This invention relates to a rotary lawn, pasture or crop sprayer, and, more particularly, to an automatically rotating sprayer designed to spray non-circular areas with uniform precipitation.

It is a primary object of this invention to provide a rotational sprayer comprising a base member, a resilient nozzle mounted for rotation about the vertical axis of said base, said nozzle having an upwardly inclined passage therethrough terminating at the discharge end of said nozzle, and means for varying the amount of upward inclination of the discharge end of said passage and for simultaneously varying the size of the passage in direct relation to the amount of upward inclination thereof.

Another object is to provide a sprayer as set forth above with resilient nozzles and with means to simultaneously deflect the nozzle downwardly and to squeeze the nozzle to restrict the flow therethrough.

Yet another object is to provide a nozzle for a sprayer as set forth above in which the nozzle is a resilient tube with an oblate rectangular orifice and in which the discharge force of the nozzle is inclined to the axis of the nozzle.

A further object is to provide a rotational sprayer comprising a base member, a conduit mounted for rotation about the vertical axis of said base member, said conduit having first and second upwardly inclined branch spaces rotationally about said vertical axis, first and second flexible nozzles respectively mounted at the upper ends of said branch spaces, said nozzles each having an upwardly inclined passage therethrough, a cam member mounted on said base member, a first lever mounted on said conduit with one end thereof in engagement with the upper surface of said first nozzle and its other end in engagement with said cam member, and a second lever mounted on said conduit with one end thereof in engagement with the upper surface of said second nozzle and its other end in engagement with said cam member at a point thereon spaced rotationally from said other end of said first lever, the engagement of said cam member and said levers at predetermined rotational positions of said conduit relative to said base member causing the upper ends of said levers to press downwardly on said nozzles to simultaneously decrease the upward inclinations and cross-sectional areas of said nozzle passages.

Still another object is to provide a means to rotate a sprayer as set forth in the last object wherein said rotating means comprises a rigid member pivotally mounted on said conduit, a stop member fixed to said conduit, a spring biasing said rigid member into engagement with said stop member, first and second vanes carried by said rigid member to simultaneously intercept and deflect the path of discharge of said first nozzle, and third and fourth vanes carried by said rigid member to simultaneously intercept the path of discharge of said second nozzle, said vanes being inclined to said paths of discharge whereby fluid issuing from said nozzles will impinge upon said first and third vanes and be deflected towards said second and fourth vanes to impinge thereagainst to force said rigid member away from said stop member, and wherein said first and third vanes are inclinedly disposed relative to said nozzles so that as said nozzles are upwardly and downwardly inclined a constant volume of flow from said nozzles will be intercepted by said first and third vanes.

Another object of the invention is to provide a rotational sprayer adapted to spray a square area with uniform precipitation and having two resilient nozzles in which the nozzles are so spaced around the vertical axis of the device as to balance the hydraulic and mechanical forces involved and to allow a uniform rate of rotation of the device as a result of a uniform recurrent rotational force.

Other objects and advantages will become apparent in the course of the following detailed description.

In the drawings, a portion of this application, and in which like parts are designated by like reference numerals throughout the same.

Fig. 1 is a plan view of a sprayer constructed in accordance with the invention.

Fig. 2 is a sectional view, with parts shown in elevation, taken on line 2—2 of Fig. 1.

Fig. 3 is a sectional view, taken on line 3—3 of Fig. 2, illustrating the impingement of water on the vanes of the oscillator.

Fig. 4 is a sectional view, taken on line 4—4 of Fig. 2, with the discharge flow of water at maximum and minimum rates being shown in dotted lines, to illustrate the manner in which the vanes of the oscillator act to give a uniform rate of advance to the sprayer.

Fig. 5 is a sectional view, taken on line 5—5 of Fig. 2.

Fig. 6 is an enlarged sectional detail, showing the nozzle in alternate positions.

Referring now to the drawings, the sprayer, indicated generally by the numeral 10, comprises a tubular base member 11 adapted to be connected to an irrigating standpipe 12 or the like. A rigid conduit 13, having two upwardly inclined tubular branches 14 and 14a, is disposed within the base member 11 so that the conduit and branches may rotate about the vertical axis of the base member. As may be seen in Fig. 1, the two branches 14 and 14a are spaced at 90° around the vertical axis of base member 11. A combined water seal and bearing 16 is provided between the conduit and base member.

A resilient nozzle 17, inserted in the upper end of conduit branch 14, has a flow passage 18 therethrough, terminating at the discharge face 19 of the nozzle. As seen in Fig. 3, the nozzle has integral retainer lugs 20 receivable within complementary holes in the branch 14 to hold the nozzle in place. Similarly, an identical nozzle 17a is inserted in conduit branch 14a.

A lever, or bracket, 21 is pivotally mounted at 22 to the conduit, for rotation with the conduit about the vertical axis of the base member. The upper end 23 of lever 21 is bent around the discharge end of nozzle 17 so as to bear downwardly on the upper surface of the nozzle. A cam follower 24, mounted on the lower end of lever 21, is in engagement with the cam track 26 of cam member 27.

Cam member 27, mounted on base member 11, is fixed against movement relative thereto by any suitable means (not shown). As seen in Fig. 1, the cam track 26 has four lobes 28, each lobe being angularly spaced at 90° from the other lobes around the vertical axis of the base member.
A lever 21a, identical to lever 21, is pivotally mounted at 22a on the conduit, with the upper end 23a of the lever bearing downwardly on the upper surface of nozzle 17a. A cam follower 24a, mounted on the lower end of the lever 21a, is in engagement with the cam track 26 at a point thereon spaced 135° from cam follower 24.

As the conduit 13 rotates within the base member 11, the levers 21 and 21a are carried by the conduit also rotate about the vertical axis of the base member, with their cam followers rolling against cam track 26. As the cam followers are forced inwardly, from the position shown at 24 to the position shown at 24a, the levers will be rotated so that the upper ends thereof will press downwardly on the upper surface of the resilient nozzles, to move these nozzles from the position shown at 17 to the position shown at 17a. When the cam followers move back into one of the cam lobes 28, the inherent resiliency of the nozzles and the force of the water passing therethrough will cause them to straighten out, back to the position as shown at 17.

Automatic rotation of the sprayer is provided by the rigid oscillating member 30, having two arms 31 and 31a, forming a horizontal angle of 135° so that each arm may simultaneously extend over one of the conduit branches 14 and 14a. The oscillating member is rotatably journaled at 32 and 32a carried by the base member 11. An upwards post 33, formed integrally with conduit 13, supports a bearing plate 34 in which the upper end of shaft 32 is received. A torsion spring 35, held at one end by the bearing plate 34 and at the other end by the oscillating member arm 31, urges the oscillating member 30 in a clockwise direction (looking downwardly) against the adjustable stop member 36 carried by post 33.

The oscillating member arm 31 has two vane 37 and 38 mounted on the outer end thereof, to intercept the path of flow from nozzle 17, when the arm 31 is against the stop member.

As shown in Fig. 3, a certain amount of water issuing from nozzle 17 strikes the inclined vane 37 and is deflected towards vane 38, which intercepts the water thus deflected. The water force has a greater effect on vane 38, and causes the oscillating member to swing in a counterclockwise direction against the bias of spring 35. The friction between conduit 13 and base member 11 is sufficiently great so that there is no movement therebetween as the oscillating member swings in the counterclockwise direction. After the oscillating member has come to a rest, the stored energy in spring 35 swings the oscillating member back in a clockwise direction, causing it to strike against the stop member 36 to jar conduit 13 forward in a clockwise direction. The jarring force is implemented by the impingement of water on vane 37 as the latter cuts back into the discharging stream.

Similarly, vane 37a and 38a are mounted on arm 31a to accomplish the same function.

In operation, with the sprayer 10 connected to a suitable water pipe 12, water will issue from nozzles 17 and 17a, and the oscillating member will cause the conduit 13 to rotate incrementally in a clockwise direction. The inherent resiliency of each nozzle, and the pressure of the water passing through the nozzles, cause each nozzle to straighten, thus insuring a positive engagement between the cam followers 24 and 24a and the cam track 26.

As shown in Figs. 1 and 2, when the cam follower 24 is in engagement with one of the cam lobes 28, the nozzle 17 will have its maximum upward inclination, causing the maximum to be thrown a maximum distance. Along with this time, the nozzle passage 18 will be unrestricted, allowing the maximum flow therethrough.

At the same moment, cam follower 24a will be halfway between cam lobes 28, causing the cam follower 24a to be forced inwardly to press lever 21a downwardly upon the top of nozzle 17a. This forces the discharge end of nozzle 17a downwardly, thereby limiting the distance that water is thrown therefrom. In addition, the squeezing of the nozzles reduces the cross-sectional area of the discharge passage 18a so that a lesser volume of flow of the water passes therethrough.

One important advantage of the squeezing of the nozzle as the nozzle is deflected is that it is possible to obtain a uniform precipitation over the area being sprayed. In a square area, for which this particular embodiment is designed, a sector area in the direction of one of the corners of the square will be much larger than a similar sector area of the same angle directed towards one of the sides of the square, and, consequently, will require more water. If the volume of flow of the water discharging from the nozzles were constant, the rate of rotation being constant, then the square area being watered would receive a much greater concentration of water per unit area in the direction towards the sides of the square than that received in the direction towards the corners. The present invention compensates for this squeezing of the nozzles, when they are deflected, by increasing the flow of water at the corners of the square to constrict the discharge orifice in order that the volume flow of water is decreased at this time as compared to the maximum flow of water when the nozzles are directed towards the corners of the square. In this manner, the concentration of precipitation is constant throughout the sprayed area.

In the present embodiment, it has been found that by forming the discharge face 19 of the nozzle at approximately 70° from the axis of the nozzle, and by forming the discharge passage in the shape of an oblate rectangle, that the volume of the flow will vary in direct proportion to the variation in distance that the water is thrown. If these factors are varied, as well as varying the resiliency of the nozzle, the relation between the volume of flow and the distance thereof may be varied to meet any other desired characteristic.

As may be seen, the spacing of the nozzles is such that when the volume of flow is greatest from one nozzle, the volume of flow from the other nozzle is at a minimum, and thus, the total volume of flow through conduit 13 is essentially constant at all rotational positions therefrom.

The amount of incremental angular rotative advance of the sprayer is relatively constant because the total volume of water acting upon the combined areas of vanes 38 and 38a is relatively constant. In addition, the force acting upon either arm of the oscillating member 30 to cause it to rotate counterclockwise is relatively constant, in spite of the variations in the volume of flow from the nozzle acting upon the oscillating vanes associated therewith.

As may be best be seen in Figs. 3 and 4, the oscillator member vane 37 is inclinedly disposed relative to nozzle 17 so that the same volume of water is intercepted by vane 37 regardless of whether the volume of flow from the nozzle is at maximum or minimum. Because of this arrangement, the same volume of water at 38 at all times, to cause the oscillator member to be rotated counterclockwise the same amount and to cause equal clockwise advances of the sprayer when the oscillator member swings back to strike against the stop member 36.

When the nozzle passage is unrestricted; i.e., at maximum throw, the volume of flow from the nozzle is at a maximum and follows flow path 40. As shown in Fig. 4, only the cross-sectional area of the flow path 40 indicated by cross-hatching is intercepted by vane 37 to be deflected towards vane 38, while the rest of the discharging water will bypass the oscillator passage. At minimum throw, the volume rate of discharge of the water issuing from the nozzle will be less than above, and will be directed along flow path 40', due to the downward inclination of the nozzle end 19. However, it will be seen that the vane 37 is downwardly inclined so that substantially all of the flow path 40' is now intercepted, again
as indicated by the cross-hatching of flow path 40 shown in Fig. 4. This greater intercepted portion of the lesser
volume at minimum flow is substantially equal to the lesser portion of the greater volume at maximum
flow so that in both instances the same volume of
flow is deflected by vane 37 towards vane 38 to cause
equal counterclockwise rotation of the oscillator member.
Similarly, the same volume of flow is intercepted by vane
37 for any intermediate position of vane 17. Stated in
other terms, as the volume of flow decreases from maxi-
mum to minimum, a constant volume of water is inter-
cepted by vanes 37 and 38 while a decreasing amount of
the water bypasses these vanes.
Another advantage of the present embodiment is that
the forces between the cam followers and vane bal-
anced, to insure a uniform rotation. Thus, whenever one
of the cam followers is “climbing” out of one of the cam
lobes 28, which would tend to slow the rotation of the
device, the other cam follower is rolling into a cam lobe
so as to tend to increase the speed of rotation of the
sprayer. The combined effects cancel, so that there is
neither a tendency to progress forwardly or backwardly
at any rotational position of the sprayer, allowing the
sole rotative force to be supplied by the uniformly swing-

Although the particular embodiment has been designed
for use in spraying a square area, it is to be realized that
other non-circular areas may be sprayed by using a dif-
ferent shaped cam member 27 in accordance with the
particular area to be sprayed.
It is to be further understood that the embodiment of
the invention herewith shown and described is but a single
embodiment of the same, and that various changes in the
shape, size, and arrangement of parts may be resorted to
without departing from the spirit of the invention, or the
scope of the attached claims.
Having thus described my invention, what I claim and
desire to secure by Letters Patent is:
1. A rotational sprayer comprising a base member,
a resilient nozzle mounted on said base member for rota-
tion about the vertical axis of said base, said nozzle hav-
ing an upwardly inclined passage therethrough terminat-
ing at the discharge end of said nozzle, and means oper-
atively associated with the discharge end of said nozzle
for varying the amount of upward inclination of the dis-
charge end of said nozzle relative to said base member
cross-sectional area of said discharge passage, and cam
means mounted on said base member and operatively associ-
ated with the last named means to vary the amount of downward pressing on said nozzle as said nozzle is rotated around said vertical axis.
6. A rotational sprayer comprising a base member, a
resilient nozzle mounted on said base member for rota-
tion about the vertical axis of said base, said nozzle hav-
ing an upwardly inclined passage therethrough terminat-
ing at the discharge end of said nozzle, means operatively
associated with the discharge end of said nozzle to press
downwardly on the upper surface of the discharge end of
said nozzle to simultaneously decrease the upward in-
clination relative to said base and cross-sectional area of
discharge passage, cam means mounted on said base
member and operatively associated with the last named
means to vary the amount of downward pressing of said
nozzle as said nozzle is rotated around said vertical axis,
and means operatively associated with said nozzle and actuable by fluid discharging from said nozzle for rotat-
ing said nozzle about the vertical axis of said base mem-
ber.
7. A rotational sprayer comprising a base member
having a vertical axis, a rigid conduit mounted on the
base member for rotation about said vertical axis, said
conduit having an upper end inclined from horizontal, a
resilient nozzle mounted at the end of said conduit,
said nozzle having an upwardly inclined passage there-
through, a lever mounted on said conduit for rotation
therewith, said lever having its upper end in engagement
with said nozzle, and a cam member fixed relative to said
base member, the other end of said lever being in engage-
ment with said cam member, said cam and lever causing
said flexible nozzle to be simultaneously deflected down-
wardly and squeezed at predetermined rotational posi-
tions of said conduit relative to said base member, where-
by the volume of flow through said nozzle will be de-
creased upon downward deflection of said nozzle.
8. A rotational sprayer comprising a base member
having a vertical axis, a conduit mounted on said base
member for rotation about said vertical axis, said conduit
having an upwardly inclined end, a resilient nozzle
mounted at the end of said conduit and projecting out-
wardly therefrom, said nozzle having a passage there-
through, a lever mounted on said conduit for rotation
therewith, said lever having its upper end in engagement
with the upper surface of said nozzle, and a cam
member fixed relative to said base member, the other end
of said lever being in engagement with said cam member,
the engagement of said cam member and lever causing
the upper end of said lever to press downwardly on said
nozzle to simultaneously decrease the upward inclination
and cross-sectional area of said nozzle passage at pre-
determined rotational positions of said conduit relative
to said base member.
9. A rotational sprayer comprising a base member,
a conduit mounted for rotation about the vertical axis of
said base member, said conduit having first and second
upwardly inclined branches spaced rotationally about said
vertical axis, first and second flexible nozzles respectively
mounted at the upper ends of said branches, said nozzles
each having an upwardly inclined passage therethrough,
a cam member mounted on said base member, a first
lever mounted on said conduit with one end thereof
in engagement with the upper surface of said first nozzle
and its other end in engagement with said cam member,
and a second lever mounted on said conduit with one end
thereof in engagement with the upper surface of said
second nozzle and its other end in engagement with said
cam member at a point thereon spaced rotationally from
said other end of said first lever, the engagement of said
cam member and said levers at predetermined rotational
positions of said conduit relative to said base member
casing the upper ends of said levers to press downward-
ly on said nozzles to simultaneously decrease the upward
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Inclinations and cross-sectional areas of said nozzle passages.

10. A rotational sprayer comprising a base member, a conduit mounted for rotation about the vertical axis of said base member, said conduit having first and second upwardly inclined branches spaced rotationally about said vertical axis, first and second flexible nozzles respectively mounted at the upper ends of said branches, said nozzles each having a flow passage therethrough, a cam member mounted on said base member, a first lever mounted on said conduit with one end thereof in engagement with the upper surface of said first nozzle and its other end in engagement with said cam member, a second lever mounted on said conduit with one end thereof in engagement with the upper surface of said second nozzle and its other end in engagement with said cam member at a point thereon 135° from said first lever, the engagement of said cam member and said levers at predetermined rotational positions of said conduit relative to said base member causing the upper ends of said levers to press downwardly on said nozzles to simultaneously decrease the upward inclinations and cross-sectional areas of said nozzle passages.

11. In a device as set forth in claim 10, wherein said rotating means comprises a rigid member pivotally mounted on said conduit, a stop member fixed to said conduit, a spring biasing said rigid member into engagement with said stop member, first and second vanes carried by said rigid member to simultaneously intercept the path of discharge of said first nozzle, and third and fourth vanes carried by said rigid member to simultaneously intercept the path of discharge of said second nozzle, said vanes being inclined to said paths of discharge whereby fluid issuing from said nozzles will impinge upon said first and third vanes and be deflected towards said second and fourth vanes to impinge thereagainst to force said rigid member away from said stop member, and wherein said first and third vanes are inclinedly disposed relative to said nozzles so that as said nozzles are upwardly and downwardly inclined a constant volume of flow from said nozzles will be intercepted by said first and third vanes.

12. A rotational sprayer comprising a base member, a rigid conduit mounted for rotation about the vertical axis of said base member, said conduit having first and second upwardly inclined branches spaced rotationally at a 135° angle about said vertical axis, first and second flexible nozzles respectively mounted at the upper ends of said branches, said nozzles each having a passage there-through, a four-lobed cam member mounted on said base member, said lobes being spaced 90° apart, a first lever mounted on said conduit with one end thereof in engagement with the upper surface of said first nozzle and its other end in engagement with said cam member, and a second lever mounted on said conduit with one end thereof in engagement with the upper surface of said second nozzle and its other end in engagement with said cam member at a point thereon 135° from said first lever, the engagement of said cam member and said levers at predetermined rotational positions of said conduit relative to said base member causing the upper ends of said levers to press downwardly on said nozzles to simultaneously decrease the upward inclinations and cross-sectional areas of said nozzle passages.

13. A rotational sprayer comprising a base member having a vertical axis, a conduit mounted on said base member for rotation about the said vertical axis, said conduit having an upwardly inclined end, a resilient nozzle mounted at the end of said conduit and projecting outwardly therefrom, said nozzle having an upwardly inclined passage therethrough, a lever mounted on said conduit for rotation therewith, said lever having its upper end in engagement with said nozzle, a cam member fixed relative to said base member, the other end of said lever being in engagement with said cam member, said cam member and lever causing said flexible nozzle to be simultaneously deflected downwardly and squeezed at predetermined rotational positions of said conduit relative to said base member, whereby the volume of flow through said nozzle will be decreased upon downward deflection of said nozzle, a rigid member pivotally mounted on said conduit, a stop member fixed to said conduit, a spring biasing said rigid member into engagement with said stop member, and first and second vanes carried by said rigid member to simultaneously intercept the path of discharge of said nozzle, said vanes being inclined to said paths of discharge whereby fluid issuing from said nozzles will impinge upon said first and third vanes and be deflected towards said second and fourth vanes to impinge thereagainst to force said rigid member away from said stop member, and wherein said first and third vanes are inclinedly disposed relative to said nozzle so that as said nozzle is upwardly and downwardly inclined a constant volume of flow from said nozzle will be intercepted by said first vane.

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