Apparatus integral with a part-circle sprinkler for automatically reversing the direction of the part-circle water pattern generated by the sprinkler relative to the direction of movement of an associated long line of sprinkler pipeline. The invention includes a vane of selected configuration secured to the sprinkler and exposed to water flow in the pipeline, which vane is sensitive to the direction of water flow to determine and maintain the desired orientation of the sprinkler relative to the pipeline.
AUTOMATIC REVERSING PART-CIRCLE SPRINKLER

BACKGROUND OF THE INVENTION

1. Field
The invention relates to automatic sprinkler systems, and particularly to an improved, automatically reversible, water sprinkler for use in lateral sprinkler systems.

2. Prior Art
On certain soils, automatic irrigation systems encounter traction problems because the wheels of the pipeline support towers bog down in the mud created by the sprinkling. In this situation, it is common to use part-circle sprinklers, which per se, are known in the art, wherein the sprinklers are oriented to irrigate only behind the line. However, a problem is encountered in using part-circle sprinklers in a lateral sprinkler system such as that disclosed in my copending application, Ser. No. 805,664, because after reversing the direction of travel the trailing edge of the line becomes the leading edge of the line. It follows that all of the part-circle sprinklers have to be reversed in order to throw the part-circle pattern in the opposite direction. The sprinklers may be reversed by changing pattern setting apparatus on each sprinkler, but this takes a considerable amount of labor especially when a large plurality of sprinklers are involved as is common in long lateral sprinkler lines. Obviously, such a manual, sprinkler pattern reversing process is extremely cumbersome, time consuming, and requires a prohibitive amount of manual labor.

SUMMARY OF THE INVENTION

In lateral water sprinkling systems, when the line is traveling in one direction across a field, water is fed from one end of the line, and when it is traveling in the opposite direction on another portion of the field water is fed from the other end of the line. Consequently, the irrigation water in the line is reversed its flow path depending on which direction the line is traveling.

The invention provides a relatively simple mechanism, operable by the direction of water flow past the sprinkler(s) in the pipeline. Reversing the water flow direction automatically reverses by 180° the orientation of the sprinkler, to thereby reverse the direction of the water pattern generated relative to the direction of pipeline movement. A simple rudder or vane is secured to the sprinkler, which is adapted to rotate within a sleeve secured to the pipeline. The vane extends into the pipeline and into the water flow to thus determine and maintain the orientation of the sprinkler in response to the direction of water flow through the pipeline. When the water flow direction is reversed within the pipeline, the force of the water causes it to turn the sprinkler 180° to automatically reverse the water pattern generated in a predetermined direction generally to the rear of the pipeline.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1 and 2 are radial and longitudinal cross sections respectively of a portion of pipeline, including a sprinkler installed thereto, which is modified in accordance with the invention.

FIG. 2 shows in addition the positions assumed by the vane in response to the opposite directions of water flow.

FIG. 3 is a partial cross section taken along section line 3—3 of FIG. 1.

FIGS. 4 and 5 are plan views illustrating the relationship between the direction of pipeline travel, the direction of water flow in the pipeline, and the resulting direction of the water pattern generated by the sprinklers modified in accordance with the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the FIGS. 1, 2 and 3 there is shown a portion of a pipeline 10 having an opening 12 at the top thereof to receive in demountable relation, a sprinkler 14, preferably of the reciprocating impact type such as that manufactured under the trademark Rain Bird. The upper portion of the sprinkler 14 is conventional in design, and includes sprinkler head apparatus 16, secured to an adapter bushing 20 via an externally threaded collar 18 and a rotatable sleeve 19. The head apparatus 16 including the sleeve 19 is free to rotate within the collar 18; the angle through which the head apparatus 16 rotates during use is selected as desired, and is regulated by conventional pattern setting means (not shown) part of which is supported by the collar 18 and part by the rotatable head apparatus 16. The angle, or arc, through which the head apparatus rotates, and which defines the extent of the water pattern, is shown in FIGS. 4 and 5, as depicted by the letters a and b respectively, further discussed hereinafter.

The sprinkler 14 is further adapted with a flanged length 22, secured as by threading or welding to the lower end of the adapter bushing 20. An externally threaded collar 24 is disposed about the flanged sleeve 22 which is retained in place by a flange 26. A fiber or hard rubber washer 28 may be disposed between the confronting surfaces of the collar 24 and the flange 26 to prevent water leakage.

The sprinkler 14 is further adapted for automatic reversing action in accordance with the invention by means of a long, preferably curved, rudder or vane 30 which is rigidly secured at one (upper) end as by press fitting, welding, etc., to the inside of the flanged sleeve 22. The vane 30 defines preferably a flat, part-annular shape (FIGS. 1, 2 and 3) which conforms generally to the inside circumference of the pipeline 10 (FIG. 1), wherein the width W of the vane along its free end is less than the diameter of the opening 12 in the pipeline 10.

As may be seen from FIG. 2, the vane 30 pivots about an axis of rotation 32 of the sprinkler head apparatus 16, with the greater portion (and thus surface) of the vane being disposed off-axis and in the path of water flow, indicated by numerals 34a and 34b in FIG. 2. The shape, length and size of the vane 30 may vary from that shown, but is generally determined by the following parameters: The vane 30 is free to turn 360° within the pipeline 10; the vane is free to pass through the opening 12 in the pipeline; and the vane should provide the greatest possible surface at the furthest distance from the axis of rotation 32, i.e., should generate the largest possible rotational moment to optimize the sensitivity and stability of the vane 30 with respect to the flow of water. The vane not only determines the sprinkler orientation, but maintains a fixed base to counteract any rotational forces generated by the sprinkler during the spraying process.

The sprinkler 14, modified with the sleeve 22/collar 24 and vane 30, is demountably secured to the pipeline 10 in any of various ways. By way of illustration, the vane is secured here by means of an internally threaded coupling 36, which is welded to one of a pair of steel bands 38, 40 in register with a hole 42 in the band 38. The hole 42 and threaded coupling 36 in turn are secured in register with the opening 12 in water-sealed relation via the bands 38, 40 and a pair of bolt fasteners 44, 46. Otherwise other ways of providing a threaded member integral with opening 12 in the pipeline are available; i.e., welding the threaded coupling 36 directly to the pipeline 10 in register with the opening 12, etc.

In operation, referring in addition to FIG. 4, if the pipeline 10 is moving laterally across a field in a direction 48, represented here as up the page, it is desirable to orient the sprinklers 14 such that they direct water only to the rear of the pipeline 10; i.e., opposite the direction of pipeline travel. The pattern setting apparatus (not shown) of the sprinklers 14 are initially preselected to provide a series of overlapping part-circle patterns 50 from the sprinklers, wherein each sprinkler head apparatus sweeps across an arc defined by the angle α. The part-circle patterns 50 are defined thus by the boundaries 50a and 50b. Note in this example that water is introduced from a water source located in the middle of a large field, only one-half of which is covered by the apparatus at any one time, and that the flow of water in the pipeline is shown by the arrow 34a. Thus the vane 30 assumes the position 30a shown in FIG. 2, and the sprinkler head setting is preselected to direct water
out of the page towards the reader. This orientation is also illustrated in the plan view of FIG. 4. Note that FIG. 2 shows the sprinkler head apparatus 16 at one position along its arc, which position is located generally at the middle of the pattern 50 shown in FIG. 4.

At such time as the pipeline system reaches the end of the field, it is disconnected from the water source and is dragged into the adjacent field, and is re-connected to the water source at the opposite, or left, end of the pipeline 10 as illustrated in FIG. 5. Thus the water flow assumes the opposite direction shown by arrow 34b (dashed arrow 34 in FIG. 2) which forces the vane to rotate from its position 30a to a new position 30b (phantom line in FIG. 2) which is 180° from the former position. Since the preselected setting of the sprinkler head apparatus 16 remains the same relative to the vane 30, the head and thus the pattern generated thereby, also rotates 180°, whereby the head directs water into the page away from the reader. The sprinkler head apparatus 16 is not shown in this orientation in FIG. 2 since it would be obscured by the solid line portrayal thereof, but it is understood that the head apparatus travels through an arc corresponding to the angle B shown in FIG. 5. The direction of travel 52 of the pipeline 10 is opposite the direction 48 of FIG. 4, the flow of water 34b is opposite that of 34a, and the sprinkler part-circle pattern 54 is automatically directed behind the pipeline 10 even though the latter's direction of travel is reversed. It is understood that the sprinkler head apparatus 16 sweeps through the angle B whereby the part-circle patterns 54 are defined by boundaries 54a and 54b.

For reasons of maintenance, it is desirable that the sprinkler/vane combination of the invention be readily removable from the pipeline even when in the field. However, pipelines presently in use have approximately a 1-inch threaded opening (opening 12/coupling 36, FIGS. 1 and 2) for receiving the threaded base of a conventional sprinkler. Thus, in order to provide the automatic part-circle pattern reversing modification without having to modify all existing pipelines presently in use, the invention contemplates in a preferred embodiment the annular, curved shape for the vane 30 such as illustrated in FIGS. 1 and 2. The vane 30 thus may be readily inserted through the coupling 36 and opening 12 into position within the pipeline 10, whereby tightening the collar 24 secures the sprinkler 14 and vane 30 in place. The sleeve 22 (and sprinkler 14) is free to rotate 360° within the collar 24, while the part-circle pattern is selected via the pattern setting apparatus (not shown) in conventional fashion.

Obviously, if a larger opening is formed in the pipeline 10 a correspondingly larger vane width (W) may also be employed in accordance with the invention concepts. Likewise there are various thicknesses, widths and shapes for the vane, including various cross-sectional configurations, e.g., double vane configurations, cross sections other than flat, etc. Furthermore, the sprinkler head apparatus 16 may be rotatable secured to the pipeline 10 via a threaded collar such as 18 or 24, whereby the intermediate sleeve 22, collar 24, etc., may be omitted, if the flanged sleeve 19 is free to rotate relative to the sprinkler head proper. Thus various alternative modifications may be made within the spirit of the invention.

What is claimed is:

1. An automatically reversing part-circle sprinkler including, a base and rotatable sprinkler head apparatus for dispersing water over a selected arcuate pattern, means for setting the orientation of an arc through which the sprinkler head apparatus rotates with respect to its base to determine the part-circle pattern, and a pipeline adapted for movement across a field while carrying water under pressure, the sprinkler comprising the combination of;

2. Coupling means associated with the pipeline to secure the sprinkler head apparatus in rotatable relation to the pipeline; and

3. Orienting means operatively coupled to the sprinkler head apparatus and responsive to the direction of water flow through the pipeline to determine and maintain the part-circle pattern in selected orientation relative to the direction of pipeline movement across the field.

4. The sprinkler of claim 1 wherein the orienting means includes vane means operatively coupled to the sprinkler head apparatus and extending into the flow of water in the pipeline.

5. The sprinkler of claim 2 wherein the coupling means further includes flanged sleeve means secured to the sprinkler head apparatus, collar means circumjacent about the sleeve means and adapted to demountably secure to the pipeline in register with an opening therein, said sleeve means being free to rotate within the collar means.

6. The sprinkler of claim 3 wherein the vane means is responsive to the direction of water flow to maintain the water pattern generated by the sprinkler head apparatus in the preselected orientation relative to the direction of travel of the pipeline, wherein reversing the direction of water flow in the pipeline reverses the orientation of the vane means substantially 180° to likewise reverse the water pattern generated by the sprinkler head apparatus substantially 180°.

7. The sprinkler of claim 4 wherein the vane means includes an annular curved vane member secured at its upper end to the sleeve means, which member has at least a portion thereof radially displaced from an axis passing longitudinally through said coupling and pipeline opening and which vane member further has a width less than the opening in the pipeline.

8. The sprinkler of claim 5 further including mounting means secured to the pipeline, said collar means being adapted to demountably secure to the mounting means to secure the sleeve means and the sprinkler head apparatus to the pipeline in rotatable relation therewith, said vane means extending through the mounting means and the opening and into the water flow in the pipeline.

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