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ROTARY SPRINKLER WITH VARIABLE RANGE

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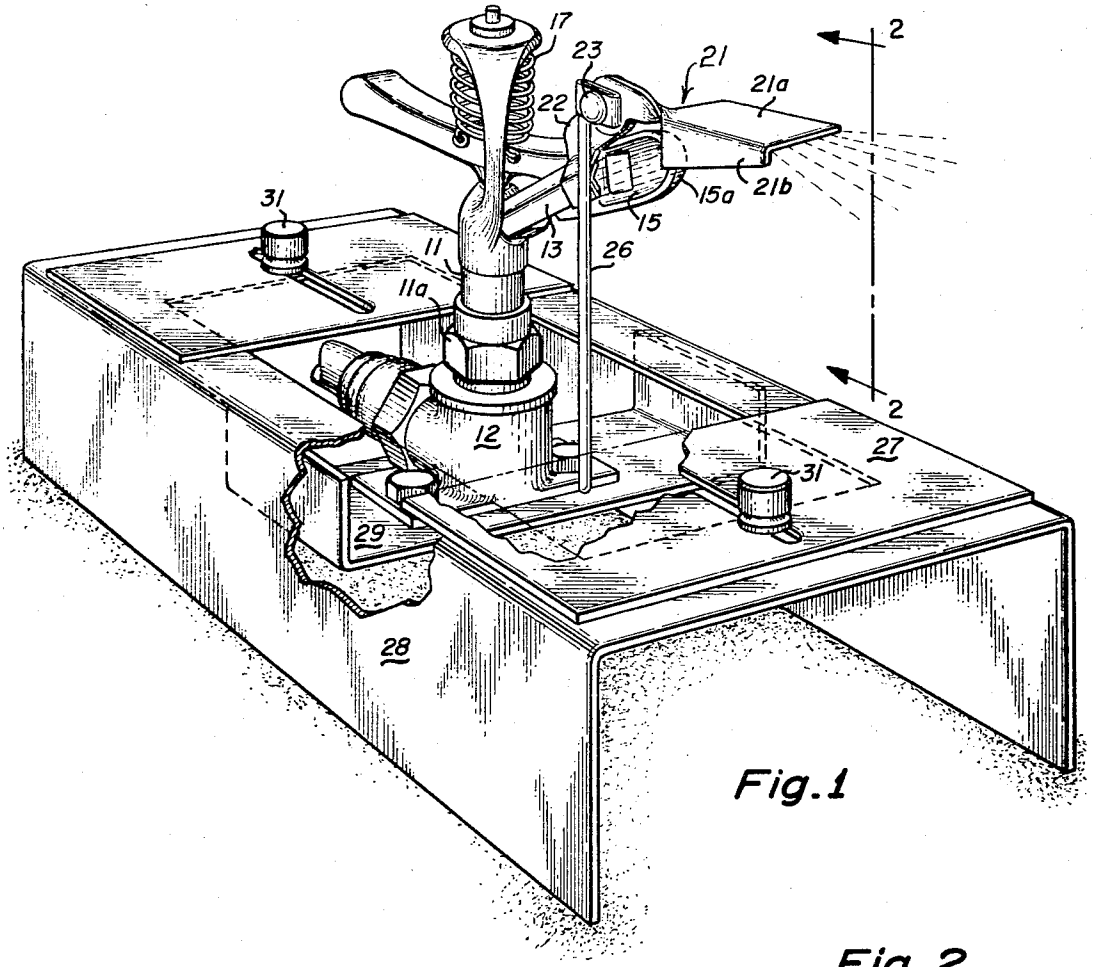


Fig. 1

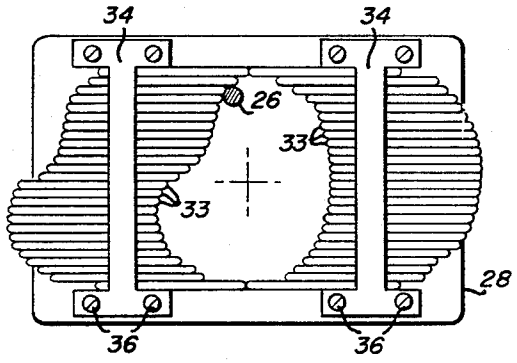
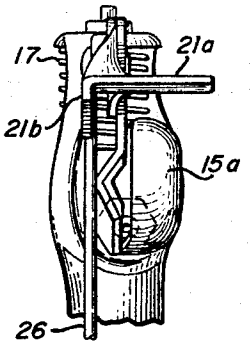


Fig. 3

Fig. 2



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ROTARY SPRINKLER WITH VARIABLE RANGE

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ABSTRACT OF THE DISCLOSURE

A rotary sprinkler of the impulse type having a member which includes a range controlling portion disposed in the path of the water issuing from the nozzle to deflect the same for ranging and an accelerator portion disposed in the path of the water deflected from the impulse device to create an opposite impulse and to change the rate of rotation. The accelerator portion is integral with the range controlling portion and presents a striking surface to the hammer deflected water (sidespit) which varies with the position of the range controlling portion.

This invention relates in general to rotary water sprinklers and relates more particularly to such sprinklers with a controllable pattern of water distribution.

Rotary sprinklers of the impulse or reaction type are well known, in which the water issuing in a stream from the sprinkler nozzle strikes a spring-loaded deflection hammer. This hammer is deflected away from the water stream and then returns under the spring pressure to strike the nozzle, imparting a step movement to the nozzle and sprinkler body in a rotary direction. This action continues, with the hammer repeatedly being forced away by the issuing water and returning under spring pressure to impart movement to the nozzle member, so that the sprinkler body and nozzle member rotate about a central axis in a series of small, separate steps. Such sprinklers may also be provided with adjustable range flap members which deflect the issuing water downwardly and hence control the range or throw of the water from the sprinkler.

The above action results in a circular motion of the nozzle member, with a resulting circular water pattern. It has been proposed in the art to modify the above rotary sprinklers to provide water distribution patterns other than circular. One such modification involves the use of a range or deflector flap which is pivotally positioned in the path of the water issuing from the nozzle. One end of this flap is connected to a tracer rod whose other end is urged against the surface of a cam plate as the sprinkler rotates. The cam plate has a configuration corresponding to the shape of the desired water pattern. Thus, as the spinkler rotates under the impulse action described above, the deflector flap assumes a position relative to the issuing water which is determined by the cam plate, the extreme positions being those where the cam pivots the deflector flap completely out of the water path so that the water is essentially unaffected by the flap, and the position where the deflector flap is fully in the path of the issuing water so that the water travels only a short distance from the nozzle.

The above described structure is effective to provide a variety of different watering patterns with a rotary sprinkler of the impulse type, since any such pattern can be obtained by selection of the required cam. However, such a device has the disadvantage that it is not capable of adjusting the amount of water delivered to the size of the area being watered. That is, the rate of rotary movement of such a sprinkler per unit of time is constant, and the amount of water delivered by it per unit of time is also constant. Thus, such a sprinkler will cause the amount of water delivered per unit area to vary in dependence upon the configuration being watered. As an example, in

the case of a rectangular configuration, if the sprinkler is adjusted to deliver the required amount of water at the ends of the rectangle, there will be an overwatering along the sides of the rectangle, particularly near the center thereof, since the sprinkler is delivering the same amount of water to a given sector of smaller area as it did to the same size sector of larger area at the ends of the rectangle.

In accordance with the present invention, there is provided a rotary sprinkler of the impulse type which provides for variable area water coverage while insuring that a substantially uniform amount of water per unit area is delivered regardless of the configuration of the area being watered. In the preferred embodiment of the invention, a conventional rotary sprinkler is provided with an accelerator member which is pivotally mounted adjacent the path of the water issuing from the nozzle and whose position relative to the issuing water is controlled by a cam follower shaft. This shaft is guided by a cam plate which is mounted around the axis of the sprinkler and which has a configuration corresponding to the shape of the area to be watered.

The accelerator member serves the dual function of controlling the range of the issuing water and of controlling the rate of rotary movement of the sprinkler as a function of this range. The rate of rotary movement of the sprinkler is controlled to vary inversely with the range, so that the rate of movement is lowest when the range is maximum and this rate increases as the range decreases, causing the sprinkler to traverse a given sector of rotary movement in less time as the range decreases. Since the sprinkler is traversing a given sector of reduced range in less time than would be required to traverse that size sector with increased range, the total amount of water delivered to the area of reduced range is decreased. By proper design of the accelerator member, this variation in total water delivery produced by the varying rate of rotary movement can be made to result in uniform water delivery per unit area, thereby avoiding overwatering of some areas or underwatering of other areas in the sprinkler pattern.

It is therefore an object of this invention to provide an improved rotary sprinkler of the impulse type which provides a water distribution pattern of any desired configuration.

It is an additional object of the present invention to provide a rotary sprinkler of the impulse type which is capable of watering areas of irregular shape while delivering substantially uniform amounts of water per unit area.

It is a further object of this invention to provide a rotary sprinkler of the impulse type having provision for controllably varying the range of the water issuing from the sprinkler and for varying the rate of rotary movement of the sprinkler as a function of this range.

It is a further object of this invention to provide a rotary sprinkler of the impulse type having an accelerator member whose position relative to the water stream issuing from the sprinkler is controlled by a cam having a configuration corresponding to the shape of the area to be watered, the accelerator member serving both to control the range of the issuing water and the rate of rotary movement of the sprinkler as a function of this range to produce delivery of a uniform amount of water per unit area in the sprinkler pattern.

Objects and advantages other than those set forth above will be readily apparent from the following description when read in connection with the accompanying drawing, in which:

FIGURE 1 is a perspective view showing a rotary sprinkler of the impulse type equipped with the accelerator member of this invention and showing the cam

follower and one embodiment of cam plate for controlling the position of the accelerator member;

FIGURE 2 is a view along line 2—2 of FIGURE 1 showing further details of the structure of the accelerator member; and

FIGURE 3 is a plan view of an alternate embodiment of a cam plate whose component parts are adjustable to provide a variety of different watering configurations.

Referring to the drawing by reference character, FIGURE 1 shows a rotary sprinkler of the impulse type modified in accordance with the present invention. The sprinkler may include a body portion **11** having a bore extending therethrough for the flow of water received from a conduit to which the sprinkler is connected. The sprinkler may be provided with a coupling **11***a* which engages a suitable fitting **12** for the supply of water to the sprinkler. The sprinkler assembly is freely rotatable within coupling **11***a*, as it well understood in the art. The water flowing through body **11** passes into a nozzle portion **13** and issues from the end thereof. As in conventional sprinklers of this type, a deflector hammer **15** is positioned adjacent the discharge opening in nozzle **13**. Deflector hammer **15** is pivotally secured to the top of body portion **11** on an axis extending essentially through the center of the bore of body **11**. Deflector hammer **15** is rotatable about this axis and is urged toward the opening in nozzle **13** by a spring **17** which has one end secured to hammer **15** and has its other end fixed to the top of body portion **11**.

The end of hammer **15** adjacent the opening in nozzle **13** has a generally cup-shaped portion **15***a* on which the water issuing from the nozzle opening impinges. Due to the shape of this cup-like portion, the impinging water exerts a sideward thrust on the hammer, tending to rotate the hammer away from the issuing water against the force of spring **17**. The hammer will be rotated a certain amount until spring **17** is cocked sufficiently to return the hammer toward nozzle **13**. Hammer **17** then returns toward nozzle **13** and strikes it, causing nozzle **13** and sprinkler body **11** to rotate a slight amount in response to the impact of the hammer. At this time, cup-shaped portion is again in the path of the issuing water and is again rotated against spring **17**. This action continues repeatedly, with hammer **17** rotating the nozzle and sprinkler body in a series of small steps, so that the sprinkler assembly rotates about the vertical axis through body **11** to distribute water in a rotary pattern in a series of bursts or pulses.

In accordance with the present invention, the sprinkler is provided with an accelerator member **21** which serves to control the range of the water issuing from the sprinkler and to vary the rate of rotation of the sprinkler as a function of this range. Accelerator member **21** includes a range-controlling portion **21***a* and an accelerator portion **21***b*. Member **21** is pivotally mounted on an arm **22** which is secured to nozzle portion **13**. A rivet **23** secures member **21** to arm **22** so that member **21** is free to move about the axis formed by this rivet.

The movement of member **21** about the axis formed by rivet **23** is controlled by a cam follower shaft **26** which has one end connected to member **21** and has its other end bearing against a cam plate **27**. As seen in FIGURE 1, the end of cam follower **26** follows the outline of the interior of cam plate **27** as the sprinkler rotates, and the shape of this cam plate determines the pattern of water distribution from the sprinkler. In the embodiment of FIGURE 1, cam plate **27** has a rectangular configuration, to produce a rectangular water distribution pattern, in a manner to be described more in detail below.

Cam plate **27** may be positioned relative to the sprinkler by any suitable means, such as a base plate **28** which has a channel portion **29** secured to fitting **12**. The position of cam plate **27** relative to the sprinkler and base plate **28** may be varied by means including thumb screws **31** disposed on threaded studs extending through the longitudinal slots in cam plate **27**.

The operation of the device is as follows. When water is supplied to the sprinkler, it will issue from the end of nozzle **13** and strike cup portion **15***a* of the deflector hammer, as in a conventional sprinkler of this type, and tend to rotate the hammer against spring **17**. The water leaving cup portion **15***a* will then strike the side of accelerator portion **21***b* of member **21**, tending to rotate member **21** and the sprinkler body in the direction opposite to that in which the deflector hammer is rotated by the water force. This rotation of the sprinkler body increases the tension on spring **17**, and this increased tension acts on the deflector hammer to speed up its return to the position to strike nozzle **13**. The shape of accelerator portion **21***b* is such that the thrust exerted against it by the water increases as member **21** is lowered about its pivot. Thus, the force against member **21***b* and hence the rotative rate of the sprinkler increases as member **21** is lowered.

Essentially simultaneously with striking accelerator portion **21***b*, the discharged water will strike range-controlling portion **21***a* of member **21** and will be diverted or deflected from the path it had upon leaving nozzle **13** by an amount determined by the position of portion **21***a*. By controlling this angle of deflection, it will be clearly seen that the range or throw of the discharged water is effectively controlled.

The sprinkler thus rotates, with the position of element **21** controlled by cam plate **27** through cam follower **26**. Range controlling portion **21***a* provides control over the distance the water is projected from the sprinkler, while accelerator portion **21***b* produces a variation in the rotative rate of the sprinkler as a function of this range. Thus, when the range is longest, member **21** is at its uppermost position where range portion **21***a* has little or no contact with the issuing water and accelerator portion **21***b* is similarly substantially out of the way of the water leaving the deflector hammer. Under these circumstances, the rotative rate of the sprinkler is determined by hammer **15** and spring **17**. As the range decreases, as determined by the contour of cam plate **27**, cam follower **26** is forced toward the sprinkler body by cam plate **27**. This rotates member **21** about rivet **23** to bring accelerator portion **21***b* and range portion **21***a* into contact with the issuing water, so that accelerator portion **21***b* produces an increase in the rotative rate of the sprinkler as the range decreases. By suitable design of the configuration of accelerator portion **21***b*, this increase in rotative rate can be made just sufficient to compensate for the decreased range so that a uniform amount of water per unit area is delivered regardless of the configuration of the area being watered.

Although a cam plate **27** having a generally rectangular configuration has been shown in FIGURE 1, it will be apparent that any other configuration can be selected to control the motion of cam follower **26** and hence control the pattern of water distribution from the sprinkler. Further, it will be apparent that the water distribution from a given sprinkler may be readily varied by substitution of different cam plates on base **28**.

As an alternative to changing the entire cam plate **27** for each different water distribution pattern desired, the embodiment of FIGURE 3 may be employed. In this embodiment, the cam plate is formed by a plurality of individually adjustable finger members **33** which are held in position by a pair of friction bars **34**. Friction bars **34** may be secured to base plate **28** by suitable means such as screws **36** which can be loosened to permit individual adjustment of the positions of the different finger members **33** and which may then be tightened to firmly clamp members **33** in this position. From FIGURE 3, it will be apparent that substantially any desired water distribution pattern may be obtained by adjusting the positions of members **33** under friction bars **34**, and that cam fol-

lower **26** will ride around on the inner edges of the finger members to control the operation of the sprinkler in a manner substantially identical to that described above.

While the invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that the foregoing and other changes in form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. A rotary sprinkler of the impulse type, comprising:
a body portion rotatable about a vertical axis;
a nozzle portion extending from said body portion and having an opening for the discharge of water;
a deflector hammer mounted on said body portion;
hammer biasing means for urging one end of said hammer toward said opening into the path of the water issuing therefrom, said hammer oscillating under the action of said biasing means and said water to rotate said nozzle and said body member about said vertical axis;
an accelerator member mounted on said nozzle portion and positioned adjacent said opening;
said accelerator member having a range controlling portion and an accelerator portion;
said range controlling portion being movable to deflect said issuing water to vary the range of said water as a function of the position of said accelerator member;
said accelerator portion being movable with said range portion and being disposed to present to the water stream deflected by said hammer an amount of water-deflecting surface which varies as a function of the position of said accelerator member; and
the force of said hammer deflected water on said accelerator portion acting to vary the biasing force of said biasing means to vary the rotative rate of said sprinkler as a function of the said water range.

2. Apparatus in accordance with claim **1** including means for controlling the position of said accelerator member as said sprinkler rotates to control the water distribution pattern of said sprinkler.

3. Apparatus in accordance with claim **2** in which said rotative rate of said sprinkler varies inversely with said water range.

4. Apparatus in accordance with claim **3** in which said rotative rate of said sprinkler varies inversely with said water range to deliver a substantially constant amount of water per unit area in said pattern.

5. Apparatus in accordance with claim **2**, including:
cam plate means having a configuration corresponding to the desired water distribution pattern; and
cam follower means connected to said accelerator member and guided by said cam plate means as said sprinkler rotates for controlling the position of said accelerator member in accordance with the configuration of said cam plate means.

6. Apparatus in accordance with claim **3** in which said range controlling portion and said accelerator portion comprise a pair of substantially planar members disposed at right angles with respect to one another.

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