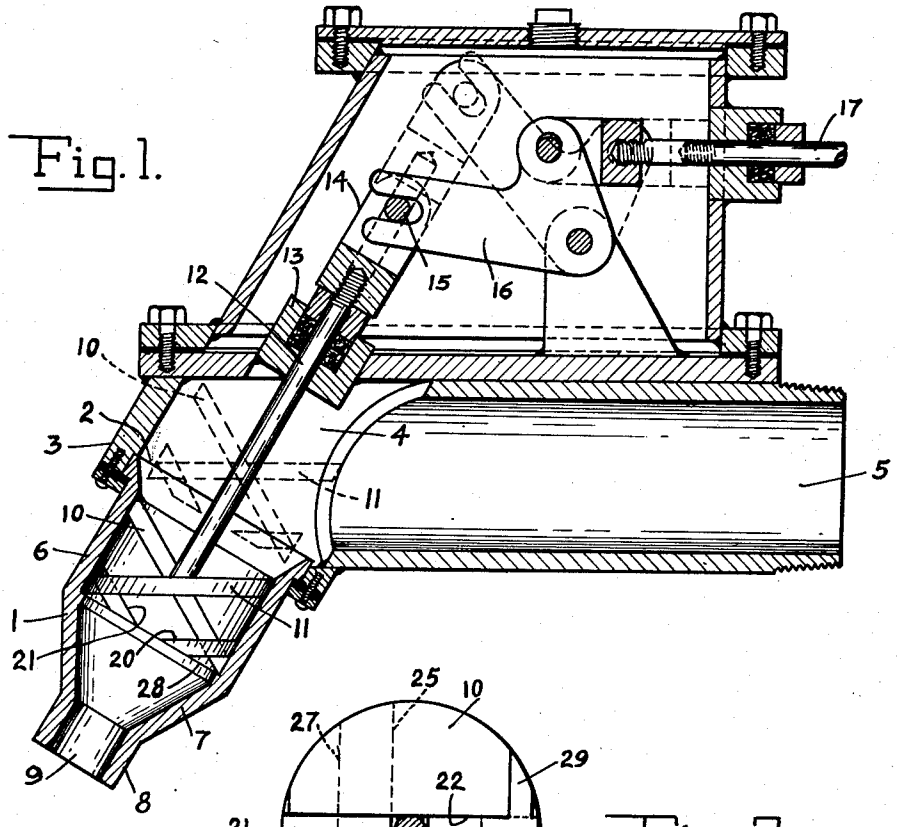
Aug. 4, 1953 S. P. KINNEY 2,647,799

DEFLECTOR VANE STRUCTURE FOR SPRAY NOZZLES

Filed Nov. 23, 1949 2 Sheets-Sheet 1

Fig. 1.



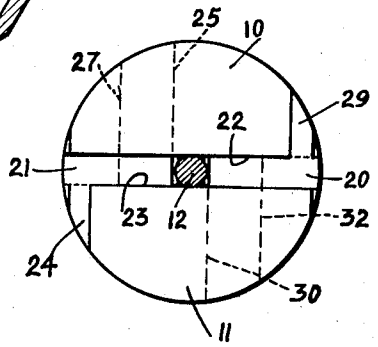


Fig. 2.

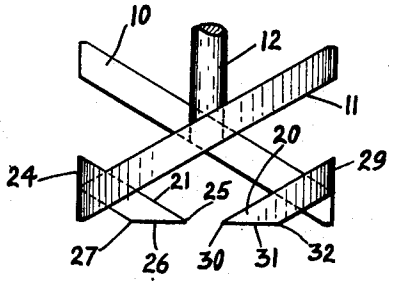


Fig. 3.

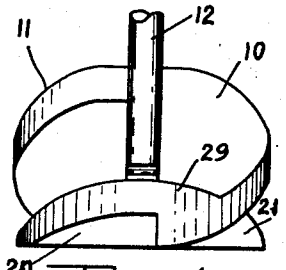


Fig. 4.

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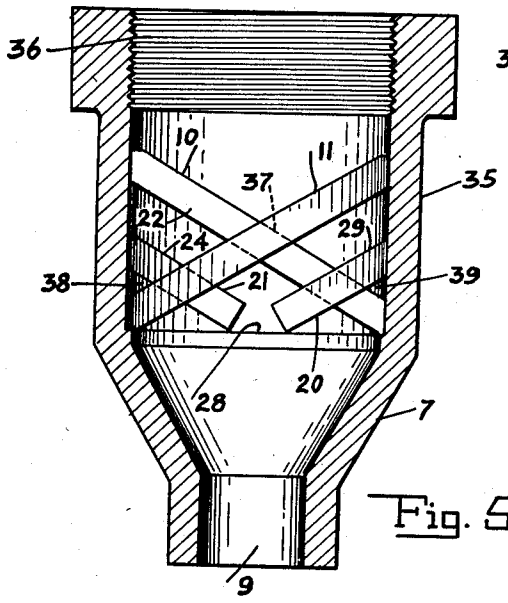

Fig. 5.

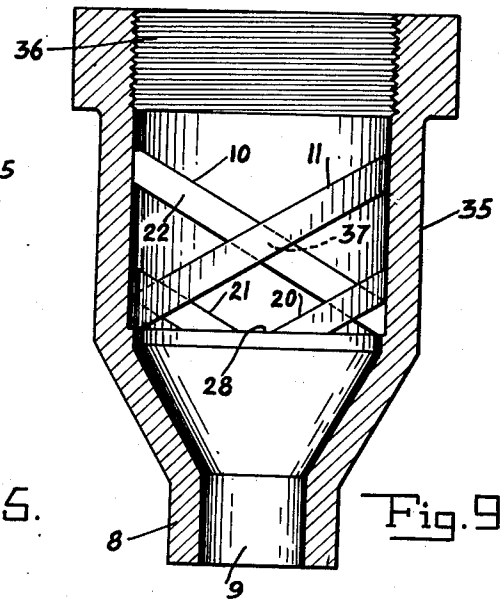

Fig. 9.

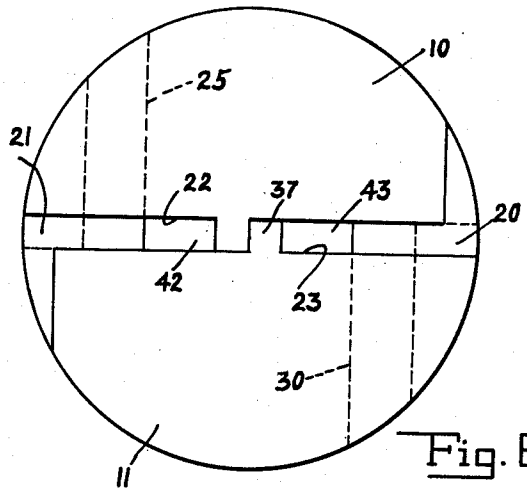

Fig. 6.

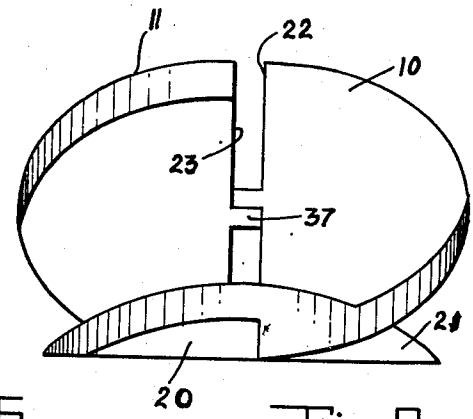

Fig. 8.

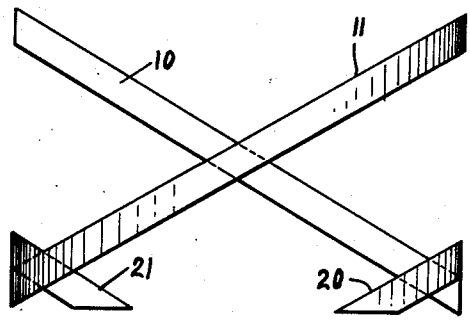

Fig. 7.

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DEFLECTOR VANE STRUCTURE FOR SPRAY NOZZLES

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Application November 23, 1949, Serial No. 129,083

9 Claims. (Cl. 299—120)

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This invention relates, as indicated, to a spray nozzle, and more particularly, to improvements in the spray producing or deflecting elements used in spray nozzles.

The spray nozzles with which this invention is primarily concerned are of a type commonly employed in gas washing apparatus such as employed for cleaning blast furnace gas. The spray discharged from nozzles of this type must be in the form of a solid cone. For this purpose, nozzles having special arrangements of spray producing elements therein are employed. One satisfactory form of such nozzle comprises a cylindrical structure having a circular inlet opening at one end with a tapered portion terminating in a spray discharge orifice of reduced diameter at the other end, and in order that the spray emerging from the orifice will be in the form of a solid cone, spray producing elements are provided in the path of the water flowing to the discharge orifice through the cylindrical chamber within the nozzle. In the nozzle referred to, the spray producing elements are in the form of substantially semi-circular plates arranged angularly inclined relative to each other in the cylindrical chamber and are so positioned that one of the plates is in the path of the water flowing through one half of the chamber, and the other of the plates is in the path of the water flowing through the other half of the chamber. In this manner, the water striking either one of the plates must flow underneath the other of the plates in order to continue its travel through the chamber. This action imparts a swirling turbulent motion to the water flowing through the nozzle chamber and results in spray emerging from the nozzle orifice in the form of a solid cone.

In the earlier forms of nozzles using a pair of semi-circular angularly inclined deflecting plates as described above, the semi-circular plates were so arranged that their straight or diametrical edges were positioned in a common plane diametral to the nozzle axis. In a later form of nozzle, the semi-circular plates had notches cut in their edges so as to provide unobstructed openings of limited cross sectional area through which a column of water might flow unimpeded by the spray producing deflecting plates. The provision of these openings was found to increase the diameter of the solid cone of spray emerging from the nozzle orifice. Although this structure resulted in an improvement from the standpoint of the spray pattern produced, it introduced a disadvantage from the standpoint of

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cloggage of the nozzle. The provision of the openings in the deflector plates resulted in sharp edges on which it was found that dirt had a tendency to collect. It was found that dirt in the water being fed to the nozzle would build up on these sharp edges in such manner that cloggage of the nozzle would sometimes take place.

One of the objects of this invention is to provide improvements in spray forming elements of the character referred to which will be effective to eliminate sharp edges in the provision openings extending by the spray forming elements.

A further object of the invention is to provide spray forming elements of the character referred to with auxiliary deflector elements for increasing the diameter of the solid cone of spray emerging from the nozzle orifice.

A still further object of the invention is to provide inclined deflector elements of the character referred to with auxiliary deflector elements mounted thereon in a position angularly inclined with respect thereto.

Another object of the invention is to provide a spray nozzle with improved spray forming deflector elements which are operative to provide a continuous self-flushing action for reducing the tendency of dirt to collect on the deflector elements.

Other objects and advantages of the invention will become apparent from the following description.

In the drawings there is shown a preferred embodiment of the invention together with modifications thereof. In this showing:

Fig. 1 is a sectional view taken in a plane extending longitudinally and centrally of a nozzle provided with spray forming elements therein constructed in accordance with the principles of this invention;

Fig. 2 is an enlarged top plan view of the deflector elements shown in the nozzle of Fig. 1 with the mounting shaft forming a part thereof broken away;

Fig. 3 is a front elevational view of the deflecting element shown in Fig. 2;

Fig. 4 is a side elevational view of the structure shown in Figs. 2 and 3 looking from the right of Fig. 3;

Fig. 5 is a sectional view of a nozzle illustrating a modified form of spray forming element mounted therein;

Figs. 6, 7, and 8 respectively are plan front and side views of a modified form of deflecting and spray producing elements; and

Fig. 9 is a view similar to Fig. 5 illustrating spray forming elements of the type shown in Figs. 6, 7 and 8 mounted therein.

In Fig. 1 of the drawings, there is shown a spray nozzle provided with mechanism for effecting a flushing operation of the spray producing elements. The flushing structure illustrated forms no part per se of this invention, but forms the basis of copending application Serial No. 127,216, filed November 14, 1949, now Patent No. 2,588,247, in the names of Selwyne P. Kinney, Cornelius J. Garrigan, and Ward W. Clarke, and to which application reference is hereby made. This apparatus, generally speaking, comprises a nozzle 1 having a collar 2 by which it is connected to a housing 3. The housing 3 provides a chamber 4 which is in communication with a supply conduit 5, the axis of the conduit 5 intersecting at an angle with the axes of the nozzle 1. The nozzle 1 is provided with a cylindrical body portion 6 connected by a conical section 7 at its lower end to a cylindrical element 8 of reduced diameter providing a circular orifice 9. In order that water flowing downwardly through the nozzle 1 will emerge from the orifice 9 in a solid cone of spray, reversely inclined deflector elements 10 and 11 are provided within the cylindrical chamber 6. The deflector elements 10 and 11 are plates, semi-circular in shape, and are reversely angularly inclined relatively to each other as illustrated. The inclination of the elements 10 and 11 is downwardly as viewed in the drawings and in the direction of the flow of water through the nozzle. The deflector elements 10 and 11 are secured to a rod 12 by which they may be moved to and from their operative position shown in solid lines to a flushing position as illustrated by the dotted lines. When the deflector elements 10 and 11 are moved to the position shown in dotted lines, they will be subjected directly to a flushing action by the water flowing through the conduit 5. This water will impinge directly upon the elements 10 and 11 to perform the necessary flushing action. The flushing action is accomplished by reason of the fact that the direction of movement of the water over the elements 10 and 11 changes when they are moved to a flushing position in the flushing chamber 4, in which position the water will knock off any dirt which may have collected on the elements. The dirt flushed from the surfaces of the elements 10 and 11 will flow downwardly through the chamber 6 since there will be nothing in the chamber to interfere with the movement of the water and dirt therethrough.

In order to move the deflecting elements 10 and 11 to their flushing position, the upper end of the rod 12 is extended through a stuffing box 13 and is provided with a threaded connection to an actuating member 14. The actuating member 14 has a pin and slot connection 15 to a bell crank lever 16 which is rocked back and forth by an actuating rod 17 in order to move the rod 12 and the deflecting elements 10 and 11 carried thereby to and from a flushing position.

As pointed out above, the structure comprising the angularly arranged supply conduit 5, the flushing chamber 4, and the mechanism for moving the deflecting elements 10 and 11 to and from a flushing position in the chamber 4 forms no part per se of this invention. This flushing structure comprises an invention covered by the above-mentioned copending application.

The present invention is concerned primarily with the structure of the spray producing elements in the cylindrical chamber 6 of the nozzle 1. Generally speaking, the invention comprises the addition of auxiliary deflecting elements 20 and 21 to the elements 10 and 11. In operation, water flowing downwardly through the nozzle 1 will strike the upper surface of the plate 11, and to continue its path through the nozzle it must flow laterally, to a position under the deflector element 10. In like manner, water striking the upper surface of the deflector element 10 must flow laterally to a position under the deflector element 11. The water flowing under the deflector element 10 is given a further kick or deflecting action by the auxiliary deflecting element 20. In a similar manner, the water flowing under the deflecting element 11 is given a further deflecting action or kick by the auxiliary deflector element 21. The additional deflecting actions imparted by the auxiliary deflector elements 20 and 21 have been found effective to increase the diameter of the cone of spray emerging from the nozzle 9.

An understanding of the spray forming structure illustrated in the nozzle 1 of Fig. 1 will be best had by referring to the showing of Figs. 2, 3 and 4 in which there is illustrated a preferred embodiment of the spray forming structure. From this showing, it will be noted that the parallel straight edges 22 and 23 of the deflector elements 10 and 11 face each other and are spaced apart rather than being positioned in a common diametral plane as customary in conventional nozzle structures employing deflector elements similar to the elements 10 and 11. The spacing of the edges 22 and 23 provides an elongated rectangular space therebetween through which water may flow unobstructed by the surfaces of the elements 10 and 11. In addition to the water flowing unobstructed through this space, water striking the upper surface of the elements 10 and 11 will cascade over the upper edges of the surfaces 22 and 23 into the space between such surfaces.

The auxiliary deflecting elements 20 and 21 each have a similar partial segmental shape. The partial segmental shape of the auxiliary element 21 extends from the line 23 to the circular edge of the element 10. This partial segmental shape has an integral arm 24 by which it is secured to the upper surface of the deflector element 11. The other boundary of the auxiliary deflector element 21 is formed by its chord 25 which extends to a position adjacent the mounting rod 12. The bottom of the deflector element 21 is flattened as at 26, the flat area terminating along the chord 27. The area 26 is made flat so that it may rest against the ledge 28 within the nozzle 1. In like manner, the auxiliary deflector element 20 has an integral arm 29 by which it is secured to the upper surface of the deflector element 10, and has a partial segmental shape extending from the edge 22 of the plate 10 to the circular edge of the deflector element 11. The partial segmental shape of the deflector element 20 is further defined by the chord 30, and it further has a flat surface 31 terminating in the chord 32. The auxiliary deflector elements 20 and 21 are preferably formed integral with their connected deflecting elements 10 and 11 by a casting operation. The circular edges of all of the deflector elements are flat spirals for fitting snugly within a cylindrical surface.

In operation, water striking the plates 10 and 11 will flow downwardly over the upper surfaces of such plates and thence laterally over the upper surfaces of the deflector elements 20

and 21. In moving by the deflector plates 20 and 21, the water will be given an additional swirling impulse and the turbulence imparted to the water flowing through the chamber 6 will be increased. Consequently, the diameter of the cone of spray emerging from the nozzle 9 will be increased. Moreover, water tending to flow through the space between the edges 22 and 23 will strike and be deflected by the upper surfaces of the auxiliary deflector elements 20 and 21.

In the preferred practice of the invention, the deflector elements 10 and 11 are mounted in positions reversely inclined at an angle of 30° to a plane perpendicular to the axis of the nozzle 1 or shaft 12. The auxiliary deflector elements 20 and 21 are mounted parallel to the deflector elements 10 or 11 under which they are respectively positioned, and the deflector elements 20 and 21 will thus also be inclined at an angle of 30° to a plane perpendicular to the axis of the nozzle 1. Although there is nothing particularly critical about the relative angles of the deflector elements 10, 11, 20 and 21, it has been found that an angle of substantially 30° as mentioned provides very satisfactory results in service.

Although the spray forming structure illustrated in Figs. 2, 3 and 4 has been shown mounted on an actuating rod 12 for mounting in a nozzle 1 to be connected to flushing mechanism of the type described in the above-mentioned copending application, it will be understood that the spray forming elements may be mounted permanently in a nozzle for connection to a water supply conduit in the conventional manner. For example, there is shown in Fig. 9 a conventional type nozzle 35 having internal threads 36 at its water inlet and for connection to a water supply conduit. The nozzle 35 is in other respects identical to the nozzle 1, and has mounted therein spray producing structure identical to that shown in Figs. 2, 3 and 4, and in which like parts have been designated by like numerals. The only difference in the spray forming structure lies in the omission of the mounting rod 12 for which a connecting member of generally diamond shape 37 is provided between the elements 10 and 11 for spacing their surfaces 22 and 23 apart.

The modified nozzle structure illustrated in Fig. 5 is generally similar to that shown in Fig. 9 and like numerals have been employed to designate like parts. The only difference lies in the fact that the auxiliary deflector elements 20 and 21 have been moved up into positions closer to the main deflector elements 10 and 11 to which they are parallel. By moving the auxiliary deflector elements 20 and 21 closer to the main deflector elements 10 and 11, the arms 24 and 29 by which they are secured respectively to the upper surface of the main deflector elements 10 and 11 move upwardly on such upper surfaces to provide notches 38 and 39 therebetween.

The showings of Figs. 6, 7 and 8 are respectively similar to the showings of Figs. 2, 3 and 4, and parts providing similar operations which are formed in a similar manner have been designated by like numerals. In this showing, the parts 10 and 11 are shown connected together by a diamond shaped connecting member 37 in place of the rod 12 of Figs. 2, 3 and 4. The main difference in the two showings is that the structure of Figs. 6, 7 and 8 has been illustrated as it will be constructed for a nozzle of relatively larger diameter than the nozzle in which the spray producing structure of Figs. 2, 3 and 4

will be mounted. In other words, the auxiliary deflector elements 20 and 21 are made relatively smaller with respect to the size of the main deflector elements 10 and 11 so that their chord edges 25 and 30 are spaced a greater distance apart. By reason of the spacing of the chord boundaries 25 and 30, there is provided a rectangular space between the chord lines 25 and 30 and the deflector element edges 22 and 23 through which water may flow unobstructed by any of the deflector elements, the only obstruction in this area being the connector elements 37 which divide the rectangular space into two rectangular spaces 42 and 43. The construction of the spray producing elements with rectangular openings 42 and 43 has been found to increase the size of the cone of spray which will emerge from the nozzle orifice 9.

Attention is directed to the fact that the provision of the auxiliary deflecting elements 20 and 21 provides plural pairs of deflecting elements, each of the elements 10 and 11 cooperating with an auxiliary element 20 or 21 to provide a spaced pair of elements. In each of these pairs, the upper surface of the auxiliary element is parallel to the upper surface of the main deflecting element under which it is positioned. It will also be noted that the spaces between the elements of each pair are in connecting relation with each other and cooperate to form a passageway. By reason of the angular and reverse inclination of the elements of each pair, such passageway is a tortuous one which imparts a turbulent condition to the water flowing therethrough.

From the foregoing, it will be seen that the provision of the auxiliary deflector elements 20 and 21 on the main deflector elements 10 and 11 is effective to provide improved nozzle performance in the production of a solid cone spray from the standpoint of increasing the diameter of the cone. Attention is particularly invited to the fact that the provision of the auxiliary deflector elements 20 and 21 enables the main deflector elements 10 and 11 to be mounted in positions with their edges 22 and 23 spaced from each other. This feature enables the provision of an unobstructed path through the deflector elements through which a slug of water may flow to increase the diameter of the cone of spray being produced. These unobstructed openings such as at 42 and 43, are provided without the necessity of forming notches in the edges 22 and 23 thereby eliminating the formation of sharp corners along such edges which would be otherwise effective to collect dirt and result in eventual clogging of the nozzle. The structure of the deflecting elements of this invention is thus effective to reduce the tendency for dirt to collect in the nozzle. Moreover, the general arrangement of the deflecting elements of this invention, particularly with respect to the provision of space between the edges 22 and 23 and the provision of the auxiliary elements, is operative to cause the water to move through the nozzle in such manner that it continuously performs a flushing action on the surface of the deflector elements. This self-flushing or cleaning action minimizes the tendency of dirt to collect within the nozzle and thereby the possibility of eventual clogging of the nozzle.

While I have illustrated and described one specific embodiment of my invention, it will be understood that this is merely by way of illustration, and that various changes and modifications may be made therein within the contem-

plation of my invention and under the scope of the following claims.

I claim:

1. A spray device comprising a pair of substantially semi-circular deflector plates in reversely inclined positions relative to and opposite each other, and auxiliary deflector elements respectively secured to one of said plates and having portions extending laterally therefrom to a position under another one of said plates, the extended portions of said deflector elements being substantially parallel to the deflector plate under which they extend.

2. A spray device comprising a pair of substantially semi-circular deflector plates in reversely inclined positions relative to and opposite each other, and auxiliary deflector elements respectively secured to one of said plates and having portions extending laterally therefrom to a position under another one of said plates, each of said deflector elements having an upper surface substantially parallel to the deflector plate under which its extended portion is positioned.

3. A spray device comprising a pair of substantially semi-circular deflector plates in reversely inclined positions relative to and opposite each other, said plates having edges forming chords which are in parallel and facing relation, and an auxiliary deflector element under each of said deflector plates, said chord edges being spaced from each to provide a narrow space through which water may flow unimpeded by said deflector plates.

4. A spray device comprising a pair of substantially semi-circular deflector plates in reversely inclined positions relative to and opposite each other, said plates having edges forming chords which are in parallel and facing relation, and an auxiliary deflector element under each of said deflector plates, said chord edges being spaced from each to provide a narrow space through which water may flow unimpeded by said deflector plates, said auxiliary deflector elements being in positions operative to deflect water flowing through said narrow space.

5. A spray nozzle comprising a cylindrical chamber having a water inlet opening at one end and a spray discharge orifice at its other end, and spray forming apparatus in said chamber comprising a pair of substantially semi-circular deflector plates in positions opposite each other and reversely and angularly inclined relative to the axis of said chamber, said plates having parallel chord edges facing toward and spaced from each to provide a rectangular space through which water may flow unimpeded by said plates, and auxiliary deflector elements respectively secured to each of said plates and having portions extending under the other said plates, each of said deflector elements having an upper surface facing said inlet opening substantially parallel to the plate under which it extends.

6. In a spray nozzle having a cylindrical chamber and a discharge orifice, a spray control structure comprising a pair of semi-circular main deflector vanes respectively positioned in opposite halves of said chamber and in reversely inclined positions relative to the axis of said cylinder, and means for providing an enlarged diameter of the spray emerging from said orifice comprising a pair of auxiliary deflector vanes, each of said main deflector vanes having one of said auxiliary vanes secured to the outer end thereof which is adjacent said nozzle and having a portion extending laterally therefrom to a position under the other of said main vanes.

7. In a spray nozzle having a cylindrical chamber and a discharge orifice, a spray control structure comprising a pair of semi-circular main deflector vanes respectively positioned in opposite halves of said chamber and in reversely inclined positions relative to the axis of said cylinder, said vanes having chord-like edges positioned respectively in spaced parallel planes to thereby provide an unobstructed opening extending axially of the nozzle through which water may flow unimpeded by said vanes, and means for providing an enlarged diameter of the spray emerging from said orifice comprising a pair of auxiliary deflector vanes, each of said main deflector vanes having one of said auxiliary vanes secured to the outer end thereof which is adjacent said nozzle and having a portion extending laterally therefrom to a position under the other of said main vanes.

8. A spray device comprising a pair of main deflector vanes in reversely inclined positions relative to and opposite each other and respectively having their outer ends spaced from each other, the outer end of each of said main vanes having an auxiliary deflector vane secured thereto and providing a vane portion extending laterally therefrom to a position under and being substantially parallel to the other of said main vanes.

9. A spray device comprising a pair of main deflector vanes in reversely inclined positions relative to and opposite each other and respectively having their outer ends spaced from each other, the outer end of each of said main vanes having an auxiliary deflector vane secured thereto and providing a vane portion extending laterally therefrom to a position under and being substantially parallel to the other of said main vanes, said main deflector vanes having adjacent edges spaced from each other to provide a narrow space extending axially of said spray device which is unobstructed by said deflector vanes.

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