence on customers’ overall perception of the product. The relationship matrix constitutes the ‘room 3’.

The seventh step is the calculation to determine the relative importance of the technical requirements. Each rating of the technical requirements is multiplied by the customer weight and summed across all customer requirements to become the Raw Score. This value is normalized by dividing each raw score by the some of all raw scores for the relative weight. The relative weight shows the amount of customer value attributed to each objective design requirement. Therefore, according to the results, the team dwells upon the technical requirement, which has the highest relative weight, to enable better customer satisfaction. The relative weights of the technical requirements constitute the ‘room 8’.

The eight step is determination of the relationship between the technical requirements. In a roof shaped matrix, conflicts or synergies between the different technical requirements are shown. This matrix constitutes the ‘room 6’.

The ninth step is the technical benchmarking and determination of the technical targets. In technical benchmarking, the technical specifications of the competitor products are measured in the laboratories, and they are compared with the product’s measurements that are calculated by the engineers. This shows how well the product compares with the competition, and determines the weak technical specifications to be improved. After the examination of the results, quantitative targets are determined for the weak technical specifications to achieve and to make the product better than the competitors. The technical benchmarking results are given in ‘room 5’, and the technical target values are given in ‘room 7’.

The technical requirements that seriously affect the development of the product are determined by analysing the relative weights of the technical requirements given in the 'room 8'. To develop the product to enlarge its market share, more superior values than the competitors' are chosen as the technical targets for the weak technical requirements, which have the highest relative weights. The technical requirements, which fit the target, are not taken in consideration (Güllü and Ulcay 2002).

In general qualitative results of QFD (determining the main customer requirements and linkages to engineering metrics, team discussions etc.) are more important than quantitative results. (Martin and Ishii 2002)

4.2. The Traditional Turkish Coffee Brewing and The Criterias For a Good Cup

It was known that, without the knowledge of traditional Turkish coffee brewing method and the important details in brewing a good cup of Turkish coffee, the examination of the design of the three Turkish coffee machines would fail. Therefore necessary information was investigated.

As it was mentioned in the second chapter, the traditional way of brewing Turkish coffee is as follows. For each cup of cold water, two level-to-rounded teaspoons of finely-ground coffee and one level teaspoon of sugar for every teaspoon of coffee are added into the ibrik. The amount of the sugar added determines the traditional Turkish coffee's type, and the one described previously is called 'medium-sweet'. There are three other sugar alternatives of Turkish coffee. If one and a half level teaspoon of sugar is added for each teaspoon of coffee, the coffee is called 'sweet'. If half level teaspoon of sugar is added for each teaspoon of coffee, the coffee is called 'light-sweet'. If no sugar is added, then it is called 'plain coffee'. The mixture is stirred to dissolve sugar if added, and the heat is turned on medium to high. After a while, the coffee begins to boil gently. It is left to continue boiling, but watched closely to avoid overflowing. Eventually the froth, which should have a darkish crust on top and which is the most important peculiarity of the Turkish coffee, starts to rise in the ibrik. When the foam fills the flare at the top of the pot, and at the point of overflowing, the ibrik is taken off the heat. Avoiding spoiling the foam, the coffee is immediately poured into the cups,

filling each cup halfway first. Then the ibrik is brought to boil again to add some foam, and the rest of the coffee is poured into the cups eventually.

The most important criterias for a good cup of Turkish coffee are its delicious taste and plentiful foam on its top. Although the desirable taste and amount of foam can depend on the people's choices, and are affected by the quality of the water and the coffee used, there are common judgments about how to obtain the desirable taste and foam. Most commonly, it is believed that the best coffee is the one, which is brewed in a copper ibrik slowly on a brazier heat. Güçlü (2002) comprises a comprehensive description of the design development process of 'Telve'. It also comprises the findings of the experiments and observations done about how to obtain Turkish coffee in the context of the common perception of quality for the Turkish coffee. In the following, to describe the factors affecting the most important quality criterias, which are the taste and the foam, for the Turkish coffee, the findings that are mentioned in Güçlü (2002) will be utilized.

The findings about the taste of the traditional Turkish coffee start with the materials used in the ibriks. During the design process of 'Telve', some experiments were done to determine which material to use for the brewing reservoir. Also during these experiments, the common idea about the copper ibrik was examined. Heat control experiments were done with ibriks, which are copper, steel, and teflon in material, to observe the heat variations on certain areas of the ibriks. It is known that the heat should slowly increase to obtain a tasty Turkish coffee. According to the results of the experiments, the steel ibrik is the worst of three ibriks to be used in brewing Turkish coffee, because it enables heat to increase suddenly. It was observed that the copper ibrik enables the water to warm slowly for a while in the beginning, and it finishes the brewing process with a quicker increase in heat. This heating allocation is the most suitable to brew the Turkish coffee properly. Thus the copper ibrik brews good Turkish coffee. The heat conductivity of the copper ibrik is high so it can quickly warm and cool. The heat distribution can be appropriately provided. In case of brewing the coffee on a low heat, the energy of the heat can be conducted quickly and appropriately on the copper ibrik, thus it enables to brew the coffee better. The aluminium ibrik that is covered with teflon was observed to have a better performance than the steel one, but worse than the copper one.

Güçlü (2002) mentions that to obtain more tasty liquor, the brewing process should start with cold water. If the brewing process begins with cold water, by means of

necessity of the time to heat the water, the sediment of the coffee is brewed better. Also if the Turkish coffee is brewed on a low heat for a long time, the sediment of it is brewed and mixed with the water completely. Thus the resultant liquor is tasty.

The findings about the foam of the traditional Turkish coffee are as follows. It is observed that to obtain plentiful foam on the Turkish coffee, the coffee, at least during the brewing process, should not be stirred.

It is determined that the brewing process should finish before the liquor starts to boil. It is observed that the bubbles of the boiling liquor spoil the foam of the Turkish coffee. And it is determined that the best way to obtain good foam is to allow the coffee swell, in other words to come to a boil, nevertheless to avoid it to boil. Also it is important to avoid the foam of the swelling coffee to fade away.

It is observed that the foam of the Turkish coffee can be spoiled while it is being poured from the reservoir to the cup. Thus this finding is a criteria for the design of the reservoir.

The last finding mentioned by Güçlü (2002) is that the Turkish coffee, which is prepared in small amounts, is usually better in foam and taste. Thus the size of the brewing reservoir is important in obtaining a tasty Turkish coffee with desirable foam on top.

4.3. The Application of the Method Chosen for the Case

As it was mentioned before, using the Quality Function Deployment method was considered to be suitable for the aim of this study. The main reason of choosing the QFD method was the coincidence of the objectives. The objective of the QFD method is to determine targets to be achieved for the engineering characteristics of a product in order to satisfy customer requirements. The objective of this study is to evaluate the current attitude of the three Turkish coffee machines by examining and comparing their specifications, and to suggest any improvement, or in other words to determine targets to be achieved for the product specifications, which will make these products better meet the customer requirements. The input of the QFD process is the customer opinions and its output is the determination of the subjects of priority for the product's development to improve the customer satisfaction. Since the aim of this study is determination of the product specifications of priority to improve the products,

consequently the customer satisfaction, utilizing the QFD method is certainly the right way to achieve the data needed.

As it was described before, the QFD method consists of 4 different matrices allowing the voice of the customer to flow down to the actual production requirements, and its first matrix, which is called the 'House of Quality', is the most important one of all since it captures the customer requirements and the benchmarking information for the project. In this study the application of the House of Quality matrix was adapted to the requirements. As it was mentioned before, the application of the House of Quality matrix has nine steps. The first step includes determining the target customers and the competitive products on the market. The second step includes identifying the customer requirements. The third step includes the classification of the customer requirements determined and weighting of the relative importances of that requirements to the customers. The fourth step is the customer perception benchmarking. The fifth step is the determination of the technical requirements that influence one or more customer requirements. The seventh step is the calculation to determine the relative importance of the technical requirements. The eight step is determination of the relationship between the technical requirements. The ninth step is the technical benchmarking and determination of the technical targets.

The first seven steps of the House of Quality matrix of QFD method were utilized by adapting to the requirements of the study. In the eight and the ninth steps of the House of Quality engineering metrics and measurements were needed, which were not subjects to this study, therefore these steps were not taken into consideration. Furthermore in this study, the requirements, which were named 'technical requirements' or 'engineering characteristics' in the description of the House of Quality application, were considered as 'product requirements' comprising the product specifications. In this study, also the application of the customer perception benchmarking was slightly changed from the original application and adapted to the requirements of the case. The applications of the seven steps are going to be explained under the following four subtitles.

4.3.1. Identifying the Customer Requirements and Their Relative Importance

Considering that the customer requirements were the input of the examination intended, the ways of collecting data to identify the customer requirements were investigated. To identify the customer requirements various ways can be used. In their study, Holt et al. (1984) mentions 27 different methods of assessing need related information classifying these into three categories, which are 'utilization of existing knowledge', 'generation of new information' and 'provision of need information by other methods'. 'Customer Information', 'Competitor Information', 'Experts' and 'Trade Fairs' are some of these methods to give (Aslan 2005).

Four of the methods mentioned above were used in this study. One of these methods was 'user questioning', which belonged to 'generation of new information' category. It was systematic collection of information regarding problems and needs, and some users of the three Turkish coffee machines, which were identified by informal contacts, were questioned about their satisfaction and demands. Another method used was 'competitor information', which belonged to 'existing information' category. It was systematically collected information concerning products, patents, and activities of competitors, and all the competitor products of these tree machines were examined in order to determine product specifications related with the possible customer requirements. The third method used was 'experts', which belonged to 'existing information' category. It was systematic questioning and/or creative talks with researchers and other knowledgeable persons, and the designer of 'Kahwe' and one of the designers from the design team of 'Telve' were questioned to get the information about the customer requirements that they took into consideration in their designs. The last method used in assessing the customer requirements was 'informal contacts', which belongs to 'other methods' category. The information was provided through informal talks with people willing to indicate problems, needs and wishes, and a number of people were questioned to learn what they expected from a Turkish coffee machine, or in other words how a Turkish coffee brewing machine should be.

After all the answers were collected, they were examined and arranged in order to eliminate the similar data and simplify the answers. The list of the raw answers is given in Appendix A. The numbers '17' and '18' were similar to number '8', and the numbers '35' and '36' were similar to number '34', so they were eliminated. The

number ‘11’ was not considered to be customer words. The number ‘43’ was related to factors that could not be managed, and the number ‘30’ was considered as a secondary requirement among the others. Thus they were eliminated.

The list of the final customer requirements, according to which the three Turkish coffee machines were going to be examined, were listed as follows:

(1) Should brew Turkish coffee with foam on top.
(2) Should adjust the foam according to demand.
(3) The coffee brewed should be tasty.
(4) Should be able to prepare coffee of different amount of sugar (like sweet-medium-light sweet-plain) at once.
(5) Should be able to brew different types of coffee like espresso, etc.
(6) Should be able to prepare at least 4 cups of coffee at once.
(7) Should have small and big-sized brewing reservoirs that enable brewing different amounts of coffee.
(8) Should automatically measure the amount of coffee and sugar and water (I should only select the number of coffee to be brewed and the sugar choices.
(9) In case of lack of water/coffee/sugar it should warn the user vocally and/or by warning lights.
(10) Should use the coffee that it roasts and grinds.
(11) Should brew the coffee quickly.
(12) Should not let the coffee overflow.
(13) Should adjust the necessary amount of water according to the size of the cup.
(14) Should keep the liquor hot for a while after brewing is completed.
(15) Should easily be operated.
(16) Should have a timer that allows the user to wind and have the coffee ready at the demanded time.
(17) Should be able to take and fill the cups itself.
(18) Should not make the user wait by side of it and interfere during the brewing process.
(19) Should warn the user vocally when the liquor is ready.
(20) If the liquor is not taken immediately after the brewing is finished, for example in 10 minutes (related to the heaters max. ability of heat keeping, and the max. time

of the liquor to protect its quality), it should remind the user vocally and/or with warning lights that the coffee is no more good to drink.

(21) Should be able to be used at the picnic area by plugging in the car's lighter.
(22) Should be ergonomic.
(23) Should have long life.
(24) Should be easy to clean.
(25) Should consist of component which can be washed in the dishwasher.
(26) Should not consist of many and small components.
(27) Should be easy to carry.
(28) Should not be heavy.
(29) Should need small spaces.
(30) Should be safe to operate.
(31) Should meet the emotional needs of the user (Should satisfy the user aesthetically).
(32) Should have colour variety.
(33) Should not considerably limit the user about the choice of the usage area relevant to the distance to the energy source.
(34) If the coffee is brewed in an ibrik like reservoir, should not drip.
(35) Should not break.
(36) Should not rust.
(37) Should not easily be scratched.
(38) Should be inexpensive to buy.
(39) Should be inexpensive to operate-low energy consumption.

After identifying the customer requirements, which were going to be the data to be used in identifying the product requirements, by means of a questionnaire realized with 77 people, the relative importances of the customer requirements were determined. In the questionnaire, the final customer requirements were listed, and the people were requested to give a mark according to the importance of the listed customer requirements for them. The people were requested to give a '9' to the most important features, a '3' to important features, a '1' to somewhat important features, and a '0' to unimportant features showing their own ideas. In the questionnaire, instead of making people set up the customer requirements in the order of importance for them, they were requested to give a mark of 9-3-1-0. Because of the high number of customer

requirements listed, it was not suitable to make the people set up the 39 requirements in the order of importance. It would be confusing for the people. Therefore the rating of 9-3-1-0, which was suitable for that case, was chosen to be used in the questionnaire to be able to calculate the relative weights of the customer requirements. The sum of the ratings given to each customer requirement was divided by the number of people participated and the result was the relative weight of that customer requirement. The relative weights were intended to be grouped having simple numbers like 9-3-1 under the name of 'customer weight', but later it was decided to use them without any changes. The questionnaire is given in Appendix B.

The relative importances of the customer requirements were determined to be used in the determination of the relative weights of the product requirements. In Appendix C, the questionnaire results and the customer weights are seen as Table C.1.

The customer requirements numbered as '3' and '31' were not eliminated from the list although it was known that the evaluation of them with the product requirements were not possible. They were expected to have high relative weights, therefore, to see their importance for the customers, they were not eliminated from the list of customer requirements which was used in the questionnaire. For example, the taste of the Turkish coffee depends on the people. While some people like the Turkish coffee prepared with plentiful coffee, some people prefer it prepared with lesser amount of coffee. Also the coffee and the water used affect the taste of the coffee, therefore the taste of the Turkish coffee having different variables, can not be evaluated only with the product requirements. Meeting the emotional needs of the products also can not be evaluated with the product requirements. The aesthetical satisfaction of every customer differs, and is something emotional and the evaluation of this requirement of the customer is not possible with the quantitative product specifications. In this study, to be able to compare the tree machines according to their aesthetical beauty the customers were questioned. At the end of the questionnaire, which was prepared to determine the relative importance of the customer requirements, a second question was added to evaluate the customer perception of aesthetics of the three products. The people were requested to give a '9' to the most satisfying, a '3' to the satisfying, a '1' to the less satisfying, and a '0' to the unsatisfying product. The aesthetical perception of the three products was determined according to which rating point they were given most.

The customer requirements which are listed according to the order of their relative importance which is determined by the questionnaire is seen in Table 4.1.

Table 4.1. The list of customer requirements according to the order of importance

Customer Weight	CUSTOMER REQUIREMENT	
8,1	The coffee brewed should be tasty .	3
7,9	Should be safe to operate .	30
7,8	Should not rust .	36
7,6	Should be easy to clean .	24
7,3	Should brew Turkish coffee with foam on the top	1
6,9	Should not let the coffee overflow .	12
6,8	Should have long life .	23
6,7	Should consist of component which can be washed in the dishwasher .	25
6,2	Should easily be operated .	15
6,2	Should be inexpensive to buy .	38
5,8	Should not make the user wait by side of it and interfere during the brewing process .	18
5,8	Should warn the user vocally when the liquor is ready.	19
5,8	Should need small spaces .	29
5,7	If the coffee is brewed in an ibrik like reservoir, should not drip .	34
5,6	Should be inexpensive to operate.	39
5,4	Should not easily be scratched .	37
5,3	Should not break .	35
5,2	Should be able to prepare at least 4 cups of coffee at once .	6
5,2	Should keep the liquor hot for a while after brewing is completed .	14
5,1	Should be easy to carry .	27
5,1	Should not be heavy .	28
5	Should not consist of many and small components .	26
4,9	Should be ergonomic .	22
4,8	In case of lack of water/coffee/sugar it should warn the user vocally and/or by warning lights.	9
4,7	Should automatically measure the amount of coffee and sugar and water (I should only select the number of coffee to be brewed and the sugar choices)	8
4,7	Should meet the emotional needs of the user (Should satisfy the user aesthetically)	31
4,6	Should not considerably limit the user about the choice of the usage area relevant to the distance to the energy source .	33
4,4	Should be able to prepare coffee of different amount of sugar (like sweet-medium-light sweet-plain) at once .	4
4,2	If the liquor is not taken immediately after the brewing is finished, for example in 10 minutes (related to the heaters max. ability of heat keeping, and the max. time of the liquor to protect its quality), it should remind the user vocally and/or with warning lights that the coffee is no more good to drink .	20
4,1	Should adjust the necessary amount of water according to the size of the cup.	13
4	Should brew the coffee quickly .	11
4	Should be able to be used at the picnic area by plugging in the car's lighter	21
3,8	Should have small and big-sized brewing reservoirs that enable brewing different amounts of coffee .	7
3,4	Should have colour variety .	32
3,3	Should be able to brew different types of coffee like espresso, etc.	5
3,3	Should have a timer that allows the user to wind and have the coffee ready at the demanded time .	16
3	Should adjust the foam according to demand.	2
2,2	Should use the coffee that it roasts and grinds.	10
1,6	Should be able to take and fill the cups itself .	17

4.3.2. Determining the Product Requirements

After identifying the customer requirements and determining their relative importances, the customer requirements were translated into product requirements. It was important here to assess the convenient product requirements, which were directly related with the customer requirements. Customers often compare the product specifications with other competitor products, and to be successful in a competitive market, a product has to satisfy the customer requirements better than the competitor products. It is through the adjustment of the parameters of the product specifications.

In this study, the product requirements responding each customer requirement were determined as follows:

(1) Should brew Turkish coffee with foam on top
   - To have technology to stop brewing before the liquor starts to boil
   - To have technology to make the liquor come to boil more than once
   - To have technology to remove the need to stir during the brewing process
   - To have small brewing reservoir

(2) Should adjust the foam according to demand
   - To have technology to adjust the amount of the foam

(3) The coffee brewed should be tasty –no product requirement was determined

(4) Should be able to prepare coffee of different amount of sugar (like sweet-medium-light sweet-plain) at once
   - # of brewing reservoir (To have more than one reservoir)

(5) Should be able to brew different types of coffee like espresso, etc.
   - # of coffee brewing methods (To have more than one choice of coffee type)

(6) Should be able to prepare at least 4 cups of coffee at once
   - Capacity of the brewing reservoir (at least 4 cups)
   - Capacity of the water reservoir (at least 4 cups)
   - Capacity of the coffee reservoir (at least 4 cups)
   - Capacity of the sugar reservoir (at least 4 cups)

(7) Should have small and big-sized brewing reservoirs that enable brewing different amounts of coffee
   - # of brewing reservoir (To have more than one reservoir)
   - Capacity of the brewing reservoir (To have different-sized reservoirs)

(8) Should automatically measure the amount of coffee and sugar and water (I should only select the number of coffee to be brewed and the sugar choices
   - To have technology to automatically measure the amount of coffee-sugar-water
   - To have coffee, sugar, and water reservoirs to stay filled
   - To have control panel to operate the product

(9) In case of lack of water/coffee/sugar it should warn the user vocally and/or by warning lights
   - To have audio alarm system
   - To have warning light system

(10) Should use the coffee that it roasts and grinds
   - To have roasting reservoir to roast the coffee
   - To have grinding reservoir to grind the coffee

(11) Should brew the coffee quickly
   - Time of brewing (Short)
   - Power consumption (The more the power consumed the shorter the brewing)

(12) Should not let the coffee overflow
   - To have technology to perceive the rising foam
   - To have technology to automatically stop to continue heating
   - To have technology to automatically stop brewing

(13) Should adjust the necessary amount of water according to the size of the cup
   - To have technology to automatically measure the water according to the size of the cup

(14) Should keep the liquor hot for a while after brewing is completed
   - To have technology to keep the heat for a specific time (heating timer)

(15) Should easily be operated
   - # of user steps (The fewer the steps the easier to operate)

(16) Should have a timer that allows the user to wind and have the coffee ready at the demanded time
   - To have technology to start brewing at the specified time (brewing timer)
   - To have coffee, sugar, and water reservoirs
   - To have technology to automatically measure the amount of coffee-sugar-water
   - To have technology to manage the cup

(17) Should be able to take and fill the cups itself

- To have technology to manage the cup
- To have technology to automatically measure the amount of coffee-sugar-water

(18) Should not make the user wait by side of it and interfere during the brewing process

- To have audio alarm system
- To have technology to automatically perceive the rising foam
- To have technology to automatically stop to continue heating
- To have technology to automatically stop brewing
- To have technology to remove the need to stir during the brewing process
- To have technology to manage the cup
- To have technology to keep the heat for a specific time (heating timer)

(19) Should warn the user vocally when the liquor is ready

- To have audio alarm system

(20) If the liquor is not taken immediately after the brewing is finished, for example in 10 minutes (related to the heaters max. ability of heat keeping, and the max. time of the liquor to protect its quality), it should remind the user vocally and/or with warning lights that the coffee is no more good to drink

- To have audio alarm system
- To have warning light system
- To have technology to keep the heat for a specific time (heating timer)

(21) Should be able to be used at the picnic area by plugging in the car's lighter

- To be small in size
- To be light in weight
- To have plug in component for car lighter

(22) Should be ergonomic –no product requirement was determined

(23) Should have long life

- To have stainless material
- To have unbreakable material

(24) Should be easy to clean

- # of brewing process components (The lesser the components the easier the cleaning)

- # of dirt holding points of the brewing process components (The lesser the number of dirt holding points the easier the cleaning)
- To have smooth material
- To have detachable brewing components from the electric body

(25) Should consist of component which can be washed in the dishwasher

- To have detachable brewing components from the electric body
- The detachable components' material should be heat resistant

(26) Should not consist of many and small components

- # of brewing process components (The fewer the components the easier the cleaning)
- Size of the brewing process' components (The bigger the components the easier the clesning)

(27) Should be easy to carry

- To be light in weight
- To be small in size
- To have handle like component to carry

(28) Should not be heavy

- To be light in weight

(29) Should need small spaces

- To be small in size
- To consists of folding components
- To have component storage areas

(30) Should be safe to operate

- To have electrical safety against electric-shock
- To have heat safety against skin burns and environmental damages
- To have technology to automatically stop brewing
- To have technology to protect against running dry

(31) Should meet the emotional needs of the user (Should satisfy the user aesthetically) –no product requirement was determined

(32) Should have colour variety

- # of colour alternatives

(33) Should not considerably limit the user about the choice of the usage area relevant to the distance to the energy source

- To have the cord in convenient length

(34) If the coffee is brewed in an ibrik like reservoir, should not drip –no product requirement was determined

(35) Should not break

- To have unbreakable material

(36) Should not rust

- To have stainless material

(37) Should not easily be scratched

- To have material resistant to scratching

(38) Should be inexpensive to buy

- # of all components (The lesser the components the cheaper the manufacturing)
- # of the Technology used (The lesser the number of technology the cheaper the product)

(39) Should be inexpensive to operate

- Power consumption (The lesser the power consumed the cheaper to operate)

After the determination of the product requirements for each customer requirements, the product requirements were listed dividing into sub-groups as technology, components, material, and the others.

4.3.3. Forming the Relationship Matrix

The relationship matrix was constructed to indicate the relationship between the customer requirements and the product requirements also showing how strongly these subjective and objective measurements were related. Indicating the importance of the relations between, they were given a 9/3/1/0 rating. A '9' meaning strongly related, a '3' meaning moderately related, a '1' meaning somewhat related and a blank or '0' meaning little or no relation. The important thing was to emphasize the product requirements that have strong relationship with the customer requirements. The relationship matrix constructed in this study is given in Appendix D, as Table D.1.

For example a '9' was given to the relationship between the customer requirement (12) 'Should not let the coffee overflow' and product requirement (3) 'Technology to perceive the rising foam'. There is a 9 point relationship between the

two requirements because in case of having a technology to perceive the rising foam and stop brewing, the coffee never overflows.

Between the customer requirement (18) ‘Should not make the user wait by side of it and interfere during the brewing process’ and the product requirement (5) ‘To have technology to remove the need to stir during the brewing process’ a ‘1’ point relationship was determined. While the customer requirement is responded with other product requirements, this product requirement is not indispensable to meet the customer requirement. But in case of having this product requirement, the product ensure better satisfaction of customer.

After rating the relationship between the customer and product requirements, the relative weights of all the product requirements were determined. The relative weight showed the amount of customer value attributed to each product requirement. It was the most important finding of the study being a guide showing which product requirement was worth to dwell on. It was calculated by multiplying each rating of the product requirements by the customer weight and summed across all customer requirements to become the Raw Score. Then this value was normalized by dividing each raw score by the some of all raw scores for the relative weight. The product requirement, which had the highest relative weight, was the most influential requirement/specification of the product that enabling better customer satisfaction. The relative weights of the product requirements are given in the Table D.1, and in Table 4.2 the product requirements are listed according to the order of their relative weights.

Table 4.2. The list of the product requirements according to the order of importance

	PRODUCT REQUIREMENT	**Relative Weight**
15	Audio alarm system	0,0546
12	Technology to automatically stop brewing	0,0546
39	Stainless material	0,0387
24	Detachable brewing components from the electric body	0,0379
3	Technology to perceive the rising foam	0,0337
4	Technology to automatically stop to continue heating	0,0337
36	# of brewing process components	0,0334
46	Size	0,0325
41	Unbreakable material	0,0321
47	Weight	0,0306
28	Capacity of the brewing reservoir (at least 4 cups)	0,0299
6	Technology to automatically measure the amount of coffee-sugar-water	0,0255
49	Power consumption	0,0255
16	Warning light system	0,0239
35	# of brewing reservoir	0,0218
19	Coffee, sugar, and water reservoirs	0,0212
5	Technology to remove the need to stir during the brewing process	0,0211
13	Technology to protect against running dry	0,0210
17	Electrical safety	0,0210
18	Heat safety	0,0210
37	# of dirt holding points of the brewing process components	0,0202
42	Smooth material	0,0202
1	Technology to stop brewing before the liquor starts to boil	0,0194
2	Technology to make the liquor come to boil more than once	0,0194
40	Heat resistant material of the detachable components	0,0178
10	Technology to keep the heat for a specific time (heating timer)	0,0167
14	# of the technology used	0,0164
34	# of all components	0,0164
44	# of user steps	0,0164
23	Folding components	0,0154
27	Component storage areas	0,0154
38	Material resistant to scratching	0,0143
29	Capacity of the water reservoir (at least 4 cups)	0,0138
30	Capacity of the coffee reservoir (at least 4 cups)	0,0138
31	Capacity of the sugar reservoir (at least 4 cups)	0,0138
22	Handle like components to carry	0,0135
32	Size of the brewing process' components	0,0133
26	Control panel	0,0125
33	Length of the cord	0,0122
8	Technology to automatically measure the water according to the size of the cup	0,0109
25	Plug in component for car lighter	0,0106
43	Time of brewing	0,0106
48	# of colour alternatives	0,0090
11	Technology to start brewing at the specified time (brewing timer)	0,0088
45	# of coffee brewing methods	0,0088
7	Technology to adjust the amount of the foam	0,0080
9	Technology to manage the cup	0,0069
20	Roasting reservoir	0,0058
21	Grinding reservoir	0,0058

4.3.4. Forming the Correlation Matrix

To define the relationship between all the product requirements the correlation matrix was used. It is given in Appendix E as the Table E.1. By the help of correlation matrix the type of the relationship between the product requirements could be viewed. The relationships were indicated with symbols. A '+ +' was given to a positive and strong relationship, a '+' was given to a positive and weak relationship, a '-' was given to a negative and weak relationship, and a '- -' was given to a negative and strong relationship between the two product requirements. If the product requirement did not have any relationship with the others, its column/row was left blank.

To give examples, there was a strong and positive relationship determined between 'to have technology to automatically measure the amount of coffee-sugar-water' and 'to have coffee, sugar, and water reservoirs' and the relationship was given a '+ +'. The relationship can be explained as follows; to use the technology of automatically measuring the amount of coffee, sugar and water, the materials should be contained in reservoirs.

There was a weak and positive relationship determined between 'to have a control panel' and 'number of user steps of the brewing process', and a '+' was given. The relationship can be explained as follows. To have a control panel, in some circumstances, can be considered to be able to automatically measure and use the amount of coffee-sugar-water that the user does not add the materials. Thus the number of user steps to brew coffee decreases, as it is preferred to be.

There was a negative and weak relationship determined between 'to have technology to manage the cup' and 'size', and it was given a '-'. The explanation is that to be able to manage the cup requires additional gadget to operate, and this causes having a bigger-sized product, which is not desired.

There was a strong and negative relationship determined between 'roasting reservoir' and 'size', and it was given a '- -'. The reason is that in case of having a roasting reservoir, the product is big in size and it is not desired.

The correlation matrix of this study shows that the numbers of positive and negative synergies between the product requirements are almost equal. The important finding of the matrix to be mentioned is the negative synergy between the product requirements, which shows the contradiction in customer requirements. The negative

synergy is mostly determined between the product requirements that are related to size, weight and the capacity of the product. The customer requiring a small, easy to carry and easy to clean product, also requires having a product brewing in large quantities, comprising coffee, sugar and water reservoirs, operating automatically, and being capable of brewing espresso in addition. Responding all the customer requirements mentioned above is not possible at the same time because of the negative synergy between the product requirements. Thus, the correlation matrix enables having an idea on the synergy between the customer requirements.

4.4. The Examination and Comparison of the Products

After obtaining the necessary data by means of House of Quality matrix' sub-matrices which enables the examination and the comparison of the three Turkish coffee machines, two tables were constructed. One of them was consisting of the customer requirements, and the other was consisting of the product requirements which had the highest ten relative weights. The main intention of constructing the tables was to indicate how the three Turkish coffee machines match the customer and product requirements. The tables collecting the three products' specifications together, provides ease in their comparison. The examination and the comparison of the products are going to be done utilizing these tables.

The Table 4.3 was constructed to show how the products meet the customer requirements. It is an adaptation of the 'Customer Perception Analysis' matrix of the House of Quality. In this study, because of the lack of ability to meet sufficient number of users to make the customer perception analyses of House of Quality, another way of analysing the customer perception was developed. The three products were purchased and used to determine how they response the customer requirements, and they were rated according to their performances. To obtain a symbolic value to be used in determining which product better fits the whole customer requirements, the ratings given to each product for each customer requirement was multiplied with the customer weight of that requirement. The results were summed up to achieve the symbolic value showing the overall performance of the products.

Table 4.3. The Customer Perception Analysis

			PRODUCTS		
	CUSTOMER REQUIREMENT	**CUSTOMER WEIGHT**	**TELVE**	**KAHWE**	**GONDOL**
1	Should brew Turkish coffee with foam on top .	7,3	9	3	3
2	Should adjust the foam according to demand .	3	0	0	0
3	The coffee brewed should be tasty .	8,1	-	-	-
4	Should be able to prepare coffee of different amount of sugar (like sweet-medium-light sweet-plain) at once .	4,4	9	0	0
5	Should be able to brew different types of coffee like espresso, etc.	3,3	0	0	0
6	Should be able to prepare at least 4 cups of coffee at once .	5,2	9	9	9
7	Should have small and big-sized brewing reservoirs that enable brewing different amounts of coffee .	3,8	0	0	0
8	Should automatically measure the amount of coffee and sugar and water (I should only select the number of coffee to be brewed and the sugar choices)	4,7	0	0	0
9	In case of lack of water/coffee/sugar it should warn the user vocally and/or by warning lights.	4,8	9	0	0
10	Should use the coffee that it roasts and grinds.	2,2	0	0	0
11	Should brew the coffee quickly .	4	3	9	9
12	Should not let the coffee overflow .	6,9	9	0	0
13	Should adjust the necessary amount of water according to the size of the cup.	4,1	9	0	0
14	Should keep the liquor hot for a while after brewing is completed .	5,2	0	0	0
15	Should easily be operated .	6,2	9	3	3
16	Should have a timer that allows the user to wind and have the coffee ready at the demanded time .	3,3	0	0	0

(cont. on next page)

Table 4.3. (cont.)

17	Should be able to take and fill the cups itself .	1,6	0	0	0
18	Should not make the user wait by side of it and interfere during the brewing process .	5,8	9	0	0
19	Should warn the user vocally when the liquor is ready.	5,8	9	0	0
20	If the liquor is not taken immediately after the brewing is finished, for example in 10 minutes (related to the heaters max. ability of heat keeping, and the max. time of the liquor to protect its quality), it should remind the user vocally and/or with warning lights that the coffee is no more good to drink .	4,2	0	0	0
21	Should be able to be used at the picnic area by plugging in the car's lighter	4	0	0	0
22	Should be ergonomic .	4,9	9	9	9
23	Should have long life .	6,8	3	9	1
24	Should be easy to clean .	7,6	9	3	1
25	Should consist of component which can be washed in the dishwasher .	6,7	0	0	0
26	Should not consist of many and small components .	5	9	9	9
27	Should be easy to carry .	5,1	1	3	9
28	Should not be heavy .	5,1	1	3	9
29	Should need small spaces .	5,8	3	9	9
30	Should be safe to operate .	7,9	9	3	0
31	Should meet the emotional needs of the user (Should satisfy the user aesthetically)	4,7	9	3	0
32	Should have colour variety .	3,4	0	9	9
33	Should not considerably limit the user about the choice of the usage area relevant to the distance to the energy source .	4,6	9	9	9
34	If the coffee is brewed in an ibrik like reservoir, should not drip .	5,7	9	3	1
35	Should not break .	5,3	9	3	3
36	Should not rust .	7,8	9	9	0
37	Should not easily be scratched .	5,4	1	1	1
38	Should be inexpensive to buy .	6,2	1	3	9
39	Should be inexpensive to operate-low energy consumption .	5,6	600W/1200W	1000W	Unknown
	TOTAL SCORE		1007,6	616,2	525,6

All the customer requirements were rated except the two, which were related with taste and power consumption. It was not possible to rate the taste by the way developed in this study, because it depended on the people's tastes, and the coffee and the water used. The power consumption could not be rated because of the lack of information. In addition to these two customer requirements, the aesthetical beauty of the three products required to be questioned to people to be evaluated, and it was evaluated by means of the questionnaire that was done to determine the customer weight.

The products' performances in meeting the customer requirements were rated with '9', '3', '1', and '0'. A '9' point meant good in meeting the requirement, a '3' point meant average in meeting the requirement, a '1' meant bad in meeting the requirement, and a '0' meant the product did not have the necessary specification to meet the requirement. In the following, the ratings given to each product for each customer requirement are going to be explained.

For the customer requirement 1, Telve is rated with a '9' because it always produces coffee with foam on top. Although Kahwe and Gondol produce coffee with foam, they are rated with '3', because they do not automatically stop brewing when the coffee is brewed, and continue boiling, and if the machines are not stopped before the liquor start to boil, the foam is spoiled. Furthermore, the lids of the two products spoil the foam while pouring the liquor to the cup.

For the customer requirement 2, the three machines are rated '0', because none of them has the ability to adjust the amount of the foam.

For the customer requirement 3, the three machines are not rated. As it was mentioned before, the taste depends on the people's choice and the materials used so it was not possible to evaluate it.

For the customer requirement 4, Telve is rated with a '9'. It has two brewing reservoirs and allows user to prepare two different types of Turkish coffee. Kahwe and Gondol are rated with a '0' because they have only one brewing reservoir.

For the customer requirement 5, the three machines are rated with a '0', because none of them has the ability to brew different types of coffee.

For the customer requirement 6, the three machines are rated with a '9', because they all have capacity to brew 4 cups of coffee at once.

For the customer requirement 7, the three machines are rated with a ‘0’, because none of them has different sized brewing reservoirs. Telve has two brewing reservoir of the same size, and Kahwe and Gondol have only one brewing reservoir.

For the customer requirement 8, the three machines are rated with a ‘0’, because none of them has the technology to automatically measure the amount of coffee, sugar and water. Furthermore, only Telve has a water reservoir, Kahwe and Gondol do not have water reservoirs.

For the customer requirement 9, Telve is rated with a ‘9’, and the others are rated with a ‘0’. Only Telve warns the user vocally and by warning lights in case of lack of water. The others do not have any reservoir so they do not need to have a system.

For the customer requirement 10, the three machines are rated ‘0’, because none of them has roasting or grinding apparatus.

For the customer requirement 11, Telve is rated with a ‘3’, and the other are rated with a ‘9’. Because Telve prepares one cup of coffee in 1,5-2,5 minutes and two cups of coffee in 2,5-3,5 minutes, while Kahwe prepares four cups of coffee in 1,5-2 minutes, and Gondol prepares six cups of coffee in 1,5-2 minutes.

For the customer requirement 12, Telve is rated with a ‘9’, and the others are rated with a ‘0’. Telve has AntiSpill technology which avoids overflowing, but Kahwe and Gondol do not have any technology, furthermore, they do not automatically stop brewing when the liquor is brewed.

For the customer requirement 13, Telve is rated with a ‘9’, and the others are rated with a ‘0’. Telve has the ability to adjust the amount of water according to the size of the cup. The others do not have any water reservoir and any adjustment system.

For the customer requirement 14, the three machines are rated with a ‘0’, because none of them has a technology intended to meet that requirement.

For the customer requirement 15, Telve is rated with a ‘9’, and the others are rated with a ‘3’. In this study ‘to be easily operated’ is evaluated with the number of steps for the user to prepare the coffee. The user finishes brewing coffee with Telve in two steps; putting coffee and sugar in the brewing reservoir and pushing the start button. In Kahwe and Gondol, the user has four steps to prepare the coffee; putting coffee and sugar in the brewing reservoir, adding water on top, stirring and pushing the start button/plugging in.

For the customer requirement 16 and 17, the three machines are rated with a ‘0’, because none of them has the technology intended to meet these requirements.

For the customer requirement 18, Telve is rated with a ‘9’, and the others are rated with a ‘0’. Telve has three technologies, which meets that customer requirement. It perceives that the foam is rising, stops brewing and by taking the heater away it avoids continuing heating and avoids overflowing. It also avoids need of stirring coffee and sugar during the brewing process by spraying spinning water on top of them. With these technologies it removes the need to wait by the side of the machine during the brewing process. Kahwe and Gondol do not have any technology to meet this requirement. To prepare coffee with any of them, the user must stir the mixture, must wait until it comes to a boil, and must stop the machine when considered the liquor is ready.

For the customer requirement 19, Telve is rated with a ‘9’, and the others are rated with a ‘0’, because Telve warns the user when the liquor is ready while the others do not.

For the customer requirement 20 and 21, the three machines are rated with a ‘0’, because none of them has the technology intended to meet these requirements.

For the customer requirement 22, the three machines are rated with a ‘9’, because they can be operated without any discomfort.

For the customer requirement 23, Telve is rated with a ‘3’, Kahwe is rated with a ‘9’, and Gondol is rated with a ‘1’. Considering that Gondol has a metal plate, which can rust, inside the brewing reservoir, the usage life of it should be the shortest of all. For Kahwe, the estimated product life is ten years, and for Telve the estimated product life is seven years.

For the customer requirement 24, Telve is rated with a ‘9’, Kahwe is rated with a ‘3’, and Gondol is rated with a ‘1’. In this study ‘to be easy to clean’ is evaluated with the few number of brewing process components, the few number of dirt holding points of the brewing process components, the smoothness of the material and having detachable brewing components from the electric body. The tree of the products has the same number of brewing process components. Considering all criterias, Telve best fits the requirement. Kahwe, which has a point of joint in the brewing reservoir that can be considered as a dirt holding point and can not be cleaned properly, is rated with a ‘3’. Also its brewing component, as the Gondol’s, can not be separated from the electric body. Gondol is the worst of all having a metal plate inside the brewing reservoir preventing to reach all the surfaces to clean.

For the customer requirement 25, the three machines are rated with a ‘0’, because none of them has components which can be washed in the dishwasher.

For the customer requirement 26, the three machines are rated with a ‘9’, because they all do not consist of many and small components.

For the customer requirement 27, Telve is rated with a ‘1’, Kahwe is rated with a ‘3’, and Gondol is rated with a ‘9’. ‘To be easy to carry’ is evaluated with to be light in weight, to be small in size and having handle like component. Telve is the heaviest and the biggest of three, and does not have any handle like component. Kahwe is the second in size and weight, and has a handle but not enough to carry the whole product because the brewing reservoir of Kahwe, which has the handle, is settled on a separate power base. Gondol is the smallest and lightest of three with the handle, which is enough to carry it.

For the customer requirement 28, Telve is rated with a ‘1’, Kahwe is rated with a ‘3’, and Gondol is rated with a ‘9’ according to their weights.

For the customer requirement 29, Telve is rated with a ‘3’, Kahwe and Gondol are rated with a ‘9’ according to their sizes.

For the customer requirement 30, Telve is rated with a ‘9’, Kahwe is rated with a ‘3’ and Gondol is rated with a ‘0’. In this study, the criterias to be safe to operate are determined as to have electrical safety against electric-shock, to have heat safety against skin burns and environmental damages, to have technology to automatically stop brewing, and to have technology to protect against running dry. Gondol which does not have electrical safety against electric-shock, without considering any other criteria, is rated with ‘0’. Kahwe does not automatically stop brewing, so is rated with a ‘3’. Telve fits all the criterias.

For the customer requirement 31, Telve is rated with a ‘9’, Kahwe is rated with a ‘3’ and Gondol is rated with a ‘0’. The rating is obtained from the questionnaire done. Among 77 people, 75 people answered the question related with the aesthetical beauty of the products in the questionnaire. The results were as follows; Telve gained ‘9’ point from 41 people, ‘3’ point from 26 people, ‘1’ point from 7 people, and ‘0’ point from 1 person. Kahwe gained ‘3’ point from 47 people, ‘9’ point from 21 people, ‘1’ point from 6 people, and ‘0’ point from 1 person. Gondol gained ‘0’ point from 42 people, ‘1’ point from 26 people, ‘3’ point from 6 people, and ‘9’ point from 1 person. The rating was determined according to these results, which rating point they gained most.

For the customer requirement 32, Telve is rated with a ‘0’, Kahwe is rated with a ‘9’ and Gondol is rated with a ‘9’. Telve has no colour option so it is rated with a ‘0’. The others having colour options, are rated with a ‘9’.

For the customer requirement 33, the three coffee machines were rated with a ‘9’, because they all have cords of one meter which meets this requirement.

For the customer requirement 34, Telve is rated with a ‘9’, Kahwe is rated with a ‘3’ and Gondol is rated with a ‘1’. The rating was done at the end of a series of experiments of coffee pouring into the cup.

For the customer requirement 35, Telve is rated with a ‘9’, Kahwe and Gondol are rated with a ‘3’. The rating was done according to the materials of the brewing reservoirs and according to the personal observation.

For the customer requirement 36, Telve and Kahwe are rated with a ‘9’, Gondol is rated with a ‘0’. The rating was done according to the materials of the brewing reservoirs, and Gondol having a metal plate which can rust in the brewing reservoir is therefore rated with a ‘0’.

For the customer requirement 37, the three products are rated with a ‘1’. They do not have materials which can not be scratched.

For the customer requirement 38, Telve is rated with a ‘1’, Kahwe is rated with a ‘3’ and Gondol is rated with a ‘9’. The most expensive of the three products is Telve. Kahwe is the second expensive one, while Gondol is the cheapest of all.

For the customer requirement 39, because of lack of information the products could not be rated.

The result of the ratings shows that among the three Turkish coffee brewing machines, Telve, with the symbolic value of ‘1007,6’, is the best in fitting the customer requirements, which are determined in the beginning of this study. Kahwe, with the symbolic value of ‘616,2’, comes in the second and Gondol comes in the third place with the symbolic value of ‘525,6’.

The Table 4.4, which is the second table constructed, shows how the three Turkish coffee machines meet the product requirements. The ten product requirements, which had the highest ten relative weights, were selected from the list of 49 to be examined in this table, because since they had the highest scores, they were the most influential product requirements in meeting the customer requirements. Therefore to better meet the customer requirements, in other words to develop the design of the

products, the three machines were examined to determine how they match these specifications, and the suggestions are going to be done according to the findings.

In the Table 4.4 to the side of the each product requirement, the product's responses are written in the words that it can be explained. For example, if it is a technological requirement or a component or a kind of material, which can be owned by the product, then the response of the products are shown with a yes/no, a 'yes' indicating that the product has that specification, is something positive. And a 'no' indicating that the product does not have that specification, is something negative for the product's satisfaction of the customer. If the product requirement is a quantitative requirement, which can be responded by numbers, then the numbers are written to the side of each product requirement. For example the size and the weight of the product, and the number of brewing process components are indicated by numbers, and they need extra explanation to describe if they fit the requirement or not.

Table 4.4. The table of evaluation of the three Turkish coffee machines regarding the first ten of the Product Requirements which have the highest importance

			PRODUCTS		
	PRODUCT REQUIREMENT	**RELATIVE WEIGHT**	**TELVE**	**KAHWE**	**GONDOL**
15	Audio alarm system	0,0546	YES	NO	NO
12	Technology to automatically stop brewing	0,0546	YES	NO	NO
39	Stainless material	0,0387	YES	YES	NO
24	Detachable brewing components from the electric body	0,0379	YES	NO	NO
3	Technology to perceive the rising foam	0,0337	YES	NO	NO
4	Technology to automatically stop to continue heating	0,0337	YES	NO	NO
36	# of brewing process components	0,0334	3	3	3
46	Size	0,0325	h:22 cm w:20 cm l:27 cm	h:22 cm w:19,5 cm	h:16,5 cm w:15 cm
41	Unbreakable material	0,0321			
47	Weight	0,0306	4,1 kg	~ 0,5 kg	~0,1 kg

At the first sight, the responses defined with ‘yes/no’ give a general idea about which of the three products responses the product requirements ‘positively’ on the largest scale. As the symbolic values obtained from the Table 4.3 show, which are the results of the examination of the three products from the aspect of meeting the customer requirements, this table shows by the ‘positive responses’ that Telve is the best in meeting the most important ten product requirements which enable the better customer satisfaction. Kahwe having more ‘yes’ responses than Gondol comes in the second place in meeting these product requirements, and Gondol is the worst of all with the fewest ‘yes’ responses, as it is the same in the result of the examination of the three products from the customer requirements’ aspect. Without taking the quantitative product requirements of the list, this observation can easily be done by means of the dominant number of the product requirements which need to be responded with yes/no of the list.

If the ten product requirements are going to be examined in detail, the insufficiencies of the three products can be comprehended clearly to be used as a guide in the suggestions.

The product requirements, which have the highest relative weight, are ‘audio alarm system’ and ‘technology to automatically stop brewing’. The highest relative weight shows that the product requirement responses considerable amount of the customer requirements, and having an audio alarm system and technology to automatically stop brewing ensures the customer satisfaction.

To comprehend the customer’s requirement related with the product requirement ‘audio alarm system’, the customer requirements need to be examined. This product requirement was determined according to the customer requirements 9, 18, 19, and 20. The customer wants to be warned by the machine when the liquor is ready, or when the liquor is no more good to drink, or in case of lack of any material. This can be explained as the customer wants a smart product, which facilitates the process of Turkish coffee brewing for the customer that the user does not have to adjust the amount of the ingredients every time in the brewing process, furthermore, does not have to know the required amounts of the ingredients, and does not have to wait by the side of the product and does not have to interfere the process. Telve has an audio alarm system. It warns the user when the coffee is ready, and continues warning until the brewing reservoir is taken out of the socket. It also warns the user if there occurs an error in brewing. With these specifications Telve meets this product requirement and consequently the

customer requirement to a level of satisfaction. Kahwe and Gondol do not have an audio alarm system and the related specifications that are mentioned above, consequently they do not meet the customer requirement. According to the findings, if the next generation designs of Kahwe and Gondol comprises an audio alarm system which means comprising the customer requirements that are met by this product requirement, the products, having a better design, will better meet the customer requirements. But having an alarm system does not solve all the problems of insufficiencies of these products. All the product requirements should be taken into consideration together.

The product requirement 'technology to automatically stop brewing', which also has the highest score of relative weights, was determined according to the customer requirements 12, 18, and 30. They indicate that the customer wants a product which is safe to operate that can automatically stop the brewing at the proper time, which does not make the user wait by side during the process and interfere, and a similar requirement including the same desire in fact, the user wants a product which does not let the coffee overflow. To meet these requirements, one of the specifications that the product should have is to be able to stop brewing automatically. Telve automatically stops brewing, and meets this product requirement, and furthermore with the other technologies it has, it meets the customer requirements mentioned above. Kahwe and Gondol do not have a technology to automatically stop the brewing process, therefore the customer has to wait by side of the product and stop the process, and there is the risk of overflow, and according to the customer requirement they can be defined as not safe enough. They do not meet the product requirement and consequently none of the related customer requirements.

The third important product requirement is 'stainless material'. This product requirement responses the customer requirements 23 and 36 basically which show the same desire of having a product of long life. One of the product requirements determined for these customer requirements is that. The relative weight of this product requirement was not expected to be in the third place, and the reason behind this result is that the high customer weights of the customer requirements 'should have long life' and 'should not rust'. Telve having components which do not comprise any rusting material, meets that product requirement, also the estimated product life of seven years shows that it meets the related customer requirement. Kahwe also meets the product requirement that it does not have any components which can rust, and with the ten years of estimated product life it also meets the related customer requirement. Gondol having

a metal plate inside of the reservoir which definitely rusts, does not meet this product requirement, and consequently the related customer requirements.

The fourth product requirement important in meeting the customer requirements is ‘detachable brewing components from the electric body’. This product requirement was determined to meet the customer requirements 24 and 25, which are related to the act of cleaning. The customer wants a product that is easy to clean and consists of components that can be washed in the dishwasher. One of the product requirements determined to meet this customer requirement is having detachable brewing components from the electric body that enables the component be washed easily without the worry about the electrical parts. The relative weight of this product requirement was not expected to be in the fourth place, the reason behind this result is that the high customer weights of the customer requirements that are responded with this product requirement. Telve having the brewing and water reservoirs detachable from the electrical body, meets this product requirement and consequently the customer requirements completely. Kahwe and Gondol having the heating components integrated to the brewing reservoir do not meet that product requirement and consequently do not meet the customer requirements properly.

The fifth important product requirement is ‘technology to perceive the rising foam’. It is clear to understand which customer requirement is related. The customer wants a product that never let the coffee to overflow. It is comprehended easily from the customer weight of that customer requirement that to meet this requirement ensures higher customer satisfaction. Telve has the technology of avoiding the overflow that it completely meets the product and the customer requirements. Kahwe and Gondol do not have any technology to avoid overflowing so they are insufficient in meeting that product requirement and the related customer requirement.

The product requirement, which has the sixth place in importance, is ‘technology to automatically stop to continue heating’. This product requirement has the same relative weight with the fifth one and is serving the same customer desire basically. This product requirement meets the customer requirements 12 and 18 and it is related with avoiding the overflowing. Telve having the AntiSpill technology, by taking the heater away, meets that product requirement and the related customer requirements. Kahwe and Gondol have no technology serving that product requirement that they have the risk of overflowing. Thus they do not meet that product requirement and its relevant customer requirement.

According to the relative weights, the seventh important product requirement is ‘number of brewing process components’. This product requirement meets the customer requirements 24 and 26. The customer wants a product which does not consist of many and small components and which is easy to clean. The customer in other words wants a product consisting of few components to be easy to clean which is translated as the product requirement of number of brewing process components. The less the number of components means the more the customer satisfaction. When the three products are examined, it is seen that they all have the same number of brewing components. Telve has a water reservoir, a measurement spoon and the brewing reservoir. Kahwe and Gondol have brewing reservoirs, spoons and lids. The three products can be defined as meeting that product requirement in order to consider that the number is to be the fewest of it can be. But when the other specifications of the brewing process components are considered, meeting this product requirement in number is not enough to meet the related customer requirements.

The eighth product requirement is ‘size’. This product requirement meets the customer requirements 21, 27, 28, and 29. To summarize these customer requirements, the customer wants a product, which is easy to carry and keep. The size of the product meets these customer requirements in case of being small, therefore to be able to compare and see if the product suits that product requirement, the measurements of the three products are given in the Table 4.4. Telve having the biggest size, needs the biggest place and hard to carry when compared with the others. Kahwe having the average measurements when compared with the others meets that requirement at the average. Gondol has the smallest measurements and meets that product requirement best. But it is important to mention that, size is not the only criteria in meeting the related customer requirements, other product requirements should be taken into consideration while examining meeting the related customer requirement.

The ninth product requirement is ‘unbreakable material’. This product requirement responses the customer requirements 23 and 35 basically which show the same desire of having a product of long life. One of the product requirements determined for these customer requirements is to be made of unbreakable material. Like the third product requirement, the relative weight of this product requirement was not expected to be in the ninth place among the 49,and the reason behind this result is that the high customer weights of the customer requirements ‘should have long life’ and ‘should not break’. The boxes relevant to that product requirement is not filled, because

of the measurements needed showing the resistance to blow. If any comment is done according to the observation, it can be said that material of the brewing reservoirs of Telve seem to be more resistant than the materials used in Kahwe and Gondol.

The product requirement, which has the tenth place in importance, is 'weight'. This product requirement meets the customer requirements 21, 27 and 28, which are the product requirement 'size's customer requirements at the same time. To summarize these customer requirements, it can be said that the customer wants a product, which is easy to carry. That can be translated as, if the product is light in weight, the customer will be more satisfied, but it is important to remember that the weight is not the only product requirement to meet the related customer requirements. The product can be light in weight but can be harder to carry when compared with a heavier one, because of lack of a handle like component. Telve is the heaviest of the three coffee machines, Kahwe is lighter than Telve, and Gondol is the lightest of all. According to this data Gondol and Kahwe are better in meeting that product requirement and the related customer requirements when they are compared with Telve. Telve is not good enough in meeting that product requirement, and consequently the related customer requirements.

In addition to all mentioned above, while examining the products according to how they meet the product requirements, in order to meet the related customer requirements, the product's other specifications should be taken into consideration. To give an example, for the three products of this study, the most developed and the best customer-satisfying product of the three is Telve. Its weight and size are the consequences of its specifications in other words, and can only be reduced to a level. And when compared with the others in the table, it is observed that the others meet these product requirements better than Telve. The smallest and the lightest of the three products is Gondol, but it is obvious that it the most primitive product of the three. The matter to say is that; while the aim of constructing this table is determining the specifications of the products to be developed to make the product better in customer perception, without considering any other criteria, directly examining and comparing the products according to the findings on this table is not efficient enough in some circumstances. During the examination of the products according to the product requirements to meet, while considering the related customer requirements, the products should be taken into consideration in a comprehensive manner, and it must be remembered that products or the product requirements can be improved to a level of

satisfaction that there is more than one variable affecting them, which can be named as the positive and the negative synergies between them.

CHAPTER 5

CONCLUSION

The main objective of this study is to examine and compare the design of three Turkish coffee machines, and to make suggestions for their design developments in order to make them better suit the customer requirements and to make them own a better place in the customer perception. The first phase of the objective, the examination and the comparisons, were completed in the fourth chapter. In this concluding chapter to achieve the objective of the study completely, the second phase of the objective, which is to determine what the next design steps of the products must be, or in other words, in which direction the development of the products better be, is going to be mentioned. The deficiencies of the three products in product requirements, and the customer requirements which are mentioned in the fourth chapter, are going to be taken into consideration and with additional ideas, suggestions are going to be made.

To start with Telve, actually about the product requirements that are listed in Table 4.4 in chapter four, it does not need many suggestions. It meets eight of the most important ten product requirements fairly good. The only problem is with the size and the weight of it. It is known that to develop a product according to better meet the customer requirements, the most important product requirements, which have the highest relative weights, should be taken into consideration, because it is known that these product requirements are the most influential ones in meeting the customer requirements and consequently the product's success. Also, as it was mentioned at the end of the fourth chapter, it should not be forgotten that products or the product requirements can be improved to a level of satisfaction that there is more than one variable affecting them, which can be named as the positive and the negative synergies between them. In this case, the customer wants the product to be small in size to be easily carried and wants the product to make plenty of coffee, furthermore wants the product to automatically measure the amount of the coffee, sugar and water, which means to have the reservoirs of the each materials. The requirements are in contradiction and can be moderately responded. In that case, being exposed to the same contradiction, expecting Telve to be smaller and lighter is a matter of discussion.

The suggestions to be made for Telve can better be considering the customer requirements determined without regarding if they have high or low relative importance for the customers, because Telve fairly meets the most of the customer requirements of primary importance. Majority of the suggestions for Telve are going to be as adding new functions to its current ones.

In the next generation designs of Telve it might have components, especially the brewing component which can be washed in the dishwasher. It might have the reservoirs of coffee and sugar, and be able to automatically measure the amount of them and prepare the liquor only pushing the start button. It might operate totally automatically that it takes the cup itself, brews the coffee, and pours it into the cup that the user has only two steps to brew coffee, to push the start button and to take the cup and drink the coffee. It might have different-sized brewing reservoirs to enable the user choose the one to use according to the amount of the coffee to be done. It might be able to brew different types of coffee in addition to Turkish coffee. It might have a timer technology which allows the user to wind and to have the coffee ready at the demanded time. It might be able to adjust the amount of the foam and the user has options to choose. Maybe by leaving the liquor to boiling degrees, which spoils the foam of the coffee, it can prepare coffee options of different amount of foams. It might have reservoirs to roast and grind the coffee, and the freshly roasted and ground coffee can be used. It might have colour options. Preserving the material and the colour of the case, the colour of the illumination can be optioned that the illumination changes the appeal of the product. The customer can choose the one which fits the place it will be used. In addition to all, as a user suggestion, it might have a cord storage area or a system that wraps up the cord and hides it. To avoid disturbing the appearance and because of the lack of space, the cord is needed to be hidden. Again as a user suggestion, a new solution should be developed to indicate the water level of the water reservoir. Because of the steam and the design, which provides viewing inside of the reservoir, the water level can not be perceived at first glance. This can be a reservoir of opaque material at the backside, which is connected to the water reservoir. And as another innovative suggestion, it might be able to operate with pre-packed coffee pods as it is mostly seen in the espresso machines, to give an example, like the Lavazza ‘Blue’ system. That removes the amount of sugar and coffee adjusting step of the user, and also might enable to keep the ground coffee fresh longer.

The suggestions for Kahwe firstly start with taking the product requirements into consideration. First of all it should have a technology to stop brewing in the next generation designs, to be perceived as totally safe to operate. It should have an audio alarm system warning the user when the coffee is ready. It should have a design enabling having or separating the electric body and the brewing reservoir, thus the brewing reservoir can be washed easily without the worry about the contact of the electrical part with water, and if the material provides, it can also be washed in the dishwasher. It should have a technology, which automatically stops continuing heating the liquor, and avoids the liquor to overflow. Technology to perceiving the rising foam is considered not to be a mandatory requirement in case of having the technologies to automatically stop brewing and to stop continuing heating. In addition to all, as a user suggestion it should not have a lid or a lid with a strainer in the next generation designs. The lid and the strainer spoil the foam of the coffee while pouring into the cup. And again as a user suggestion, it should have a solution to carry the brewing reservoir and the power base together, because, although the product is small in size, it is uncomfortable to carry it in two parts especially when the cord is out of the storage area. The solution may be designing details on the power base and under the base of the reservoir enabling temporary attachment of the two components. And as a final suggestion, because the point of joining the base and the side walls in the brewing reservoir, and the material used in that point, can not be cleaned properly, a new joining detail should be developed, or the material used in the joint should be changed with a less dirt holding one.

The suggestions for Gondol starts, without considering any other requirement, with that it should be safe to operate in the next generation. The risk of electric-shock must be eliminated. Secondly it should have a technology which automatically stops brewing, and it should have a technology, which automatically stops continuing heating the liquor, and avoids the liquor to overflow. And as it is the problem of Kahwe, it should have a design that separates the electrical part and the brewing reservoir. Also it should have the heating plate, which is in the brewing reservoir, made of stainless material. The stainless heating plate provides it a longer product life. Furthermore it should not have the heating plate in the brewing reservoir because the reservoir can not be cleaned properly because of that component. These specifications are mandatory for Gondol to meet in the next generation designs. With an additional specification, having an audio alarm sytem, it meets all the important product requirements except the

technology to perceive the rising foam, which is not needed in case of having the automatically stop brewing and to continue heating specifications. In addition, it might have a storage area for its cord. It might have a plug in apparatus for the car that enables the outdoor usage. And finally, it might have another spout design that does not drip.

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APPENDIX A

THE CUSTOMER REQUIREMENTS

MÜŞTERİ İSTEKLERİ

(1) Köpüklü Türk kahvesi pişirmeli
(2) Köpük oranını ayarlayabilmeli isteğe göre
(3) Lezzetli Türk kahvesi pişirmeli
(4) Aynı anda birden çok çeşit kahve (şekerli orta vs. gibi) pişirebilmeli
(5) Farklı kahve çeşitleri yapabilmeli espresso örneğin.
(6) Aynı anda en az 4 kişilik kahve hazırlayabilmeli
(7) Farklı sayılarda kahve yapmaya olanak sağlayan küçük hacimli ve büyük hacimli hazne seçenekleri olmalı
(8) Kahve-seker-suyu otomatik olarak kendi ölçülendirmeli (sadece kahve adedi ve şeker miktarı tuşlamalıyım)
(9) Su-kahve-şeker miktarlarında yetersizlik durumunda sesli/ışıklı uyarmalı
(10) Kahveyi kendi kavurup ve öğütüp kullanmalı
(11) Pişirme haznesi bakır olabilir
(12) Hızlı pişirmeli
(13) Kahveyi taşırmamalı
(14) Fincan büyüklüğüne göre gereken su miktarını ayarlayabilmeli
(15) Pişirilen kahvenin ısısını bir süre koruyabilmeli
(16) Kullanımı basit olmalı
(17) Fincan sayısını nümerik seçebilmeliyim
(18) Sadece kahve adedi ve şeker miktarı tuşlamalıyım
(19) Timer özelliği olmalı, önceden kurulup istenen saatte kahveyi hazır edebilmeli
(20) Fincanları kendi alıp doldurabilmeli
(21) Başında bekleme ve müdahale gerektirmemeli
(22) Sesli uyarıyla pişmeyi haber vermeli
(23) Kahve belli sürede alınmaz, boşaltılmazsa, örn.10dk (yani ısıtıcının sıcaklığı max. koruma ve kahvenin kalitesinin bozulma süreleriyle ilişkili belirlenen süre) sonunda eğer kahve alınmamışsa 2. uyarıyla (sesli ve/veya ışıklı) kahvenin içilmez olduğunu belirtmeli.
(24) Gerektiğinde arabanın çakmak fişine takılıp piknikte kahve yapmaya elverişli olmalı
(25) Ergonomik olmalı
(26) Uzun ömürlü olmalı
(27) Kolay temizlenebilir olmalı
(28) Makinede yıkamaya elverişli parçaları olmalı
(29) Çok ve küçük parçalı olmamalı
(30) Parçalarının yıkama sonrası montajı kolay olsun
(31) Kolay taşınabilir olmalı
(32) Hafif olmalı
(33) Çok yer kaplamamalı
(34) Güvenli çalışmalı
(35) Elektrik çarpmasın
(36) Aşırı ısınıp eli yakmasın, yakınındaki objelere zarar vermesin
(37) Estetik açıdan tatmin etmeli
(38) Renk seçenekleri olmalı
(39) Kullanım yeri seçilirken elektrik kaynağına erişim problem olmamalı
(40) Kahve eğer cezve benzeri bir hazneden boşaltılıyorsa damlamamalı/bulaştırmamalı
(41) Kırılmamalı
(42) Paslanmamalı
(43) Kireçlenme yapmasın
(44) Çabuk çizilmemeli
(45) Uygun fiyatlı olmalı
(46) Az enerji harcamalı, kullanımı ekonomik olmalı

APPENDIX B

THE QUESTIONNAIRE

ANKET

1) Bu anketin sonuçları İzmir Yüksek Teknoloji Enstitüsü, Endüstri Ürünleri Tasarımı Bölümü'nde, 'Türk kahvesi makinelerinin tasarımları' üzerine hazırlanmakta olan bir yüksek lisans tez çalışmasında kaynak olarak kullanılacaktır. Aşağıda bir 'Türk kahvesi makinesi'nden beklenen özellikler sıralanmıştır. Bu özellikleri sizin için önemine göre notlandırınız:

'9': çok önemli bir özellik

'3': önemli bir özellik

'1': bir şekilde önemli bir özellik

'0': olsa da olmasa da olur bir özellik

Lütfen 'yaş', 'cinsiyet' ve 'meslek' belirtmeyi unutmayınız.

Katılımınız için teşekkür ederim.

Saygılarımla

YAŞ: **CİNSİYET:** **MESLEK:**

1. Köpüklü Türk kahvesi pişirmeli
2. Köpük oranını ayarlayabilmeli isteğe göre
3. Lezzetli Türk kahvesi pişirmeli
4. Aynı anda birden çok çeşit kahve (şekerli orta vs. gibi) pişirebilmeli
5. Farklı kahve çeşitleri yapabilmeli espresso örneğin.
6. Aynı anda en az 4 kişilik kahve hazırlayabilmeli
7. Farklı sayılarda kahve yapmaya olanak sağlayan küçük hacimli ve büyük hacimli hazne seçenekleri olmalı
8. Kahve-seker-suyu otomatik olarak kendi ölçülendirmeli (sadece kahve adedi ve şeker miktarı tuşlamalıyım)
9. Su-kahve-şeker miktarlarında yetersizlik durumunda sesli/ışıklı uyarmalı
10. Kahveyi kendi kavurup ve öğütüp kullanmalı
11. Hızlı pişirmeli
12. Kahveyi taşırmamalı
13. Fincan büyüklüğüne göre gereken su miktarını ayarlayabilmeli
14. Pişirilen kahvenin ısısını bir süre koruyabilmeli
15. Kullanımı basit olmalı
16. Timer özelliği olmalı, önceden kurulup istenen saatte kahveyi hazır edebilmeli
17. Fincanları kendi alıp doldurabilmeli
18. Başında bekleme ve müdahale gerektirmemeli
19. Sesli uyarıyla pişmeyi haber vermeli

20. Kahve belli sürede alınmaz, boşaltılmazsa, örn.10dk (yani ısıtıcının sıcaklığı max. koruma ve kahvenin kalitesinin bozulma süreleriyle ilişkili belirlenen süre) sonunda eğer kahve alınmamışsa 2. uyarıyla (sesli ve/veya ışıklı) kahvenin içilmez olduğunu belirtmeli.
21. Gerektiğinde arabanın çakmak fişine takılıp piknikte kahve yapmaya elverişli olmalı
22. Ergonomik olmalı
23. Uzun ömürlü olmalı
24. Kolay temizlenebilir olmalı
25. Makinede yıkamaya elverişli parçaları olmalı
26. Çok ve küçük parçalı olmamalı
27. Kolay taşınabilir olmalı
28. Hafif olmalı
29. Çok yer kaplamamalı
30. Güvenli çalışmalı
31. Estetik açıdan tatmin etmeli
32. Renk seçenekleri olmalı
33. Kullanım yeri seçilirken elektrik kaynağına erişim problem olmamalı
34. Kahve eğer cezve benzeri bir hazneden boşaltılıyorsa damlamamalı/bulaştırmamalı
35. Kırılmamalı
36. Paslanmamalı
37. Çabuk çizilmemeli
38. Uygun fiyatlı olmalı
39. Az enerji harcamalı, kullanımı ekonomik olmalı

2) Aşağıdaki üç ürünün estetik açıdan sizi tatmin derecesini '**9'(çok tatmin ediyor)-'3'(yeterince tatmin ediyor)-'1'(az tatmin ediyor)-'0'(hiç tatmin etmiyor)** olarak notlandırarak belirtiniz.

Telve:

Kahwe:

Gondol:

APPENDIX C

QUESTIONNAIRE RESULTS AND CUSTOMER WEIGHTS MATRIX

Table C.1. Questionnaire Results and Customer Weight

	AGE	GENDER	OCCUPATION	CUSTOMER REQUIREMENT																																						
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
1	27	F	MEC.ENG.	9	3	9	9	9	9	3	3	9	3	3	9	3	9	9	0	0	9	9	3	1	3	9	9	9	3	9	9	9	9	9	9	3	3	9	9	3	9	3
2	22	M	STUDENT	9	3	9	9	3	9	9	9	1	3	3	9	9	9	9	3	3	9	3	9	1	1	9	9	3	3	1	3	3	9	3	3	3	9	9	9	9	3	3
3	28	M	DOCTOR	9	0	9	3	0	3	0	9	3	1	0	0	3	3	3	0	0	9	9	0	1	3	3	9	9	9	9	9	9	3	3	3	1	3	3	9	9	9	1
4	25	F	DOCTOR	9	0	9	3	0	3	3	0	0	3	9	3	0	3	9	3	0	3	3	0	9	9	9	9	9	1	9	9	9	9	3	3	3	1	3	3	3	9	9
5	27	M	ARCHITECT	9	1	3	9	0	9	3	9	3	9	3	9	9	3	3	0	0	1	1	3	3	3	9	9	9	9	3	3	9	9	9	1	3	3	3	9	9	1	3
6	27	F	CHEMIST	1	1	3	3	9	3	3	3	3	3	3	3	3	3	3	9	0	9	9	3	1	3	9	9	9	9	3	1	9	9	3	3	1	3	3	9	9	3	3
7	26	M	MEC.ENG.	9	3	9	1	1	1	3	1	1	1	3	3	1	3	3	3	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	3	3	3	1	3	3
8	26	M	ARCHITECT	9	2	9	9	3	9	3	9	3	1	3	9	3	9	9	1	1	9	9	3	1	9	9	9	9	3	3	9	9	9	9	3	3	9	3	9	9	9	3
9	26	F	ARCHITECT	9	3	9	1	0	9	0	3	3	0	1	9	1	9	9	3	9	9	9	3	0	3	9	9	9	1	9	3	9	9	0	0	1	3	3	9	3	9	9
10	28	F	RESEARC ASSIST	3	0	9	9	0	0	9	9	3	0	3	3	3	3	3	1	0	9	3	0	1	9	3	9	9	3	3	1	3	9	9	3	3	1	3	3	1	3	1
11	40	M	IND. DES.	9	3	9	3	3	9	3	3	3	9	1	9	9	9	9	3	3	3	3	1	1	9	9	9	9	3	3	0	0	9	9	3	9	9	9	9	9	3	1
12	57	F	ARCHITECT	9	0	3	1	0	3	3	1	1	0	3	3	3	3	1	0	0	3	3	3	0	3	3	3	0	0	0	0	1	3	1	1	1	3	3	3	3	1	1
13	27	M	CHEMICAL ENG.	9	3	9	3	1	3	1	3	3	0	3	9	3	9	9	1	0	1	3	1	3	1	3	3	3	1	1	1	3	3	1	1	1	3	1	3	3	9	3
14	37	M	COMPUTER ENG.	9	9	9	9	9	9	0	3	3	3	3	9	9	3	9	3	3	9	3	3	3	3	9	9	5	5	5	5	9	9	3	3	9	3	9	9	3	9	9
15	39	F	PHARMACIST	9	3	9	9	3	9	9	9	9	1	3	9	3	9	9	9	0	9	9	3	9	3	9	9	9	9	9	3	3	9	9	9	9	9	9	9	9	9	9
16	50	M	HAIR DRESSER	9	9	3	3	9	3	9	9	9	9	0	9	3	9	9	9	9	9	3	9	3	1	9	3	1	3	3	3	1	9	9	9	9	3	0	3	1	9	3
17	19	F	HAIR DRESSER	9	1	3	9	0	9	3	0	0	1	9	9	0	9	3	9	0	1	9	0	9	3	9	9	1	9	9	3	1	9	0	0	9	9	1	9	3	3	9
18	41	M	BUSINESSMAN	9	1	9	3	3	0	3	3	9	0	9	9	9	3	9	3	0	1	3	1	3	0	9	9	9	3	9	9	9	9	0	9	3	3	9	9	3	9	0
19	38	F	TOURISM	9	3	9	3	9	3	3	9	3	1	3	9	3	9	3	1	1	3	9	3	1	3	9	9	3	9	3	9	3	9	9	3	1	3	9	9	9	9	9
20	33	M	BUSINESSMAN	3	1	9	1	1	3	1	3	1	0	1	3	1	3	3	1	0	1	0	9	3	1	9	3	1	3	1	1	3	3	1	0	1	0	3	3	1	3	9
21	25	M	ADVERTISER	9	3	9	3	9	9	3	9	3	9	9	9	9	3	3	3	3	9	3	3	9	9	9	9	9	3	9	9	9	9	3	3	9	9	3	9	9	3	3
22	28	M	TEXTILE	3	3	9	3	1	3	3	1	1	1	3	3	3	9	3	3	1	0	1	3	9	9	9	3	3	9	1	1	1	9	1	1	0	3	3	9	1	1	3
23	27	M	BUSINESSMAN	3	9	9	3	1	9	3	3	3	1	3	9	3	3	3	1	1	9	3	3	9	3	9	3	3	9	3	3	3	9	9	3	9	3	3	3	3	3	3
24	19	F	SHOP ASSISTANT	3	9	3	1	0	1	1	0	0	1	0	9	3	3	3	0	0	3	1	3	3	3	3	3	3	0	9	9	3	9	3	1	3	3	9	3	3	3	3
25	24	F	SHOP ASSISTANT	9	3	9	9	3	9	9	0	3	0	9	9	0	3	9	0	0	9	9	3	3	9	9	9	9	9	9	9	9	9	9	3	9	9	9	9	9	9	9
26	35	F	PHARMACIST	9	3	9	9	0	9	9	0	0	0	9	9	0	3	9	0	0	9	9	3	3	9	9	9	9	9	9	9	9	9	9	3	9	9	9	9	9	9	9
27	50	M	INSURER	9	3	9	3	3	9	0	1	1	0	0	9	3	0	3	1	9	9	1	1	9	1	3	3	9	3	3	9	3	9	3	9	9	9	3	9	3	9	9
28	25	F	ACCOUNTANT	3	3	9	3	1	0	3	9	9	0	9	9	3	9	3	3	0	9	3	3	3	3	9	3	1	9	3	9	9	3	3	3	9	3	3	3	9	9	9
29	18	M	STUDENT	3	3	9	0	3	9	3		9	0	9	9	1	3	9	0	0	3	9	9	3	9	9	9	0	3	9	9	3	9	3	9	9	9	3	9	3	9	9
30	48	M	MARKET. EX.	3	3	9	0	0	9	3	1	1	0	3	9	1	3	3	0	0	3	9	0	1	1	9	3	9	9	9	3	3	9	9	1	0	9	9	9	9	9	9
31	34	F	JEWELRY DESIG	9	1	9	9	3	9	9	9	9	1	1	9	3	1	1	1	0	9	3	1	1	3	3	9	9	9	1	1	3	9	1	1	9	3	3	9	3	3	1
32	32	M	OFFICER	1	1	3	0	0	0	3	1	1	0	1	3	1	3	1	3	0	3	3	3	0	0	0	3	3	9	9	9	9	3	3	9	9	9	9	9	9	9	9
33	33	M	ECONOMIST	1	0	9	1	3	0	3	1	1	0	0	3	3	9	9	3	1	3	3	1	1	3	3	9	9	1	3	1	1	9	3	3	3	9	1	9	3	3	9
34	27	F	ARCHITECT	9	9	9	9	3	3	3	0	9	0	3	9	3	3	9	9	1	9	9	9	3	9	3	9	9	9	1	9	9	9	9	3	3	9	9	9	9	3	3
35	26	F	ENGINEER	9	1	9	1	3	9	9	9	9	3	1	9	9	9	9	0	0	1	9	9	3	1	9	9	9	1	9	9	9	9	3	3	9	9	9	9	9	9	9
36	27	M	ENGINEER	9	3	9	3	0	1	0	1	3	0	3	9	1	1	0	0	0	0	1	1	1	0	0	3	9	3	3	3	3	9	0	0	3	3	3	9	0	9	3
37	31	M	MEC.ENG.	9	3	9	3	0	0	1	3	3	0	3	9	3	3	9	3	0	9	9	3	9	9	9	9	9	0	9	9	9	9	9	9	3	3	9	9	9	3	3
38	28	M	CIVIL ENG.	9	1	9	9	3	9	1	9	9	0	0	9	3	9	9	3	0	9	9	9	1	3	3	9	9	3	1	1	3	9	0	0	3	9	1	9	1	3	3
39	32	M	ELEC.ENG.	1	0	9	0	3	3	3	9	0	1	0	1	0	9	9	9	0	0	9	9	3	9	9	9	9	9	9	9	9	9	9	0	1	1	0	9	1	1	9
40	28	M	MEC.ENG.	9	3	3	1	9	1	1	1	9	0	0	0	9	9	9	1	1	3	3	3	3	9	9	9	9	9	9	9	9	9	9	0	3	1	0	9	9	9	9
41	58	M	MEC.ENG.	9	9	9	3	3	3	3	3	9	0	3	3	1	9	9	0	0	9	9	3	9	3	9	9	9	3	3	3	3	9	3	3	3	9	9	9	3	9	9
42	27	M	ENGINEER	9	9	3	3	3	1	9	9	9	3	1	3	1	3	0	3	0	3	3	1	0	0	1	1	3	1	1	1	0	1	3	0	0	0	0	1	1	1	3
43	27	M	DEALER	3	0	9	0	3	0	0	3	3	1	3	3	1	3	3	0	0	1	0	3	1	3	3	9	9	3	1	3	3	3	3	3	1	1	3	9	3	3	3
44	39	F	PHARMACIST	3	1	9	9	0	3	0	0	0	0	1	1	1	1	3	0	0	1	3	1	1	1	1	1	1	1	1	1	3	3	3	1	1	3	3	9	9	9	9
45	49	F	HAIR DRESSER	9	1	9	1	3	3	3	1	1	3	0	9	3	3	9	9	0	9	9	1	9	3	3	9	9	3	3	9	9	9	3	1	1	9	3	9	3	3	3
46	26	F	IND.DES.	9	3	9	9	3	9	9	9	9	3	9	9	9	3	3	1	1	9	9	3	1	9	9	9	3	9	1	1	9	9	9	3	3	9	3	9	3	3	3
47	32	F	TOURISM	9	1	9	3	9	3	9	9	9	1	9	9	9	9	9	0	0	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
48	38	M	ENGINEER	9	9	9	9	9	9	1	9	9	0	1	9	0	9	9	3	0	9	9	3	3	9	9	9	9	9	9	9	9	9	3	3	3	3	9	9	9	9	9
49	27	F	AGR.	9	0	9	3	9	9	9	9	3	0	1	9	9	3	3	0	0	3	9	1	3	3	3	9	9	3	3	3	9	9	9	9	1	9	3	9	3	3	3
50	24	F	STUDENT	9	1	9	3	1	9	3	9	9	0	3	9	3	3	9	3	1	9	3	3	3	9	9	9	3	9	9	9	3	9	3	1	3	9	9	9	3	9	9
51	61	F	TEACHER	9	3	9	9	3	9	1	3	9	9	3	3	3	9	3	3	3	9	9	9	9	3	3	9	9	9	3	9	9	9	3	1	9	9	3	9	9	3	3
52	26	M	SALESMAN	9	3	9	0	1	3	3	3	9	3	1	3	3	3	9	3	0	1	9	9	1	3	1	9	9	9	9	9	3	9	0	9	9	9	9	9	1	9	0
53	31	M	JEWELLER	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	3	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
54	27	M	ACCOUNTANT	9	1	9	1	9	9	9	3	9	1	9	9	9	9	9	3	1	9	1	3	3	9	9	9	9	1	1	1	9	9	1	1	3	9	3	9	1	9	9
55	29	M	INSURER	3	3	9	3	9	3	9	9	9	0	1	3	3	3	9	9	9	9	9	9	9	9	9	9	9	1	9	3	3	9	3	9	9	9	9	9	9	9	3
56	31	M	JEWELLER	9	3	3	1	9	9	3	3	9	9	9	9	9	9	9	9	0	9	9	9	9	9	9	9	9	3	9	9	9	9	9	9	9	9	9	9	9	9	9
57	25	M	MARKET. EX.	9	0	9	0	0	9	3	9	0	9	3	3	9	3	3	1	3	0	0	9	3	3	3	9	9	9	9	9	9	9	9	9	3	9	3	3	9	3	3
58	26	M	SALESMAN	9	9	9	9	0	9	9	9	9	0	9	9	3	3	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
59	28	M	JEWELLER	9	9	9	3	9	9	9	9	9	9	0	9	9	9	9	9	9	9	9	9	3	9	9	9	9	0	9	0	9	9	0	3	9	0	9	9	9	9	9
60	19	M	STUDENT	3	1	3	3	3	3	0	3	9	3	9	9	3	9	9	3	0	9	9	9	3	3	9	9	9	3	9	9	9	9	9	0	3	9	9	9	9	3	9
61	34	F	TOURISM	3	3	3	3	0	1	0	3	1	3	3	3	3	0	0	0	0	3	1	0	0	0	3	9	9	0	0	0	0	3	1	1	0	3	0	3	3	9	3
62	26	F	ACCOUNTANT	9	1	9	9	9	3	3	9	9	3	3	3	3	3	9	9	3	9	9	9	9	9	9	9	9	3	3	3	3	9	3	3	9	9	9	9	9	9	9
63	33	F	HOUSEWIFE	3	1	9	3	0	3	3	9	3	9	3	9	9	3	3	0	3	3	3	0	0	0	3	9	9	0	0	0	3	9	3	0	1	9	0	9	3	3	1
64	26	F	BANKER	3	3	9	0	0	0	1	3	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	0	3	3	3	3	1	0	3	3	3	9	3	3	3
65	27	M	BUSINESSMAN	9	9	9	3	9	1	3	9	9	1	9	9	9	3	9	9	9	9	3	3	9	9	9	9	9	9	9	9	9	9	3	3	3	3	9	9	9	9	9
66	27	F	ARCHITECT	9	3	9	3	1	9	3	9	3	0	9	9	3	3	9	9	0	0	9	9	3	0	9	9	3	3	3	3	3	9	9	3	3	9	3	9	3	3	3
67	26	F	IND.DES.	9	0	9	3	0	3	1	3	3	1	3	9	3	9	9	3	0	3	9	3	1	9	9	9	9	9	3	3	3	9	9	3	3	3	9	9	9	3	3
68	26	M	ENGINEER	9	3	9	3	0	1	0	0	0	0	3	3	3	9	9	0	0	9	9	0	3	3	3	0	1	3	3	3	1	0	0	1	3	1	1	1	0	3	3
69	32	M	CIVIL ENG.	3	3	9	3	3	3	1	1	1	1	3	3	1	9	3	3	3	3	3	1	1	3	3	9	3	3	3	3	3	9	3	1	3	3	1	3	1	3	1
70	35	M	MEC.ENG.	9	1	9	9	0	9	3	3	9	3	1	9	9	3	3	1	9	9	3	9	9	9	9	9	9	9	9	9	9	9	3	3	9	9	9	9	9	9	9
71	23	F	CONT. TECH	9	3	9	3	1	9	3	0	3	9	9	9	3	9	3	9	1	9	9	9	9	1	9	9	3	3	9	0	3	9	3	1	9	3	9	9	9	9	9
72	25	F	RESAER.ASS.	9	1	9	9	3	3	9	0	3	0	9	9	0	9	9	3	1	9	0	3	3	9	9	9	9	9	3	3	9	9	3	3	9	9	9	9	3	9	9
73	32	F	CHEMICAL ENG.	9	0	9	3	3	3	9	9	9	1	9	9	3	1	9	1	0	9	9	9	9	9	9	9	1	9	3	3	9	9	1	1	1	3	3	9	3	3	1
74	27	M	MARKET. EX.	9	1	9	9	3	3	3	3	9	3	3	9	9	3	1	9	0	3	9	3	3	9	9	9	9	3	1	1	9	9	9	1	3	9	9	9	3	9	9
75	30	M	ENGINEER	9	9	9	9	1	3	3	1	3	3	9	9	3	3	9	3	3	3	3	1	1	3	9	9	3	3	3	3	9	9	9	1	3	3	3	9	3	9	3
76	38	M	DOCTOR	9	1	9	9	9	9	9	9	9	9	3	3	9	9	3	9	3	3	9	9	9	3	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
77	51	M	ECONOMIST	3	3	9	9	3	9	0	3	3	0	9	9	9	3	9	9	0	3	9	3	9	3	9	9	9	1	1	9	3	9	3	3	1	1	9	9	9	9	9
RELATIVE WEIGHT				7,3	3	8,1	4,4	3,3	5,2	3,8	4,7	4,8	2,2	4	6,9	4,1	5,2	6,2	3,3	1,6	5,8	5,8	4,2	4	4,9	6,8	7,6	6,7	5	5,1	5,1	5,8	7,9	4,7	3,4	4,6	5,7	5,3	7,8	5,4	6,2	5,6
CUSTOMER WEIGHT				7,3	3	8,1	4,4	3,3	5,2	3,8	4,7	4,8	2,2	4	6,9	4,1	5,2	6,2	3,3	1,6	5,8	5,8	4,2	4	4,9	6,8	7,6	6,7	5	5,1	5,1	5,8	7,9	4,7	3,4	4,6	5,7	5,3	7,8	5,4	6,2	5,6

APPENDIX D

THE RELATIONSHIP MATRIX

Table D.1. The Relationship Matrix

PRODUCT REQUIREMENT — Technology (1–18)

No.	CUSTOMER REQUIREMENT	CUSTOMER WEIGHT	1 Technology to stop brewing before the liquor starts to boil	2 Technology to make the liquor come to boil more than once	3 Technology to perceive the rising foam	4 Technology to automatically stop to continue heating	5 Technology to remove the need to stir during the brewing process	6 Technology to automatically measure the amount of coffee-sugar-water	7 Technology to adjust the amount of the foam	8 Technology to automatically measure the water according to the size of the cup	9 Technology to manage the cup	10 Technology to keep the heat for a specific time (heating timer)	11 Technology to start brewing at the specified time (brewing timer)	12 Technology to automatically stop brewing	13 Technology to protect against running dry	14 # of the technology used	15 Audio alarm system	16 Warning light system	17 Electrical safety	18 Heat safety
1	Should brew Turkish coffee with foam on top.	7,3	9	9			9													
2	Should adjust the foam according to demand.	3							9											
3	The coffee brewed should be tasty.	8,1																		
4	Should be able to prepare coffee of different amount of sugar (like sweet-medium-light sweet-plain) at once.	4,4																		
5	Should be able to brew different types of coffee like espresso, etc.	3,3																		
6	Should be able to prepare at least 4 cups of coffee at once.	5,2																		
7	Should have small and big-sized brewing reservoirs that enable brewing different amounts of coffee.	3,8																		
8	Should automatically measure the amount of coffee and sugar and water (I should only select the number of coffee to be brewed and the sugar choices)	4,7						9												
9	In case of lack of water/coffee/sugar it should warn the user vocally and/or by warning lights.	4,8															9	9		
10	Should use the coffee that it roasts and grinds.	2,2																		
11	Should brew the coffee quickly.	4																		
12	Should not let the coffee overflow.	6,9			9	9								9						
13	Should adjust the necessary amount of water according to the size of the cup.	4,1								9										
14	Should keep the liquor hot for a while after brewing is completed.	5,2										9								
15	Should easily be operated.	6,2																		
16	Should have a timer that allows the user to wind and have the coffee ready at the demanded time.	3,3						9			1		9							
17	Should be able to take and fill the cups itself.	1,6						9			9									
18	Should not make the user wait by side of it and interfere during the brewing process.	5,8			9	9	1				1	1		9			9			
19	Should warn the user vocally when the liquor is ready.	5,8															9			
20	If the liquor is not taken immediately after the brewing is finished, for example in 10 minutes (related to the heater's max. ability of heat keeping and the max. time of the liquor to protect its quality), it should remind the user vocally and/or with warning lights that the coffee is no more good to drink.	4,2										1					9	9		
21	Should be able to be used at the picnic area by plugging in the car's lighter	4																		
22	Should be ergonomic.	4,9																		
23	Should have long life.	6,8																		
24	Should be easy to clean.	7,6																		
25	Should consist of component which can be washed in the dishwasher.	6,7																		
26	Should not consist of many and small components.	5																		
27	Should be easy to carry.	5,1																		
28	Should not be heavy.	5,1																		
29	Should need small spaces.	5,8																		
30	Should be safe to operate.	7,9												9	9				9	9
31	Should meet the emotional needs of the user (Should satisfy the user aesthetically)	4,7																		
32	Should have colour variety.	3,4																		
33	Should not considerably limit the user about the choice of the usage area relevant to the distance to the energy source.	4,6																		
34	If the coffee is brewed in an ibrik like reservoir, should not drip.	5,7																		
35	Should not break.	5,3																		
36	Should not rust.	7,8																		
37	Should not easily be scratched.	5,4																		
38	Should be inexpensive to buy.	6,2														9				
39	Should be inexpensive to operate.	5,6																		
	RAW SCORE		65,7	65,7	114,3	114,3	71,5	86,4	27,0	36,9	23,5	56,8	29,7	185,0	71,1	55,8	185,0	81,0	71,1	71,1
	RELATIVE WEIGHT		0,0194	0,0194	0,0337	0,0337	0,0211	0,0255	0,0080	0,0109	0,0069	0,0167	0,0088	0,0546	0,0210	0,0164	0,0546	0,0239	0,0210	0,0210

PRODUCT REQUIREMENT — Components (19–37)

No.	19 Coffee, sugar, and water reservoirs	20 Roasting reservoir	21 Grinding reservoir	22 Handle like components to carry	23 Folding components	24 Detachable brewing components from the electric body	25 Plug in component for car lighter	26 Control panel	27 Component storage area	28 Capacity of the brewing reservoir (at least 4 cups)	29 Capacity of the water reservoir (at least 4 cups)	30 Capacity of the coffee reservoir (at least 4 cups)	31 Capacity of the sugar reservoir (at least 4 cups)	32 Size of the brewing process' components	33 Length of the cord	34 # of all components	35 # of brewing reservoir	36 # of brewing process components	37 # of dirt holding points of the brewing process components
1										3									
2																			
3																			
4																	9		
5																			
6										9	9	9	9						
7										9							9		
8	9							9											
9																			
10		9	9																
11																			
12																			
13																			
14																			
15																			
16	9																		
17																			
18																			
19																			
20																			
21							9												
22																			
23																			
24						9												9	9
25						9													
26														9				9	
27				9															
28																			
29					9				9										
30																			
31																			
32																			
33															9				
34																			
35																			
36																			
37																			
38																9			
39																			
RAW SCORE	72,0	19,8	19,8	45,9	52,2	129,0	36,0	42,3	52,2	103,0	46,8	46,8	46,8	45,0	41,4	55,8	73,8	113,4	68,4
RELATIVE WEIGHT	0,0212	0,0058	0,0058	0,0135	0,0154	0,0379	0,0106	0,0125	0,0154	0,0299	0,0138	0,0138	0,0138	0,0133	0,0122	0,0164	0,0218	0,0334	0,0202

PRODUCT REQUIREMENT — Material (38–42), Others (43–49)

No.	38 Material resistant to scratching	39 Stainless material	40 Heat resistant material of the detachable components	41 Unbreakable material	42 Smooth material	43 Time of brewing	44 # of user steps	45 # of coffee brewing methods	46 Size	47 Weight	48 # of colour alternatives	49 Power consumption
1												
2												
3												
4												
5								9				
6												
7												
8												
9												
10												
11						9						9
12												
13												
14												
15							9					
16												
17												
18												
19												
20												
21									3	3		
22												
23		9		9								
24					9							
25			9									
26												
27									9	9		
28										9		
29									9			
30												
31												
32											9	
33												
34												
35				9								
36		9										
37	9											
38												
39												9
RAW SCORE	48,6	131,4	60,3	108,9	68,4	36,0	55,8	29,7	110,1	103,8	30,6	86,4
RELATIVE WEIGHT	0,0143	0,0387	0,0178	0,0321	0,0202	0,0106	0,0164	0,0088	0,0325	0,0306	0,0090	0,0255

APPENDIX E

THE CORRELATION MATRIX

Table E.1. The Correlation Matrix

	PRODUCT REQUIREMENT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
1	Technology to stop brewing before the liquor starts to boil		+	++	++						+		++																																				
2	Technology to make the liquor come to boil more than once	+		++	+			++			+	+	++																																				
3	Technology to perceive the rising foam		++		++								++																																				
4	Technology to automatically stop to continue heating	++	+	++									++						++																														
5	Technology to remove the need to stir during the brewing process																																												++				
6	Technology to automatically measure the amount of coffee-sugar-water								+					+						++							+		+		+													++		-			
7	Technology to adjust the amount of the foam		++																								++																	++					
8	Technology to automatically measure the water according to the size of the cup						+			+				+						+							+																	++					
9	Technology to manage the cup								+																		+																	++		-	+		
10	Technology to keep the heat for a specific time (heating timer)	+	+																+																														
11	Technology to start brewing at the specified time (brewing timer)		+																								+																						
12	Technology to automatically stop brewing	++	++	++	++																																											
13	Technology to protect against running dry						+		+																																								
14	# of the technology used																																																
15	Audio alarm system																																															
16	Warning light system																																															
17	Electrical safety																																															
18	Heat safety																																															
19	Coffee, sugar, and water reservoirs						++		+											++							+																						
20	Roasting reservoir																			+							+																						
21	Grinding reservoir																										+																						
22	Handle like components to carry																										+																						
23	Folding components																										+																						
24	Detachable brewing components from the electric body																																															
25	Plug in component for car lighter																																															
26	Control panel						+	++	+			+								+	+	+					+																						
27	Component storage areas																																															
28	Capacity of the brewing reservoir (at least 4 cups)						+																																									
29	Capacity of the water reservoir (at least 4 cups)						+																																									
30	Capacity of the coffee reservoir (at least 4 cups)						+																																									
31	Capacity of the sugar reservoir (at least 4 cups)						+																																									
32	Size of the brewing process' components																																															
33	Length of the cord																																															
34	# of all components																			--	--	--	-																										
35	# of brewing reservoir																																			--												
36	# of brewing process components																										-									--		--										
37	# of dirt holding points of the brewing process components																																			--		--										
38	Material resistant to scratching																																															
39	Stainless material																																															
40	Heat resistant material of the detachable components																																															
41	Unbreakable material																																															
42	Smooth material																																															
43	Time of brewing																																															
44	# of user steps					++	++		++	++										++	-	-		-													++											
45	# of coffee brewing methods																																															
46	Size						-			-										--	--	--	--		++												-								++				
47	Weight									-										--	--	-	--					++	-	-	-	-	-			-											
48	# of colour alternatives																																															
49	Power consumption																																															