

Dec. 19, 1939.

K. S. SMITH ET AL

2,184,025

SIPHON APPARATUS

Filed April 17, 1937

Fig. 1.

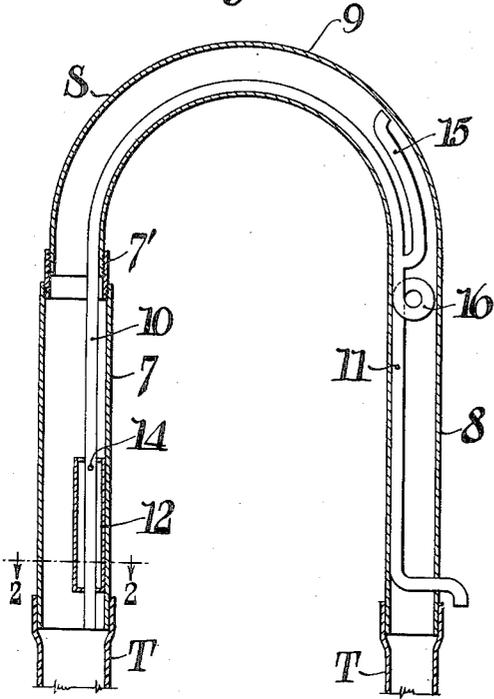


Fig. 3.

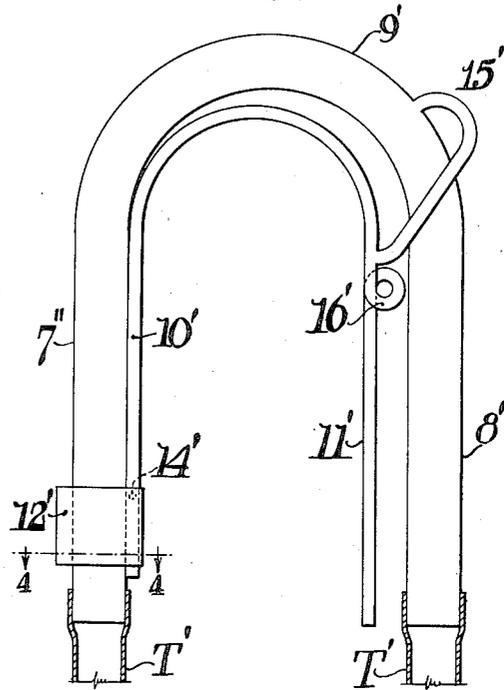


Fig. 2.

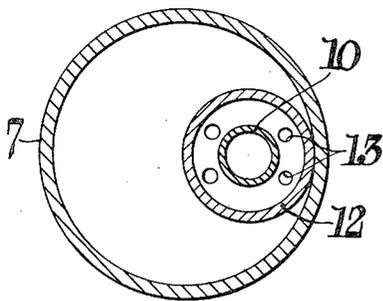
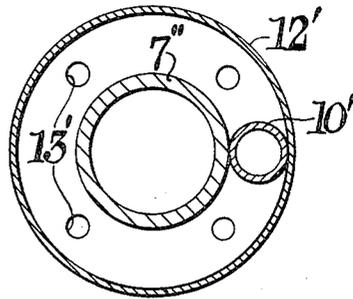


Fig. 4.



*Kenneth S. Smith &
Ernest V. Casburn,*

INVENTORS:

Newton M. Parsons,

Orwell H. Stewart.

BY

ATTORNEYS.

UNITED STATES PATENT OFFICE

2,184,025

SIPHON APPARATUS

Kenneth Stuart Smith, Wealdstone, Harrow, and Ernest Victor Casburn, Hitchin, England, assignors to Eastman Kodak Company, Rochester, N. Y., a corporation of New Jersey

Application April 17, 1937, Serial No. 137,482
In Great Britain June 16, 1936

5 Claims. (Cl. 137—20)

This invention relates to a siphon apparatus wherein a siphon action is set up in a main siphon tube through the medium of the discharge of an auxiliary self-starting siphon which is connected to the main siphon tube.

The prior art shows many different forms of self-starting siphons including some which depend on air pressure, and some which depend upon capillary attraction, but in each case the principle involved so limits the size of the tube that can be used for satisfactory operation, that siphons of this type have not been practical for commercial use due to the limited volume of fluid which could be siphoned thereby.

One form of self-starting siphon of the air pressure type is known wherein the lower end of one limb passes through and extends below an air chamber having one or more small inlets provided in the bottom wall thereof. A small outlet is provided in the limb near the upper end of the interior of said chamber so that when said limb is immersed in a liquid to be discharged from a vessel, the liquid rapidly rises in the limb and more slowly enters the surrounding air chamber through the inlets therein with the result that the air is compressed in the chamber and forced through the small opening into the associated limb where it gradually forces the liquid up the immerse tube into the outer limb thus starting the siphon.

This construction of siphon while having the advantage of being self-starting upon being plunged into the liquid to be siphoned has the disadvantage that it can be only used to produce a small siphon stream, since if the cross-sectional area exceeds a certain limit no siphon action can be initiated as the air forced into the immersed limb bubbles through the liquid therein and breaks through the meniscus.

One object of the present invention is to combine a self-starting siphon as above referred to as an auxiliary siphon for initiating the action of a main siphon in order to permit the rapid discharge of a liquid from a receptacle. Another object is to combine an automatic self-starting siphon with a main siphon tube in such a way that the resulting siphon has the appearance and handles like a single siphon unit. And still another object is to provide a siphon apparatus of the type referred to wherein a siphon action can be automatically induced in a siphon tube having dimensions which make it practical commercially and in which the siphon action is induced by merely plunging the intake limb thereof into the vessel of liquid to be emptied.

Briefly, our invention consists of combining a self-starting siphon of the air pressure type, in which siphon action is initiated by merely immersing the intake limb thereof into a vessel of liquid, with a main siphon tube of comparatively

large diameter in such a way that the discharging liquid from the self-starting siphon entrains air from the main siphon when the end of the latter is sealed, and thereby induces the siphon action in the main siphon tube.

The novel features that we consider characteristic of our invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description of specific embodiments when read in conjunction with the accompanying drawing in which,

Fig. 1 is a vertical section of a preferred embodiment of the novel siphon apparatus,

Fig. 2 is a section taken on line 2—2 of Fig. 1,

Fig. 3 is a side elevation showing a modified form of the siphon apparatus, and

Fig. 4 is a section taken on line 4—4 of Fig. 3.

Like reference characters refer to corresponding parts throughout the drawing.

Referring now to Figs. 1 and 2, wherein the preferred form of the apparatus is shown, the siphon apparatus comprises a main U-shaped siphon tube of any rigid material, such as metal or glass, indicated generally as S, and having an intake limb 7, a discharge limb 8, and a curved inter-connecting portion 9 which serves to connect the two limbs. The intake limb 7 is placed in the tank to be emptied while the discharge limb 8 is placed in the vessel into which the liquid is to be siphoned, being sealed when the siphon is started; and as illustrated the end of each tube can be provided with a length of flexible tubing T to lend some flexibility to the siphon apparatus.

A self-starting siphon of the air pressure type above referred to, comprises a U-shaped tube of small bore having an intake limb 10 and a discharge limb 11. An air chamber 12 is fixed to the intake limb 10 of the self-starting siphon in such a way that it surrounds said intake limb 10 and is located near the lower end thereof for the purpose hereinafter described. The lower end of the air chamber is provided with a plurality of inlets 13, see Fig. 2, and the upper end of the air chamber communicates with the interior of the intake limb 10 of the auxiliary siphon through a small opening 14 in said intake limb.

The self-starting siphon is accommodated within the main siphon tube S, as illustrated in Figs. 1 and 2, and is so fixed therein, in any suitable manner, that the end of its intake limb 10 extends to the end of the intake limb 7 of the main siphon tube, and the end of the discharge limb 11 extends through the wall of the discharge limb 8 of the main siphon S to discharge outside thereof. In order to accommodate the air chamber 12 which is of a substantially greater diam-

eter than the tube of the self-starting siphon, the intake limb 7 of the main siphon tube must be of greater diameter than the remainder of the tube S. Although this enlargement may be accomplished in many ways, for the purpose of illustration I have shown an enlarged collar 7' fitted into the end of the inter-connecting portion 9, and the intake limb 7 threaded thereon.

In order to render the self-starting siphon as an auxiliary for inducing the siphon action in the main siphon, the discharge limb 11 thereof is provided with an open ended tube 15 of small bore which extends upwardly into the inter-connecting portion 9 of the main siphon tube, and through which air is removed from the main siphon tube by a suction action, as will be described hereinafter. The free end of tube 15 is bent toward the outer part of the inter-connecting portion 9, and terminates just short of the wall thereof at a position about midway between the commencement and the highest part of the curve of the inter-connecting portion in order to permit the main siphon stream to be induced. A bend 13 is provided in the discharge limb 11 of the self-starting siphon below the position at which the tube 15 is connected thereto, this bend being provided to obviate air locks, and thereby maintain the suction action through the tube 15.

The siphon apparatus operates in the following manner: The intake limb 7 of the main siphon tube S is plunged into a liquid to be siphoned to a depth at which the end of the intake limb 10 of the self-starting siphon and the air chamber 12 surrounding it are partially or wholly immersed, and the discharge limb 8 of the main siphon is provided with a liquid seal. The liquid rises rapidly in the intake limb 10 of the self-starting siphon, and more slowly enters the air chamber 12 through the inlet 13 therein with the result that the air is compressed in the top of the air chamber. The compressed air in the top of the chamber is forced through the small opening 14 into the intake limb 10 of the self-starting siphon where it gradually forces the liquid up the immersed limb 10 and into the discharge limb 11 thus starting the auxiliary siphon. Self-starting siphons of the air pressure type are limited to tubes of small cross sections and are, therefore, impractical commercially due to the fact that if the cross-sectional area exceeds a certain limit no siphon action can be initiated, because the air forced into the immersed intake limb 10 bubbles through the liquid therein and breaks through the meniscus. It will be understood that the cross section allowable in these self-starting siphons will vary between small limits depending upon the viscosity of the liquid to be siphoned which give different degrees of surface tension, but in no case can a cross section be used in a self-starting tube which would make the siphon practical from the standpoint of volume handled per unit of time. During discharge of the liquid through the discharge limb 11 of the self-starting siphon, air is withdrawn gradually by suction from the main siphon through the small bore tube 15. The withdrawn air is prevented from being replaced since the end of the discharge limb 8 is provided with a liquid seal, and eventually the liquid rises in both limbs of the main siphon due to the reduction of air pressure therein. The liquid rises more rapidly, however, in the immersed intake limb 7, and eventually passes the inter-connecting portion 9 and drops down the discharge limb thereupon initiating the siphon action in the main tube.

In Figs. 3 and 4 a modified form of our novel siphon apparatus is shown, but the difference between this apparatus and the preferred form resides merely in the relative position of the auxiliary siphon and the main siphon, the parts and operation of the two forms being identical. In the modified form, the auxiliary siphon instead of being accommodated within the main siphon tube is fixed to the outside thereof, and the air chamber 12' surrounds both the intake limb 7' of the main siphon and the intake limb 10' of the auxiliary siphon. Communication is provided between the top of the air chamber 12' and the intake limb of the auxiliary siphon through an opening 14' in said intake limb, and openings 13' are provided in the bottom of the air chamber through which the liquid can pass into the chamber. Air is withdrawn from the inter-connecting portion 9' of the main siphon tube through a tube 15' of small bore, which connects the discharge limb 11' of the auxiliary siphon with an outlet in the wall of the inter-connecting portion 9' of the main siphon tube.

From the above description it will be readily understood that we have combined a self-starting siphon of the air pressure type which is in itself impractical for commercial purposes, with a main siphon tube which can handle a large enough volume of liquid to make it practical, in such a way that the resultant siphon apparatus constitutes a self-starting siphon which is practical commercially. The preferred form of our siphon apparatus is neat as well as simple, and provides a practical self-starting siphon apparatus which has the appearance of and handles like a single siphon. The novel siphon apparatus provides a commercially practical siphon apparatus which is self-starting upon plunging the intake limb thereof into a vessel containing a liquid to be emptied therefrom, and providing the discharge limb thereof with a liquid seal.

Although we have shown and described certain specific embodiments of our invention, we are fully aware that many modifications thereof are possible. Our invention, therefore, is not to be restricted except in so far as is necessitated by the prior art and by the spirit of the appended claims.

Having thus described our invention, what we declare is new and desire to secure by Letters Patent of the United States is:

1. In a siphon apparatus the combination with a portable main siphon tube including an open ended intake limb which is adapted to be immersed in a liquid to be siphoned, an open ended discharge limb, an interconnecting portion constituting with said limbs a vacuum space when said intake limb is immersed in a liquid to be siphoned and the discharge limb is provided with a liquid seal, of an auxiliary automatic siphon of the air pressure type connected to said main siphon tube to be moved as a unit therewith and comprising a tube of small bore having an open ended intake limb which is to be immersed in a liquid to be siphoned simultaneously with the intake limb of the main siphon tube and an open ended discharge limb, an elongated air chamber surrounding the intake limb of the auxiliary siphon and adapted to be immersed therewith into a liquid to be siphoned, said air chamber having openings in its lower end through which the liquid may enter the chamber upon immersion, the upper end of said chamber communicating with the interior of the intake limb of the auxiliary siphon through an opening in the intake limb and through which compressed air may enter the

auxiliary siphon and induce a siphon action there-
in automatically, and a tube connecting the dis-
charge limb of the auxiliary siphon with the vac-
uum space in the main siphon tube whereby the
air is drawn out of the vacuum space by the dis-
charging liquid in the auxiliary siphon to induce a
siphon action in the main siphon.

2. In a siphon apparatus the combination with
a main siphon tube including an open ended in-
take limb which is adapted to be immersed in a
liquid to be siphoned, an open ended discharge
limb, an interconnecting portion constituting with
said limbs a vacuum space when said intake limb
is immersed in a liquid to be siphoned and the
discharge limb is provided with a liquid seal, of
an auxiliary automatic siphon of the air pressure
type wholly contained within said main siphon,
said auxiliary siphon comprising a tube of small
bore having an open ended intake limb situated
within the intake limb of the main siphon to be
immersed therewith, an open ended discharge
limb wholly contained within the discharge limb
with the exception of its extreme end which ex-
tends outside thereof, an elongated air cham-
ber surrounding the intake limb of the auxiliary
siphon and having openings in its bottom wall
through which a liquid to be siphoned will enter
the chamber to compress the air therein when the
intake limb of the siphon is immersed therein, the
intake limb of said auxiliary siphon having an
opening communicating with the upper end of the
air chamber through which the compressed air
may pass from the chamber to the auxiliary siphon
to automatically induce a siphon action
therein, and a tube extending from the discharge
limb of the auxiliary siphon into the vacuum space
of the main siphon tube whereby the air can be
evacuated from the vacuum space by the dis-
charging liquid of the auxiliary siphon to auto-
matically induce a siphon action in the main
siphon.

3. In a siphon apparatus the combination with
a main siphon tube including an open ended in-
take limb which is adapted to be immersed in a
liquid to be siphoned, an open ended discharge
limb, an interconnecting portion constituting with
said limbs a vacuum space when said intake limb
is immersed in a liquid to be siphoned and the dis-
charge limb is provided with a liquid seal, of an
auxiliary automatic siphon of the air pressure
type wholly contained within said main siphon,
said auxiliary siphon comprising a tube of small
bore having an open ended intake limb situ-
ated within the intake limb of the main siphon
to be immersed therewith, an open ended dis-
charge limb wholly contained within the dis-
charge limb with the exception of its extreme
end which extends outside thereof, an elongated
air chamber surrounding the intake limb of the
auxiliary siphon and having openings in its bot-
tom wall through which a liquid to be siphoned
will enter the chamber to compress the air there-
in when the intake limb of the siphon is immersed
therein, the intake limb of said auxiliary siphon
having an opening communicating with the upper
end of the air chamber through which the com-
pressed air may pass from the chamber to the
auxiliary siphon to automatically induce siphon
action therein, a tube extending from the dis-
charge limb of the auxiliary siphon into the vac-
uum space of the main siphon tube whereby the
air can be evacuated from the vacuum space by

the discharging liquid, the discharge limb of the
auxiliary siphon having a bend beyond said tube
for obviating air locks therein.

4. In a siphon apparatus the combination with
a main siphon tube including an open ended in-
take limb which is adapted to be immersed in a
liquid to be siphoned, an open ended discharge
limb, an interconnecting portion constituting with
said limbs a vacuum space when said intake limb
is immersed in a liquid to be siphoned and the
discharge limb is provided with a liquid seal, of
an auxiliary automatic siphon of the air pressure
type and comprising a tube of small bore and
having an open ended intake limb, an open ended
discharge limb, said auxiliary siphon being situ-
ated relative the main siphon so that their re-
spective intake limbs are side by side so as to be
immersed simultaneously into a liquid to be si-
phoned, an elongated air chamber surrounding
the intake limbs of the auxiliary and main siphon
and located near the ends thereof to be immersed
simultaneously with said limbs, said air chamber
having openings in its bottom wall through which
liquid may pass to compress the air in said cham-
ber, the intake of the limb of the auxiliary siphon
having an opening near the top of the air cham-
ber through which compressed air from the cham-
ber may pass to induce a siphon action in the
auxiliary siphon, and a tube connecting an out-
let in the interconnecting portion of the main
siphon whereby the air can be evacuated from the
main siphon tube by the discharging liquid of the
auxiliary siphon to automatically induce a siphon
action in the main siphon.

5. In a siphon apparatus the combination with
a main siphon tube including an open ended in-
take limb which is adapted to be immersed in a
liquid to be siphoned, an open ended discharge
limb, an interconnecting portion constituting with
said limbs a vacuum space when said intake limb
is immersed in a liquid to be siphoned and the
discharge limb is provided with a liquid seal, of
an auxiliary automatic siphon of the air pres-
sure type and comprising a tube of small bore and
having an open ended intake limb, an open ended
discharge limb, said auxiliary siphon being situ-
ated relative the main siphon so that their respec-
tive intake limbs are side by side so as to be
immersed simultaneously into a liquid to be si-
phoned, an elongated air chamber surrounding
the intake limbs of the auxiliary and main si-
phon and located near the ends thereof to be
immersed simultaneously with said limbs, said
air chamber having openings in its bottom wall
through which liquid may pass to compress the
air in said chamber, the intake limb of the
auxiliary siphon having an opening near the top
of the air chamber through which compressed
air from the chamber may pass to induce a siphon
action in the auxiliary siphon, a tube connecting
an outlet in the discharge limb of the auxiliary
siphon with an outlet in the interconnecting por-
tion of the main siphon whereby the air can be
evacuated from the main siphon tube by the dis-
charging liquid of the auxiliary siphon to auto-
matically induce a siphon action in the main si-
phon, the discharge limb of the auxiliary siphon
having a bend beyond the tube connecting the two
siphons for obviating air locks therein.

KENNETH STUART SMITH.
ERNEST VICTOR CASBURN.