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*Edited by*

Muhammad Ishtiaq Khan

THE DEPARTMENT OF ARCHAEOLOGY  
MINISTRY OF EDUCATION, GOVERNMENT OF PAKISTAN  
K A R A C H I

**JAHANSIR BOOK HOUSE**

37-Bari Chambers 4th Floor,  
Robson Road,

## THE EARLIEST DISTILLATION UNITS OF POTTERY IN INDO-PAKISTAN

*by*

**S. Mahdihassan**

*(Figures 41 to 48)*

Distillation is an important device for purifying liquids. The greatest impetus to this technique was offered by alchemy. But its earliest origin has yet to be established. Considering the possible motives which must have initiated distillation nothing can appear more pressing than want of fresh water on desert coasts. Nomads along the southern coast of Arabia live mainly on fish and even feed their camels with ground date-seeds and fish meal. It may be recalled that when Alexander was returning from India, via Makran coast, his chroniclers described the local inhabitants as Ichthyophagus or eaters of raw fish. The problem for such nomads would be the procurement of drinking water. Next to them would be merchants undertaking long sea voyages. Here we read in Encyclopedia Britannica (1) that, according to Aristotle (384-322 B.C.), "pure water was made by the evaporation of sea water." No details are given but Taylor (2;17) informs that, "a sort of sublimation of liquids was occasionally practised. Thus sea water was heated in covered cauldrons and the drops condensed on the lid were collected and used as drinking water". This naturally would represent the simplest procedure of distillation but the yield would be most discouraging. While nomads would be too backward to think of any better device sea merchants must have seriously thought of improvement. With them the actual problem must have been whether it was more practical to distil sea water and carry enough fuel for the purpose, or sufficient water itself to last until the next port. Presumably the latter alternative would have proved the better.

Next to the distillation of sea water was the problem of preparing fermented liquors from raw materials when these, nor their fermentation products, could be

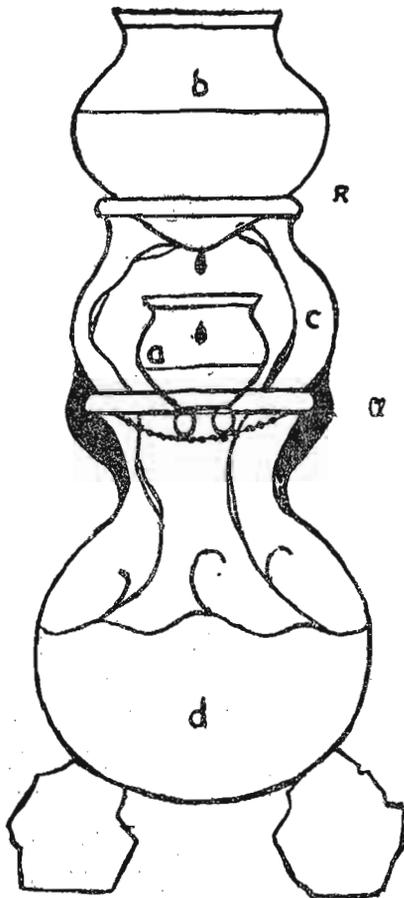


Fig. 41

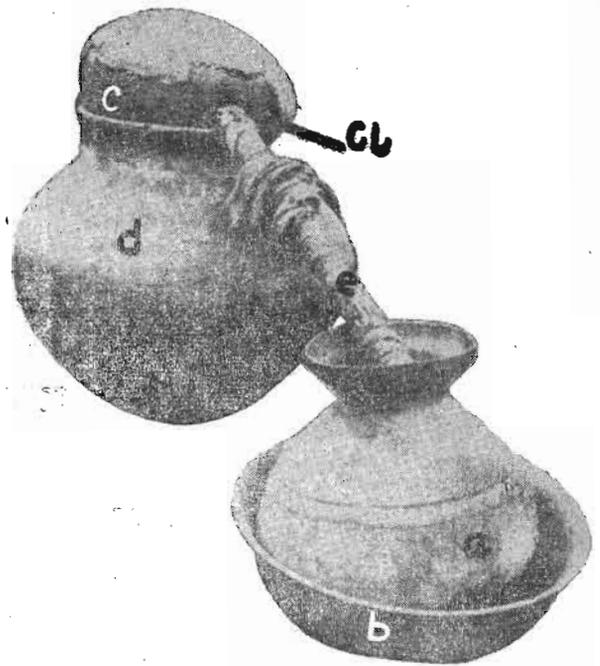


Fig. 42

directly consumed. In Egypt and Assyria barley was fermented into beer which is consumable. In China there was rice-beer. The tartars fermented mare's milk and drank it as Koumis. Then came fruit liquors like grape-wine in Iran and apple-wine or cider in Europe.

Wines from fruits are richer in alcohol as compared to beers from grains, consequently they have a long storage life; in fact their quality improves with age. Now there are other raw products which can be fermented into alcohol. Among them first to be considered is mahua flowers, *Bassia latifolia*, and next molasses. Moreover mahua flowers are found all over India and when dry contain about 30 p.c. fermentable sugar, a potential source of alcohol. However the flowers also contain a laxative principle which prevents their serving even as animal fodder. During famines poor folks roast mahua flowers to detoxicate them and even then eat them sparingly. Molasses likewise, when consumed in any large quantity, cause diarrhoea. Moreover when given to cattle beyond a small proportion of fodder they

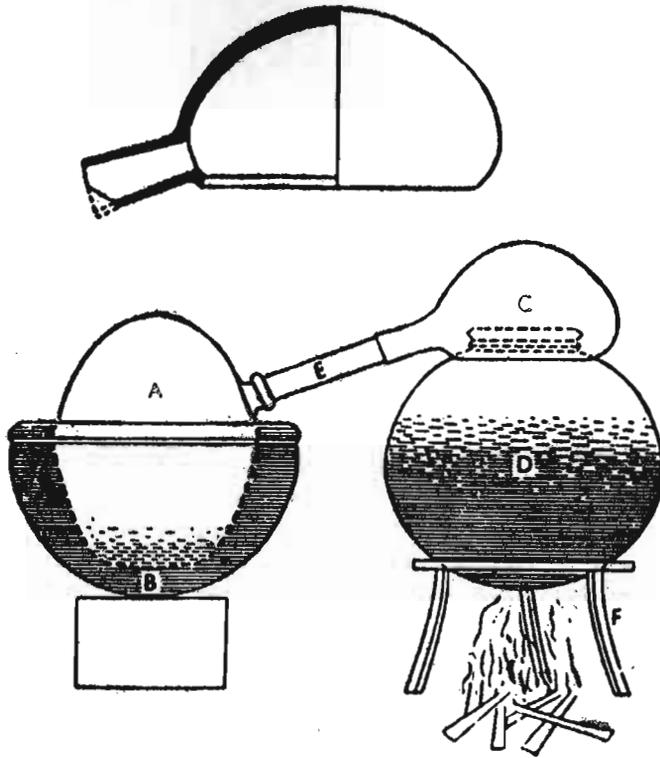


Fig. 43

cannot tolerate it. Correspondingly fermented products of mahua and molasses contain the toxic principles present in them. In such cases there is no alternative than to distil their fermented mash. Thus arose the indispensable idea of alcoholic distillation.

There are many references to the use of beer and wine in ancient Indian literature. Om Praksah (3;152) briefly informs that, "liquors were also made from madhuka, *Bassia latifolia*, flowers and honey". Distilled liquors were known as Madya, which is mentioned by Susruta, a Master of Indian Medicine, as being in common use in his time. Then Rig Veda speaks of an intoxicating liquor named Sura, a preparation from fermented barley which was subsequently distilled (3; 24). Since Sura was highly intoxicating its use was positively discouraged in Rig Veda. But this indirectly implies that the art of distilling alcohol existed even in those immemorial times.

When we now focus attention on the technique of distillation or on the actual devices used the sources of information are almost silent. It is the purpose of this communication to explain how distillation must have been carried out by merely as-

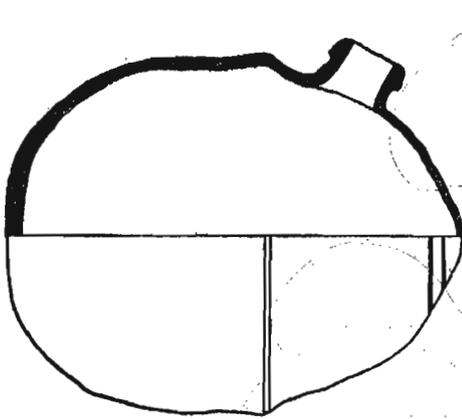


Fig. 44

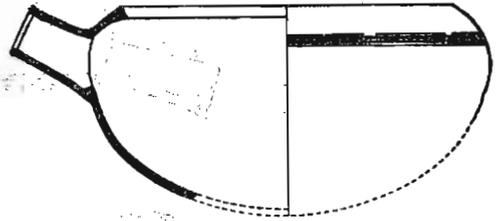


Fig. 45

sembling units of pottery found in domestic use. Here two early systems are being described which have survived to this day. The simplest is the one used by the forest tribes of Bihar in India. It was discovered by my friend, Hakim Moinul Haque of Pabna, formerly of Patna. The distillation assembly as reconstructed is shown in fig. 41. On three large stones rests a pot, *d.*, fig. 41, into which the fermented mash is placed, and boiled. Over pot, *d.*, rests another vessel of pottery, *c.*, with perforations or holes drilled in its bottom by an ordinary nail. It may be mentioned in advance that a regular perforated pot has been excavated to which no use has been

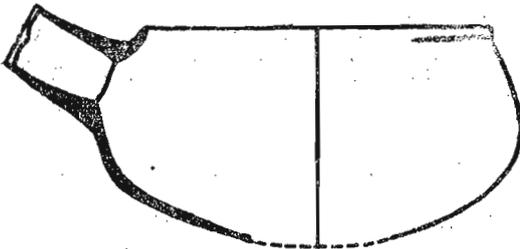


Fig. 46

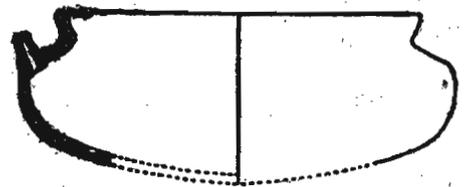


Fig. 47

ascribed, not to talk of such pieces of regular pottery. Apart from it a regular distillation unit, with all items of pottery, has been reconstructed by Marshall from his findings at Taxila. It is therefore probable if not even certain that the perforated pieces of pottery would belong to vessels similar to the perforated pot *c.*, fig. 41. Then through the holes of pot *c.*, vapours of alcohol would pass upwards and strike at the bottom of pot *b.*, filled with cold water. Alcohol condenses at the bottom of pot *b.*, and is shown as a drop, with another falling below into pot *a.*, being the final receiver. Briefly the course alcohol vapours take would be, originating from pot,

*d.*, passing through the holes of pot, *c.*, cooling at the bottom of pot, *b.*, and falling into pot, *a.*, The connection between pots, *d.*, and *c.*, is hermetically sealed with clay, *Cl.*, fig. 41, to avoid warm vapours escaping. But the similar joint between pots, *c.*, and *b.*, is not cemented. On the contrary pot *b.*, rests loosely on the rim, *R.*, of pot *c.*. The use of clay here is intentionally avoided. Firstly distillation increases internal pressure which requires ventilation to adjust itself. Accordingly the connection between pots *c.*, and *b.*, is kept loose enough to serve as a safety value. Moreover it allows some alcohol vapours to escape, so that when no trace of alcohol could be detected by smell it would be an indication that practically all alcohol has been distilled. The advantage in assembly, fig., 41, is that all units are of pottery, and such as are already in domestic use. Its disadvantages would be mentioned when we deal with the relatively advanced distillation unit, fig. 42.

Some illicit distillers of alcohol in Pabna, Bengla Desh, were using an arrangement photographed in fig. 42. It was recovered by the local Exicse Department, which kindly permitted its being photographed. Pot *d.*, fig. 42, is identical with pot *d.*, fig. 41, and is meant for boiling fermented mash. The mouth of pot *d.*, fig. 42, is covered by an inverted pot *c.*, and the connection between pots *d.*, and *c.*, is cemented with clay, *Cl.*, fig. 42. Clay also covers the entire exposed surface of pot. *c.* A hole is made on the side of pot *c.*, to receive one end of a hollow bamboo tube, *e.*, which is wrapped all round with rags, kept wet by sprinkling water from time to time. Vapours leaving pot *d.*, are redirected by pot *c.*, into the bamboo piece, *e.* Chemists would realize that tube, *e.*, is the ancestor of what they know as Leibig's condenser. Alcohol vapours are only partially cooled while passing through the bamboo tube but are properly condensed in pot, *a.*, kept in a large earthen basin or in an aluminium one as was actual the case at Pabna. The vessel, *b.*, would be filled with water to be replaced as it gets warm. In the assembly, fig. 42, pot *a.*, can be conveniently removed aside to taste the drops of distillate and thereby judge better when distillation

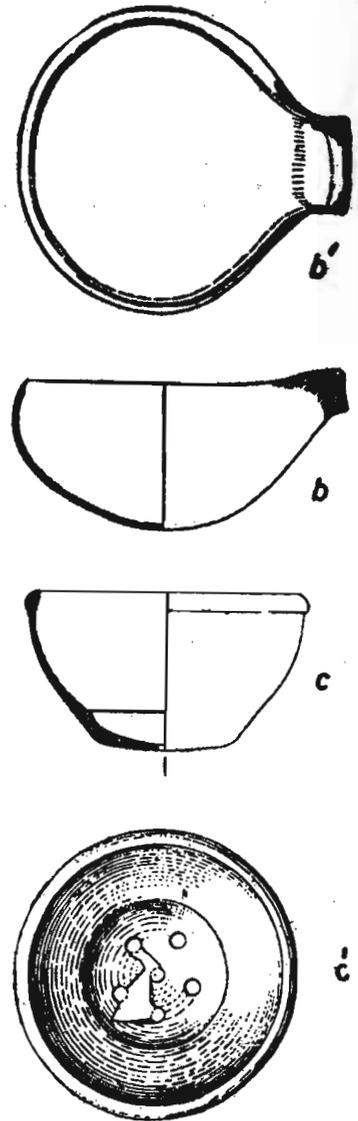


Fig. 48

has to be terminated. In fig. 41, the smell of alcohol escaping from the space between pots *c.*, and *b.*, alone would be the criterion. On the contrary in fig. 42 the distillate could be actually tasted.

Excavations carried out at Taxila revealed items of pottery which Sir John Marshall (4) has happily reconstructed into a distillation unit, reproduced here as fig. 43. In essence it is identical with the assembly fig. 42, but not with fig. 41. Fig. 43 is all of pottery, even the bamboo tube, *e.*, of fig. 43. Such were also blow-pipes of pottery used in the kitchen and called Phukni in villages during my childhood. In the Punjab bamboo is not prolific and explains how tube, *e.*, of Taxila, had to be of pottery. On careful examination it would be further realized that pot *a.*, fig. 43 is a special construction. It has a narrow hole or rather a spout into which the clay tube, *e.*, can be properly fitted, a provision to prevent alcohol vapours escaping. This spout in vessel, *a.*, at once reveals its use in distilling alcohol and not water. Even today a chemist uses no such closed receiver while distilling water, but only when he tries to recover alcohol or some volatile liquid as distillate. Marshall assigns to fig. 43 the use of distilling water which should be corrected by spirits or alcohol instead. The third item to note in fig. 43 is the distillation hood, or cowl, *c.*, fig. 43. It is a real improvement upon the inverted pot, *c.*, fig. 42, there being nothing corresponding in fig. 41.

A. Ghosh (5) also carried out excavations at Sirkap, near Taxila, and fig. 44, here is his Type 73, p. 65. Upon this he informs that, "Type 73 is a large close vessel save for a small spout on one side. It is made of two pieces luted together, the line of seam being marked by a conspicuous ridge. It is a highly specialized type but occurs occasionally throughout the occupation of the site. It may be part of an apparatus for condensing water (which Marshall had suggested before). According to Sir John Marshall the whole apparatus consists of a cooler or condenser (*a*), resting in a deep bowl of water (*b*), a condensing cowl (*c*), which fitted over the top of a handi (or pot, *d*.) containing water (or fermented mash to be distilled), a pipe (*e*) connecting cowl (*c*), condenser (or receiver, *a*.), and a tripod on which the handi (or pot *d*) rested with a fire beneath it. The steam thus generated passed into the cooler and was condensed. The present vessel (fig. 44) is the condenser (*a*, fig. 43) of Marshall's series." From Ghosh has also been taken fig. 45, here. It is his Type 74, p. 65, being identical with item *c.*, fig. 43 of Marshall. In the above description Ghosh has given a sketch of this hood or cowl and its identity with Marshall's previous finding which has been shown again by itself on the top in fig. 43. Before proceeding further we may note that Marshall takes his distillation unit to 200 A.D. and the same applies to Ghosh's

items, figs. 44 and 45, since their localities are Taxila and Sirkap respectively, and both belong to the Gandhara period.

Now Wheeler (6) has discovered primitive culture at Brahmagiri in Mysore State which he designates as "Brahmagiri Stone Age Culture A". This is Megalithic culture existing from the early first millenium B.C. to the beginning of 2nd Cent. B.C." Here he discovered Type 34, p. 226 reproduced here as fig. 46. It is obvious that this cowl or hood is the same as fig. 43 (c) and fig. 45, from Marshall and Ghosh respectively. Wheeler's fig. 46, from Mysore is dated 100 B.C. or three hundred years earlier to the objects at Taxila. The history of narcotics reveals a natural lust on the part of man for alcoholic drinks and would explain an early distillation of fermented Mahua flowers even in ancient Mysore.

Panigrahi (7) has reported findings from his excavations at Ahichchatra in Bareilly Dt. Fig. 47 here is taken from his Type 13, p. 43, upon which he writes that, "it has a short slightly out-turned rim and a small spout probably meant as an outlet for vapour. It is curious that the cooking vessels in the early period are always found with short rims or no rim at all, a deficiency which must have been a serious handicap in use". Not appreciating that the hood, fig. 47, represents part of an assembly for distillation he mistakes it for a cooking vessel and proceeds to criticise it as such. Fig. 47, is identical with fig. 43c. We have further to qualify his words "outlet for vapours" as "outlet for alcohol vapours", to bring fig. 47 in line with figs. 45, 46 and 43c. The date Panigrahi assigns to his cowl is between B.C. 300-200 which is even earlier than that of Wheeler's objects from Mysore of 2nd Cent. B.C. Panigrahi's finding would be nearest to the age of Rig Veda when distilled liquors were actually known.

Even Panigrahi's cowl cannot be a component of the earliest distillation assembly in the past. It is not the simplest of its kind for pot c., of fig. 42, is superior, in so far as it is nothing else than an ordinary pot inverted. But when such objects are excavated who could interpret them as having been used in distillation. In as much as assemblies, figs. 41 and 42, have both survived to this day, we are justified in concluding that they must have existed also during vedic times. However what we can legitimately do is to look for special improvements of items seen in the units figs. 41 and 42. Focussing our attention on fig. 41, we find pot, c., is made porous thereby assigning it a special feature. But it would be also appreciated that it would be easier for a potter to construct a pot with holes at the bottom than for a distiller to pierce holes in a pot without breaking it. Now such a manufactured pot with holes has been excavated by Lal (8) at Hastinapura, Meerut Distt. He explains it as "a grey ware

with six perforations", illustrating it as Type XXVII, p. 58, without however being able to suggest any role for it. It is offered here as fig. 48*c'*., also shown from above as fig. 8*c*.

Moreover there can be a further improvement in assembly fig. 41. The top-most vessel is a broad mouthed pot in order to enable a smaller pot to be dipped for emptying warm water. Instead, a dish like bowl, again of pottery, can be easily tilted if it is deep enough to rest well on another pot. Warm water can then be decanted using, if required, a long wet cloth hanging below to serve like a siphon. Such bowls are however used for washing rice and grains like lentils. Such a bowl has been discovered by Lal (8) at Hastinapura and illustrated by him as type XXIV, p. 58 which is not reproduced here. According to him it is "grey ware with an inturned rim distinguished by a lip. Type is abundant at Kausambi and Pataliputra". The record of such abundance would easily support its primary use as kitchen utensil. Nevertheless as replacing item *b.*, fig. 41, it would certainly be an improvement in this distillation assembly.

Wheeler (6) has also found a similar bowl, at Brahmagiri, and illustrates it as P. 16, p. 218. This has a broader lip and is again not reproduced here. But there is another also discovered at Brahmagiri, his type, T44, p. 228, which is both deeper and has a smaller lip, being offered here as fig. 48*b.*, also seen from above as 48*b'*. Between pots *b.*, and *c.*, in fig. 41, lies pot *a.*, the receiver of alcohol resting on stones. Placing the porous pot *c.*, fig. 48, below bowl *b.*, of fig. 48, they can be a suitable substitute of a receiver-pot *a.*, fig. 41, now provided with protrubances or legs to dispense with the smaller stones, fig. 41. Such a pot *c.*, 25*a.*, p. 213, with three legs, is also among the potteries unearthed at Brahmagiri. Even today such pots are seen and accordingly its reproduction from Wheeler has been considered superfluous. Thus replacing modified substitutes for the most primitive units in fig. 41 we shall have the following improvements. In fig. 41, pot *b.*, would be replaced by bowl *b.*, fig. 48; in fig. 41 pot *c.*, by porous pot *c.*, fig. 48; in fig. 41, pot *a.*, by a pot with three legs, not illustrated here. The items discovered by archaeologists would challenge interpretation unless we know that the assembly fig. 1 has actually survived.

More than fig. 41, the later assembly fig. 42, shows a better arrangement of distillation units. Its inverted pot *c.*, has been developed into cowl or hood, *c.*, fig. 43. This has been further improved by a metallic construction, called Aludal, and used by Arab alchemists and those of Europe during medieval ages. It is still in use by distillers of rose water and such drugs, even in Karachi, also reported earlier. Really speaking the great impetus to distillation came from alchemy. Taylor (2;37) rightly

maintains that, "nothing that can really be called distillation was known before the time of the alchemists". This is because the alchemists considered their distillates nothing short of vital force or a life-giving element. In English distilled alcohol is called "Spirits of Wine" or simply Spirits or Soul. In Persian there is the corresponding term for the distillate, Ruhe-Gulab, the "Spirit of Rose". In early days the terms "Spirits" and "Ruh" were taken literally and accordingly much importance was attached to distillates.

Finally we may inquire when alcohol was first distilled in Europe. Gallen, who lived in Rome about 150 A.D., knew no distilled drug, like rose-water. Before Galen drugs were boiled and decocted every time the patient was recommended to take medicine. Later they were soaked in wine and such a medicated wine was taken in doses prescribed. From such preparations we have our Galenicals which are alcoholic extracts of vegetable drugs, and these came into use when alcohol itself was regularly distilled. From Read (9) we learn that "distilled wine, probably in Italy in the 9th or 10th Cent. A.D., made the discovery of pure alcohol." On the contrary we find distilled alcoholic drinks are mentioned in Rig Veda and archaeological findings of some of the units constituting distillation assembly can be assigned the earliest date of 300 B.C.

#### FIGURES

- Fig. 41. The simplest distillation assembly, entirely of pots, as sused by a forest tribe of Bihar.
- Fig. 42. Distillation assembly again comprising of pots used by illicit distillers of Pabna.
- Fig. 43. Distillation unit entirely of pottery reconstructed from findings at Taxila by Marshall (3), dated 200 A.D. Pot (*d*) is the boiler of fermented mash; (*c*) is hood or cowl for redirecting vapours, (*e*) is a hollow tube for leading vapours, partially cooled, into the receiver (*a*), kept cold with water in a basin or pot (*b*). Similar markings apply to all other figures. A cowl or hood is seen enlarged above, in fig. 43.
- Fig. 44. Receiver pot, similar to (*a*), fig. 43, discovered at Sirkap by Ghosh (5), his type 73, p. 65, Dated 200 A.D.
- Fig. 45. Cowl or hood similar to item (*c*), fig. 43, from Sirkap, excavated by Ghosh (5), his type 74, p. 65, Dated 200 A.D.
- Fig. 46. Cowl or hood, like item (*c*), fig. 43, from Brahmagiri, Mysore State, excavated by Wheeler (6) his type 34, p. 226. Dated 100 B.C.
- Fig. 47. Cowl, like item (*c*), fig. 43, from Ahichchatra, Bareilly Dt., recovered by Panigrahi, being his type 13, p. 42, Dated 200 B.C.
- Fig. 48. *b*., and *b'*., a deep pottery bowl, replacing pot (*b*) fig. 41, and on being tilted, enabling warm water to be decanted without being lifted. Discovered at Brahmagiri by Wheeler (6), as his type 44 p. 228. Fig. 48*c* and pot with holes at bottom allowing alcohol vapours to pass, replacing pot (*a*), fig. 41. Excavated at Hastinapura by Lal (8), as his type XXVII, p. 58. Dated 300 B.C.

## SUMMARY

Two primitive systems of distillation, have survived, consisting of items entirely of pottery. Even earlier some items were replaced by improved units. Some of them are discovered but archaeologists have not found their uses. Their findings are incorporated and roles assigned to their finds. Archaeologically the earliest finding is dated 3rd Cent. B.C. We can conclude that with such units distillation was carried out even in Rig Vedic times when distilled liquors were actually known.

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