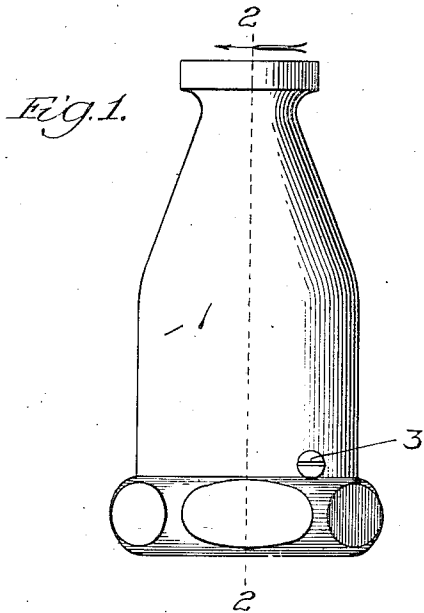
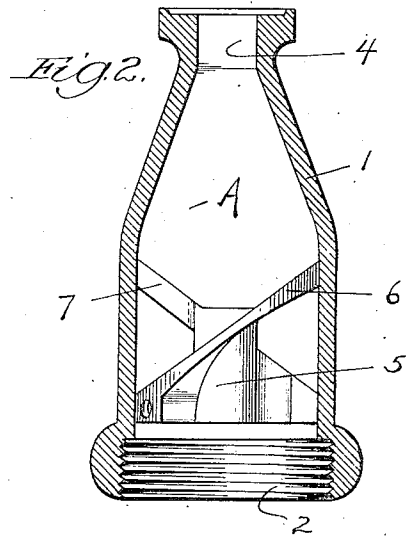
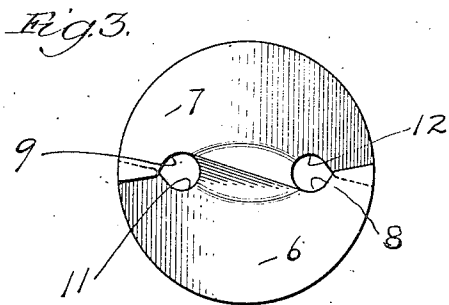
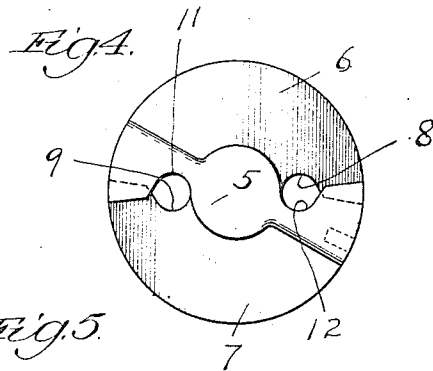
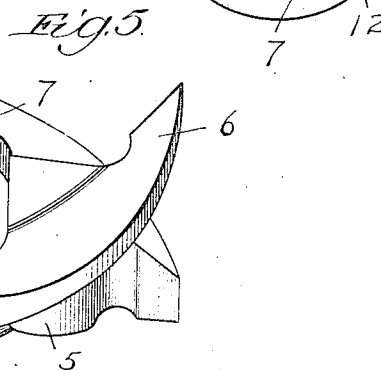


H. D. BINKS.
 SPRAY NOZZLE.
 APPLICATION FILED APR. 16, 1918.

1,282,175.

Patented Oct. 22, 1918.



Witnesses:
 D. Kentish
 Brock Williams

Inventor:
 Harry D. Binks.
 By Albert Scheidt,

UNITED STATES PATENT OFFICE.

HARRY D. BINKS, OF RIVER FOREST, ILLINOIS.

SPRAY-NOZZLE.

1,282,175.

Specification of Letters Patent.

Patented Oct. 22, 1918.

Application filed April 16, 1918. Serial No. 228,869.

To all whom it may concern:

Be it known that I, HARRY D. BINKS, citizen of the United States, residing at River Forest, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Spray-Nozzles; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

In some of its general aspects, my invention relates to nozzles for spraying fluids, and to methods for manipulating a fluid while within a nozzle-casing or the like, so as to produce certain desirable effects. More particularly, my invention relates to a novel method of manipulating fluid within a spray-nozzle so that the spray emitted from the nozzle will be substantially uniform or homogeneous, and to the providing of means for accomplishing this purpose with a minimum of friction and a minimum risk of clogging the nozzle. For these general purposes, by invention aims to provide a nozzle construction in which the desired manipulating of the fluid within the casing of the nozzle is accomplished by a single, easily removed and cleaned core, and one which affords relatively large passages for the fluid and therefore reduces the risk of clogging the nozzle either by scale deposits upon portions of the nozzle or by the lodging of foreign matters within the nozzle. Moreover, my invention aims to accomplish these purposes by the use of a simple nozzle core having all of the fluid-manipulating portions formed upon its exterior, and hence avoiding the difficulties heretofore met with nozzles having one or more fluid supply bores extending through the bodies of the same.

Viewed in another aspect, my invention aims to subject a stream of liquid to forces acting in relatively different directions upon this stream, so as to cause different portions of a single and imperforate stream of liquid to impact both upon each other and upon a nozzle casing for the purpose of converting this stream into a spray of substantially uniform consistency. Heretofore, the spray nozzles in general use have been so

designed as to transform a solid stream of liquid by centrifugal action into a hollow column, which column was advanced spirally and afterward broken into spray, thereby affording a substantially funnel shaped or conical sheet of spray. Attempts have also been made to provide a central core for such a hollow column of liquid so as to afford a spray in the shape of a solid cone, and for this purpose nozzles have been constructed with one portion producing a tubular stream, while another portion produced a separate jet or jets which were afterward intermixed and blended with the hollow stream. To produce the two different types of separated jets or streams which were afterward intermingled, it has been necessary to equip the core of the nozzle with a number of passages extending substantially longitudinally through the core and disposed one within the other. This multiplicity of passages has involved considerable friction for the liquid; and, in providing passages disposed one within the other, it has been necessary to make these passages so small as to be easily clogged and difficult to clean. Moreover, the inner passages have necessarily been in the shape of bores, thus increasing the tendency toward clogging the same, and the difficulty of cleaning the same, as compared with turbine vanes disposed adjacent to the casing of the nozzle and therefore freely accessible when the core was removed from the casing.

To overcome these and other objections, my invention aims to manipulate a solid stream of liquid in such a way as to deliver the same in an imperforate condition into the mixing or spray-producing chamber, and to subdivide this stream into spray entirely by the impact of the single and imperforate stream against the walls of the mixing chamber and by the action of different parts of the stream upon each other. For this purpose, my invention aims to provide a nozzle core which will impart different motional tendencies to different parts of the stream, and which will deliver the stream into the mixing chamber in a solid form impressed in its different portions with such differently directed impulses. In other words, my invention proposes to im-

part a plurality of thrusts to different portions of the liquid stream which thrusts will differ as to the rotational or spirally advancing tendencies afforded by them and which thrusts may also differ as to their effectiveness longitudinally of the nozzle, so that the conflicting tendencies of these various thrusts will tend to move the liquid particles within the stream. I then aim to utilize the resulting composite motions of the particles of liquid as well as the impact of this solid stream against the walls of the mixing chamber, for breaking this stream into a spray, and for forcing the resulting spray out of the nozzle in a substantially homogeneous or solid cone form.

In carrying out my invention, I preferably afford these varying forces by the action of the pressure of the liquid upon formations disposed entirely upon the exterior of a core, thus avoiding the objectionable perforations heretofore used in nozzle cores. For this purpose I desirably employ a core of a turbine or helicoidal vane type, and desirably arrange these vanes so that the rear surface of each vane coöperates with the casing of the nozzle in reflecting liquid against the forward surface of another vane, thereby causing liquid to flow along the opposite faces of each vane. I also and preferably fashion the tip of each vane for utilizing the pressure of the liquid in intermingling the liquid which had been flowing toward the said tip along opposite surface portions of the vane, thereby uniting the parts into which the liquid was initially divided by the body of the core and delivering this liquid in the form of a single and solid stream into the mixing chamber.

Illustrative of my invention, Figure 1 of the accompanying drawings is an elevation of a nozzle embodying my invention.

Fig. 2 is a longitudinal and vertical section through the same along the line 2—2 of Fig. 1.

Figs. 3 and 4 are enlarged top and bottom plan views respectively of the nozzle core of the embodiment of Fig. 2.

Fig. 5 is an enlarged perspective view of the same nozzle core.

In the embodiment of the drawings, the spray nozzle of my invention consists of a nozzle casing, which in this instance is equipped with a thread 2 for attachment to a liquid supply pipe, and a nozzle core supported within this casing by a suitable means, such as the screw 3. The casing 1 has a substantially cylindrical tubular portion closely fitting the exterior of the nozzle core, and also has a tapering portion connecting this tubular part with the contracted outlet 4 at the tip of the nozzle, thus affording a tapering mixing chamber A between the core and the outlet of the nozzle. The nozzle core in this instance has two sub-

stantially helical vanes rigidly connected to each other, as for example by a hub 5, which vanes present inclined surfaces against which the liquid impinges, so that the rear surfaces of the vanes deflect the liquid and coöperate with the adjacent wall portions of the nozzle casing in imparting a spirally advancing movement to the liquid as the latter passes between the vanes, or spirally around the hub 5. Each of these vanes has a forward tip overhanging the rear end of the other vane in a direction longitudinal of the nozzle.

With the liquid pressure under which spray nozzles are commonly used, a considerable part of the liquid deflected from the rear surfaces of each vane will be projected against the forward surface of the other vane, so that portions of the liquid will flow along the opposed surfaces of each vane. If both ends of each vane were plain surfaces extending radially of the nozzle, the result would be the formation of spiral or hollow rotating jets, thus delivering liquid in one or more hollow streams into the mixing chamber. To avoid such a hollow formation, I subject portions of the liquid flowing along the opposed surfaces of each vane to pressure so directed as to commingle these liquid portions at the moment of their leaving the said opposed surface portions of the vane at the tip of the latter, and so as to force some of these liquid portions toward the axis of the nozzle. For example, I may form recesses 8 and 9 respectively at the forward ends of the vanes 6 and 7, so that the radially inward portions of the liquid flowing along the rear face of these vanes may issue through the said recesses before the adjacent radially outward portions of the stream flowing along the same vanes reach the extreme tips of the latter. By so doing, the continual forward pressure of the liquid forces a portion of the same through the said recesses more forcibly than such liquid is forced forward beyond the extreme tip of the vanes, since the said extreme tips are partly shielded as to a direct forward pressure of the liquid by the extreme rear ends of the companion vanes. As the result, the liquid issuing through the said recesses is forcibly commingled with a portion of the liquid which flowed toward the same recesses along the forward surfaces of the vanes, and this forcible commingling moves the liquid in front of the two recess portions of the core toward each other. Consequently, the portions into which the stream was divided by the core of the nozzle meet immediately in front of the hub or center portion of the nozzle, thus presenting a single and solid stream at the rear end of the mixing chamber D. To increase the effect of the said recesses 8 and 9, I desirably equip the rear end of the nozzle core with coöperating for-

mations, such as the recesses 11 and 12 respectively, which recesses may desirably be disposed in such relation to the first named recesses as to cooperate with the latter in affording the equivalent of bores extending through the nozzle core in directions substantially parallel to the axis of the core.

Besides affording such a commingling of the liquid stream portions previously flowing along opposite surface portions of the two vanes, as will also force divisional portions of the liquid radially inward of the nozzle to entirely cover the forward end of the latter, these recess formations are also effective in subjecting certain portions of the liquid stream forward of the nozzle core to pressures acting in different directions from the pressures acting upon the portions of the liquid stream which flowed along the vanes to the extreme tips of the latter. Thus, it will be obvious from Figs. 3 and 4 that the equivalent of longitudinal bores afforded by the pairs of cooperating recesses would tend to afford liquid jets extending past the core and parallel to the axis of the nozzle. However, each of the liquid portions tending to form such a jet will be successively subjected to the lateral pressure of liquid reflected from the rear surface of one of the vanes, and thereafter to that of liquid flowing along the forward surface of the same vane. Consequently, instead of flowing parallel to the axis of the nozzle, such portions of the liquid will tend to flow along spiral courses differing from that pursued by the portions of the liquid which traverse the faces of the vanes all the way to the tips of the latter. Thus, the solid stream immediately in front of the nozzle (or at the rear end of the mixing chamber) has a pair of diametrically opposite outer portions tending to move with a spirally advancing motion, has portions inward of the latter and tending to move at a different spirally advancing rate, and still other portions tending to move toward each other from the two recesses. These conflicting tendencies (perhaps increased in number by the differences in the spiral movement imparted by the rear and forward faces of the vanes respectively) are accentuated by the impact of different portions of the liquid against the sloping wall of the mixing chamber and by the taper of the latter, which taper tends to force the different portions of the liquid more closely toward one another. Hence, these conflicting forces, together with the shape of the mixing chamber, cooperate in breaking the liquid into a spray, and the pressure of the solid stream of liquid back of this spray forces the latter through the outlet of the nozzle. By suitably proportioning the formations of the vanes which convert the supply pressure of the liquid stream into the conflicting forces into which the stream is

thus subjected (and which formations are here illustrated in the form of recesses at both ends of the vane), and by suitably proportioning the size of the solid hub of the core which shields the outlet 4 from a direct projecting of uncomminuted liquid through the same, I can adjust the constituency of the resulting spray so as to secure the desired uniformity or homogeneity in the latter.

From the above description it will be obvious that I produce my spray entirely from a solid stream of water which effectively and closely houses the core of the nozzle during the operation of my appliance, thus avoiding air spaces of other hollow formations. It will also be obvious from Figs. 2 and 5 that I accomplish the desired result with unusually large passages for the liquid, thus effectively preventing clogging and also reducing the deposit of scale or the like on the nozzle core. Moreover, all of the operative portions of the core are upon its exterior and are readily accessible when the core is removed from the casing, thus simplifying and expediting the inspection and cleaning of the nozzle whenever this should be desired. However, while I have illustrated and described an embodiment of my invention in which the core has two vanes and in which the recesses in the vanes are located close to the hub of the core, I do not wish to be limited to these or other details of my invention, it being obvious that the same might be modified in many ways without departing from the spirit of the appended claims. Neither do I wish to be limited to the use of the novel core of my appliance in connection with a tapering spray nozzle casing, as this feature of my invention might obviously be used in any connection in which it may be desirable to transform a solid and non-rotating stream of liquid into a solid and rotating stream, or into an imperforate stream subject to a variety of differently directed strains.

I claim as my invention:

1. A spray nozzle comprising a tubular housing having a tapering portion directed toward the outlet of the nozzle, and means within the housing for imparting a variety of different motional tendencies to different portions of the initial liquid stream, the said means being disposed for delivering an imperforate stream of liquid subject to such different tendencies to the larger end of the tapering portion of the nozzle casing, the operative portions of the core being disposed entirely upon its exterior.

2. A spray nozzle comprising a tubular housing having a tapering portion directed toward the outlet of the nozzle, and means within the housing for imparting a variety of different motional tendencies to different portions of the initial liquid stream, the said means being disposed for delivering an im-

perforate stream of liquid subject to such different tendencies to the larger end of the tapering portion of the nozzle casing, the said means consisting entirely of an imperforate hub and vanes interposed between this

3. In a liquid manipulating nozzle, an imperforate core including a spiral vane having portions formed for imparting relatively different spirally advancing movements to different parts of the liquid and for moving parts of the liquid toward each other contiguous to the forward end of the core.

4. In a nozzle, a core including a spiral vane having its forward edge equipped with a recess for modifying the rate of spiral advancement imparted to a portion of the liquid by the vane.

5. In a spray nozzle core, a plurality of helical vanes each having a recess at its forward end, and each having at its rear end a recess cooperating with the recess at the forward end of another vane for modifying the rate of spiral advancement imparted to a portion of the liquid by the vanes.

6. In a spray nozzle, a plurality of helical vanes disposed for producing rotary jets advancing spirally at a given rate, and means symmetrically disposed upon the exterior of the said vanes for altering the rate of spiral advancement of a portion of each of the said jets.

7. In a nozzle, helical vanes each disposed for deflecting liquid from its rear surface against the forward surface of another vane, the said vanes having portions cut away to afford passages for liquid in a direction substantially parallel to the axis of the nozzle, and a casing having a portion peripherally housing the vanes, the said casing portion cooperating with the liquid moving through the said passages in commingling the portions of the liquid previously flowing along the forward and rear surfaces of the vanes into a single and imperforate stream.

8. A nozzle as per claim 7, in combination with a spray-producing chamber into which the said imperforate stream is projected.

9. A spray nozzle comprising a casing and an imperforate core within the casing cooperating with the latter for initially imparting spirally advancing motion to parts of a liquid stream and thereafter altering the motion for a portion of each of the said parts, thereby causing these parts to blend into an imperforate stream subjected to a variety of different strains.

10. In a liquid-manipulating appliance, means tending to produce a spirally advancing and hollow jet, and means for causing a part of said hollow jet to exert liquid pressure directed longitudinally of the nozzle

and thereby accelerating the rate of spiral advancement of a portion of this jet.

11. In a spray nozzle, an imperforate core including substantially helicoidal vanes formed for initially imparting a spirally advancing movement to the liquid traversing the entire width of the vanes and for thereafter modifying the rate of spiral advancement of the liquid which previously had traversed a portion only of the width of the vanes.

12. In a spray nozzle, a casing contracted at one end into a tapering spray-producing chamber having a forward outlet smaller than the rear end of the said chamber, and a core mounted in the casing behind the said chamber, the said core comprising a hub shielding the outlet from the projection of an axial portion of the initial stream of liquid therethrough, and having lateral portions formed for imparting a plurality of different movements to different portions of the said initial stream and for uniting the said portions of liquid into a single unitary stream at the forward end of the core.

13. In a spray nozzle, a plurality of helical vanes disposed for producing rotary jets advancing spirally at a given rate, and means disposed upon the exterior of the said vanes for altering the rate of spiral advancement of a portion of each of the said jets.

14. In a nozzle, a core including as one element a hub coaxial with the nozzle and as another element a vane disposed in substantially helical formation about the hub, one of the said elements having a recess for modifying the rate of spiral advancement imparted to the liquid by the vane.

15. The method of producing a spray which consists in subdividing a solid stream of liquid into portions all spaced from the axis of the stream, imparting similar tendencies to each of the said portions for causing the same to advance as portions of a spiral coaxial with the stream, impressing each of the said portions with strains tending to move a part thereof toward the said axis and thereby reuniting the said portions into a single solid stream, and projecting the latter against the walls of a tapering bore.

16. The method of producing a spray which consists in subdividing a solid stream of liquid into portions all spaced from the axis of the stream, imparting similar tendencies to each of the said portions for causing the same to advance as portions of a spiral coaxial with the stream, impressing each of the said portions with strains tending to move a part at a different rate of spiral advancement also coaxial with the stream, and thereafter projecting all of the said liquid portions in a single imperforate stream into a tapering bore.

17. In a spray nozzle, a casing including

a tapering tip, and a core disposed within the casing back of the taper of the tip and formed for initially subdividing the liquid into parts all spaced from the axis of the
5 nozzle, for then imparting movement of each of the liquid parts whereby to spirally advance the latter about the said axis, and

for thereafter impressing each of the said liquid parts with strains tending to move a portion thereof toward the said axis. 10

Signed at Chicago, Illinois, April 11th, 1918.

HARRY D. BINKS.