H. D. BINKS.

SPRAY NOZZLE.

APPLICATION FILED APR. 25, 1918.

1,282,176. Patented Oct. 22, 1918.

Fig. 1.

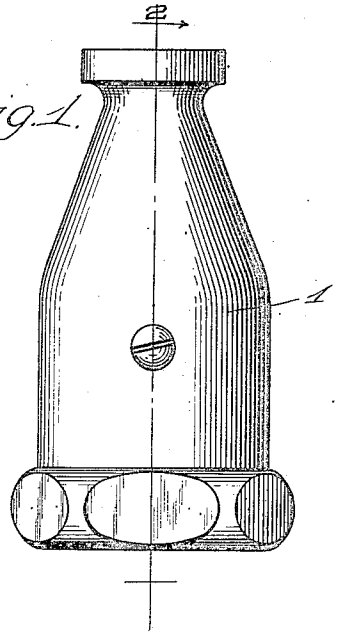



Fig. 2

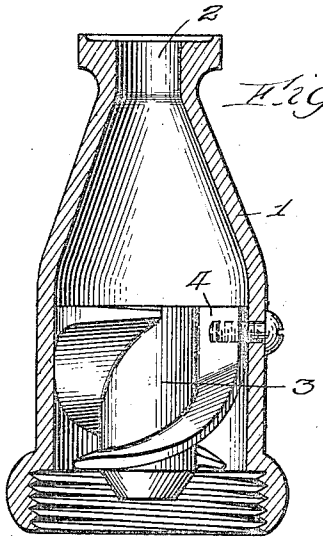
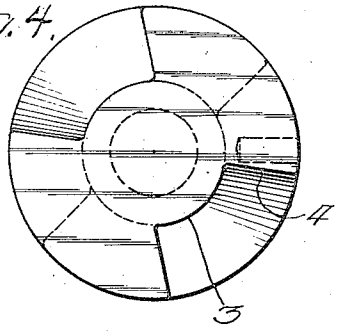



Fig. 4.



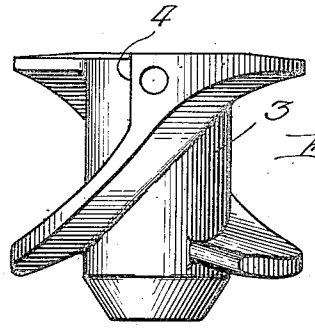
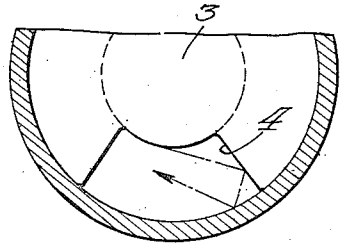




Fig. 3

Fig. 5.




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# UNITED STATES PATENT OFFICE.

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## SPRAY-NOZZLE.

1,282,176. Specification of Letters Patent. Patented Oct. 22, 1918.

Application filed April 25, 1913. Serial No. 230,651.

*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 methods and means for manipulating a solid stream of liquid so as to subject it to a plurality of strains tending to move different particles in a variety of directions, thereby producing an imperforate stream subject to a variety of conflicting strains. In another aspect, my invention relates to methods and means for producing substantially uniform or homogeneous sprays with relatively little friction and with a minimized risk of clogging, and to provide for the simple and speedy removal of scale deposits or other foreign matter if lodged within the liquid-manipulating appliance. More particularly, my invention relates to means for producing a homogenous and imperforate, or so called "solid" spray from a solid stream of liquid, and to provide means for so manipulating a solid stream of liquid that the same will produce a spray of the kind described when projected into and through the tapering forward end of a nozzle. Furthermore, my invention aims to provide a spray nozzle adapted to produce a homogeneous spray, and having all of the operative portions within the casing of the nozzle arranged upon the exterior of an imperforate core; thereby avoiding the danger of clogging perforations in the core, and permitting a speedy inspection and cleaning of the operative portions of the core.

Heretofore, nozzles designed for producing an imperforate or so-called solid spray have commonly had cores each equipped with one or more perforations extending longitudinally through the same, and such perforations have commonly been arranged concentrically with respect to each other or with respect to vane formations, thereby restricting the available diameter of such perforations to sizes which were easily clogged by scale deposits or other foreign matter in the liquid. It has also been customary for this purpose to provide nozzle cores designed for projecting an axial jet and a number of other jets issuing at some distance from the axial jet, and thereafter to intermingle these jets in a portion of the nozzle casing disposed at a considerable distance from the point at which the several jets were emitted. In other words, it has been customary to produce both an axial jet of relatively small diameter as compared with the initial stream of liquid, and one or more spiral or hollow jets surrounding this axial jet and initially spaced considerably from the latter, and afterward utilizing the tapering bore of a nozzle casing both for intermingling the axial jet with the hollow jet formation and for reacting upon the latter to assist in converting the liquid into a spray. Such constructions have required relatively small passages and in practice have led to deviations from the homogeneity of the spray, owing to differences in the uneven depositing of scale or the like in the various passages; and they have also required relatively long casings to afford the desired mixing of the numerous jets and the producing of spray from the latter.

To overcome these and other difficulties, my invention aims to provide a nozzle having a core tending to form a plurality of jets, but so constructed that the mixing of these jets into a single and imperforate stream occurs contiguous to the forward end of the core, or before the liquid enters the tapering spray-producing chamber, thereby considerably shortening the required length of the tapering portion of the nozzle casing. For this purpose I aim to provide a nozzle core in which both the portions tending to transform the initial solid stream of liquid into a hollow and rotating stream, and the portions which cause the liquid to fill the bore of the otherwise hollow resulting stream, are all disposed on exterior and related parts of the core, so that any deposits of scale or the like will be substantially uniform and therefore will not effect the uniformity or homogeneity of the resulting spray. Still further objects will appear from the following specification and from the accompanying drawings in which—

Figure 1 is an elevation of a nozzle embodying my invention.

Fig. 2 is a central and longitudinal sec-

tion through this nozzle, taken along the line 2—2 of Fig. 1.

Fig. 3 is an enlarged elevation of the core, taken at right angles to the view of Fig. 2.

Fig. 4 is a plan view of the core, on the same scale as Fig. 3.

Fig. 5 is a fragmentary and enlarged transverse section through the nozzle casing immediately forward of the core, showing the separate directions in which the core formations and the casing tend to move certain portions of the liquid.

In the embodiment of the drawings, the spray nozzle of my invention consists of a nozzle casing 1, shown as threaded for attachment to a liquid supply pipe, and a nozzle core supported within this casing by suitable means such as the screw 3. The tubular 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 2 at the tip of the nozzle, thus affording a tapering spray-producing chamber between the core and the outlet 2 of the nozzle. The nozzle core in this instance comprises a hub 3, which is desirably tapered at its rear end to reduce the friction of the liquid impinging against the same, and a pair of substantially helical vanes each extending for somewhat more than a half turn around the exterior of the hub. These vanes desirably are symmetrically disposed, so that the forward end portion of each vane is in alinement longitudinally of the nozzle with the rear end portion of the other vane. Each vane is equipped somewhat back of its forward end of the core with a heel affording an abrupt shoulder or abutment 4, which abutment desirably extends at least as far as the under surface of the other vane, so that the said under surface will reflect liquid against this abutment. To increase the effectiveness of each vane in thus projecting parts of the stream of liquid against the abutments on the other vane, I desirably decrease the pitches of the vanes in the portions which are in substantial alinement longitudinally of the nozzle; that is to say, the longitudinally alined parts at the ends of the vanes.

With the nozzle thus constructed, it will be obvious from the drawings that the solid stream of liquid entering the nozzle from the supply pipe is temporarily subdivided into two streams which first follow the under sides of the two vanes. If these two vanes were of simple helical types, the result would be merely the imparting of spirally an advancing motion to each of the two stream portions, so that these two portions would issue as separate and spirally advancing jets which would be both merged with each other and converted into spray the tapering part of the nozzle. The resulting spray would be correspondingly hollow or uneven in its effectiveness at different distances radially of the axis of the sprays. However, the reduced pitch at the forward end of each vane as above described causes the liquid to be directed in planes approximately at right angles to the axis of the nozzle and to be projected both directly and by reflection from the bore of the nozzle casing against such shoulders or abutments. The result is an interference of variously directed stream portions with each other, which interaction partly modifies the rotational or spirally advancing movement initially imparted to each half of the stream by the vanes, and which forces parts of the liquid both radially inward and over the top of the tip of each vane. For example, the particles of liquid projected tangentially of the hub and close to the latter as shown in Fig. 5, if unimpeded by other particles of liquid, would first be reflected by the shoulder 4 against the inner wall of the casing and would then be reflected again in a direction rotationally almost reverse to that of the general spiral course pursued by the half of the initial stream directed toward the said shoulder or abutment. But the liquid particles urged in this way (as shown by the arrow) encounter other liquid particles tending to pursue the said spirally advancing course, and the resulting clash will force part of the liquid radially inward of the core over the forward end of the latter.

Consequently, the forward end of the core is entirely and continuously covered by liquid, and the liquid therefore enters the large end of the tapered or spray-producing portion of the casing in a single and imperforate stream subjected to a number of conflicting strains. These strains partly tend to advance the unitary stream with a spiral motion, and partly tend to move it transversely of the nozzle, thus subjecting different particles of the liquid to different thrusts, and thereby producing a quite different effect in the tapering chamber from that obtained with a core of a plain screw type. Moreover, the close embracing of the forward end of the nozzle core by the liquid effectively prevents the heretofore customary production of a hollow bore for the stream of liquid, and therefore aids in producing an imperforate and substantially homogeneous spray, while the solid hub effectively screens the outlet of the nozzle to prevent the direct projection through it of liquid particles which have not been divided into the desired spray.

It will be noted that this is accomplished with a core having no bores extending through the same and therefore one which cannot readily be clogged by scale deposits

or other foreign matter, as has been the case with nozzle cores equipped with perforations. Moreover, the active formations on the nozzle core are all disposed upon the exterior of the latter, so that this core can easily be cleaned if this should be necessary. So also, the winding passages through which the two portions of the stream flow may be quite large in cross-section in comparison with those permissible in nozzle cores equipped with perforations, thus practically eliminating the chance of having any foreign particles of matter clog these passages. So also, if any scale should be deposited on the core, this deposit would be distributed over the various surfaces, thus maintaining the distribution of the spray substantially uniform, which is impossible with the older types of nozzle cores arranged for producing jets issuing through separated perforations in the core. To increase the effective reflection of portions of the liquid from the rear surface of the vanes, I may desirably dispose these rear surfaces somewhat obliquely to the axis of the nozzle. However, I do not wish to be limited to this or other details of the construction and arrangement here disclosed, it being obvious that the same might be modified in many ways without departing from the spirit of my invention as shown in the appended claims.

I claim as my invention:—

1. In a spray nozzle, a core including substantially spiral vanes coöperating to cause the liquid to advance spirally about the axis of the nozzle, and means associated with the forward ends of the vanes for impeding the flow of liquid along only the forward surfaces of the vanes.

2. A spray nozzle core having substantially helical vanes, and abutments associated respectively with the vanes and disposed for altering the direction of movement imparted to liquid by the vanes, the said vanes and abutments being symmetrically disposed with respect to the nozzle of the core.

3. A spray nozzle core having spiral vanes equipped back of their forward tips with formations arranged for altering the movement imparted to liquid by a portion of the vanes.

4. In a spray nozzle, a tubular casing, and a core mounted therein and including a pair of helical vanes each equipped back of its forward end with an abutment extending substantially longitudinally and radially of the nozzle casing.

5. In a spray nozzle, a tubular casing, and a core mounted therein, the said core including a hub, a plurality of helical vanes symmetrically disposed about the hub, and abutments at the forward end of the core coöperating with the bore of the nozzle casing for causing a radially inward movement of portions of the liquid, thereby causing the forward end of the core to be continuously and entirely immersed in liquid.

6. In a spray nozzle, an imperforate core including substantially helicoidal vanes formed for initially imparting a spirally advancing movement to the liquid and for thereafter abruptly accelerating the rate of spiral advancement of the liquid over the entire radial width of the vanes.

7. In a spray nozzle, a core including helicoidal vanes formed for initially imparting a spirally advancing movement at a predetermined rate to the portions of the liquid traversing both the forward and rear surfaces of each vane, and for thereafter modifying the rate of spiral advancement of only the portions of the liquid traversing the forward surfaces of each vane.

8. In a spray nozzle, a tubular casing, and a core mounted therein; said core including a plurality of helical vanes symmetrically disposed about the axis of the core and each having its forward tip in alinement longitudinally of the casing with the rear portion of another vane, and an abutment mounted on each vane and extending at least as far forwardly of the nozzle as the extreme vane-tip directed toward the said abutment.

9. In a spray nozzle, a tubular casing and a core mounted therein, said core comprising a hub, a pair of helical vanes symmetrically disposed about the hub and each having its rear end spaced from and underhanging the forward end of the other vane, and a pair of abutments disposed respectively at some distance back of the forward ends of the said vanes and extending forwardly from the vanes to afford surfaces substantially in a common plane substantially radial of the common axis of the core and the casing.

Signed at Chicago, Illinois, April 20th, 1918.

HARRY D. BINKS.