United States Patent [19]

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[11] **3,831,853**

[45] **Aug. 27, 1974**

[54] **ROTARY SPRINKLERS**

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[22] Filed: **Mar. 26, 1973**

[21] Appl. No.: **344,831**

[30] **Foreign Application Priority Data**

Dec. 12. 1972 Israel 41070

[52] **U.S. Cl.** **239/230,** 239/233

[51] **Int. Cl.** **B05b 3/08**

[58] **Field of Search** 239/230, 231, 232, 233

[56] **References Cited**

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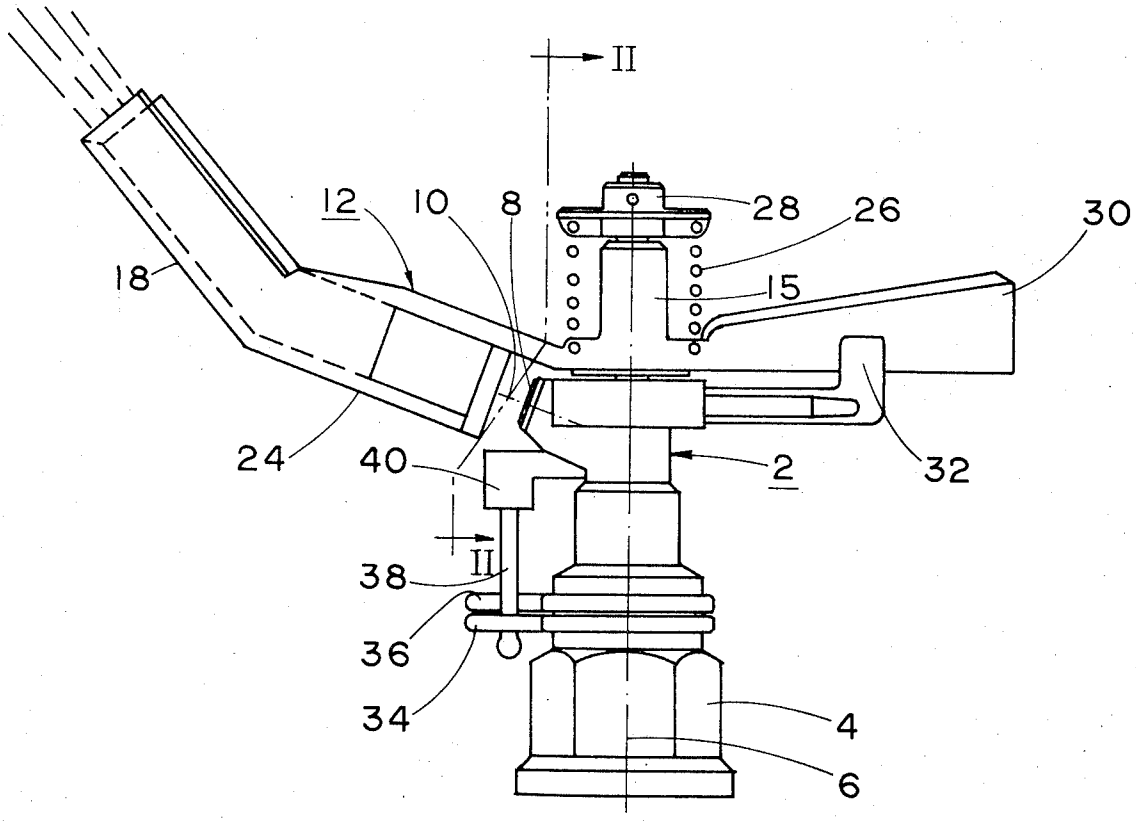
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Primary Examiner—Lloyd L. King
Assistant Examiner—John J. Love
Attorney, Agent, or Firm—Benjamin J. Barish

[57] **ABSTRACT**

A rotary sprinkler of the hammer-type is described wherein the arm of the sprinkler impinged by the jet is oscillatingly mounted on a pivotal axis laterally spaced from the vertical axis of rotation of the sprinkler head such that the impingement of the water jet on the arm produces a rotary torque for oscillating the hammer, while producing relatively little side-splash. In addition, the portion of the arm impinged by the water jet includes baffles substantially blocking whatever side-splash is produced.

10 Claims, 17 Drawing Figures



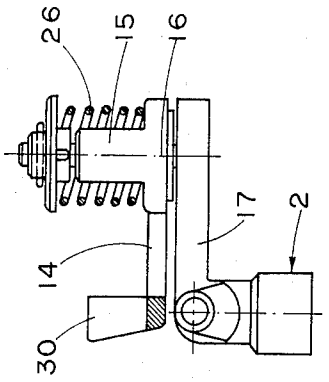


Fig. 2

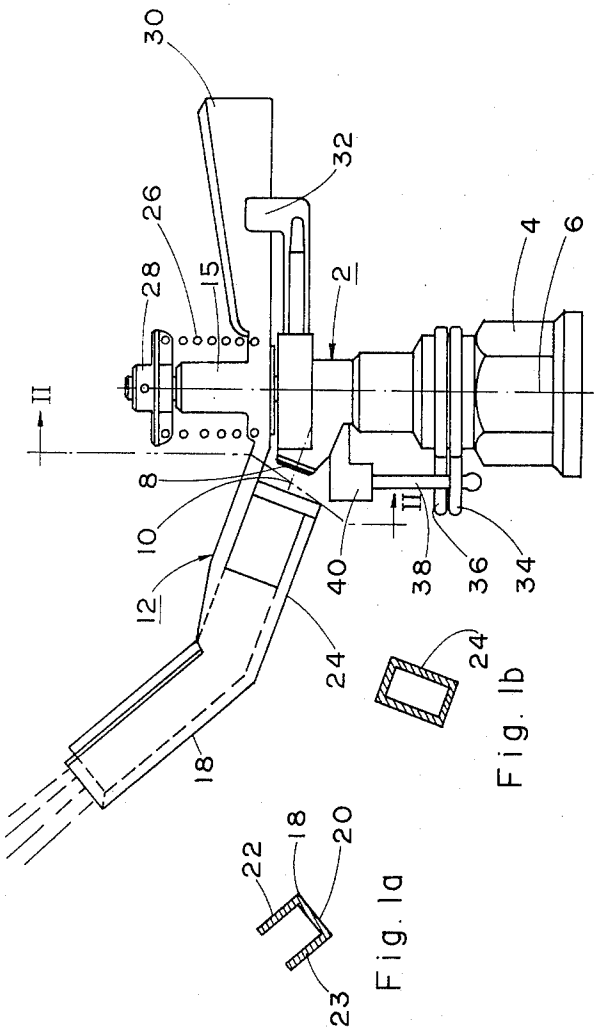


Fig. 1

Fig. 1b

Fig. 1a

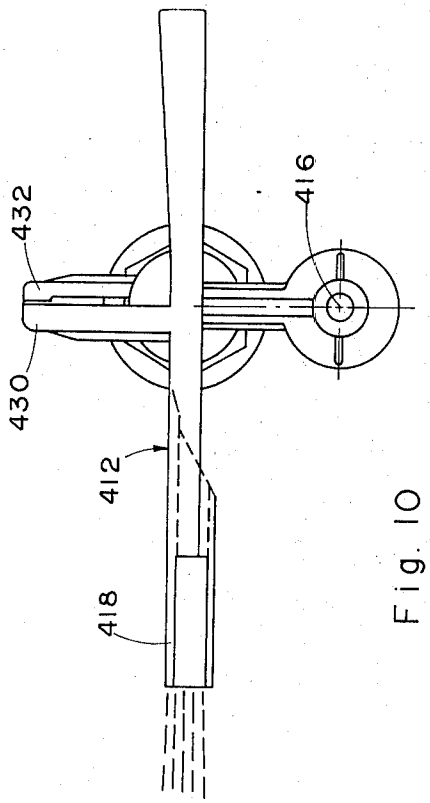


Fig. 10

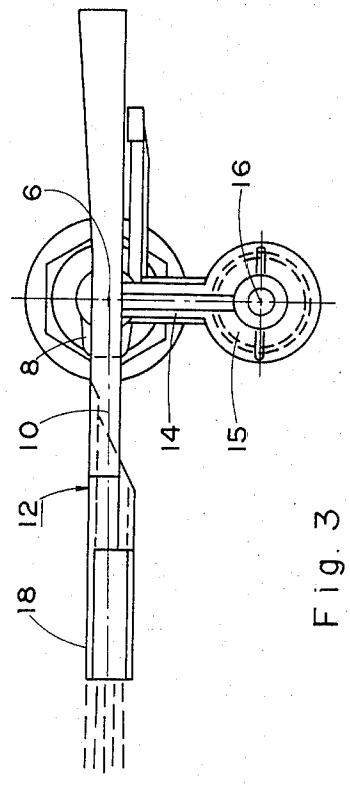


Fig. 3

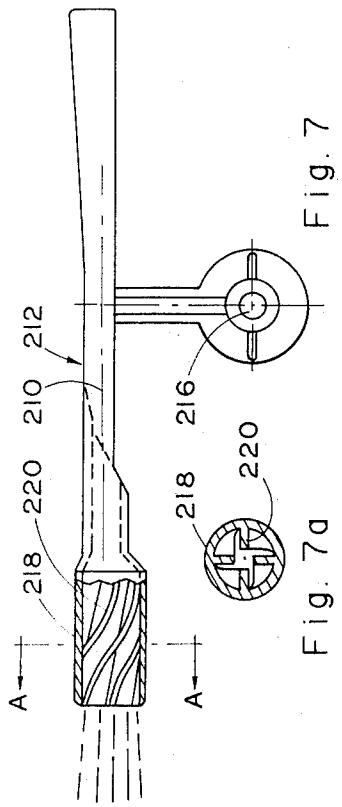


Fig. 7

Fig. 7a

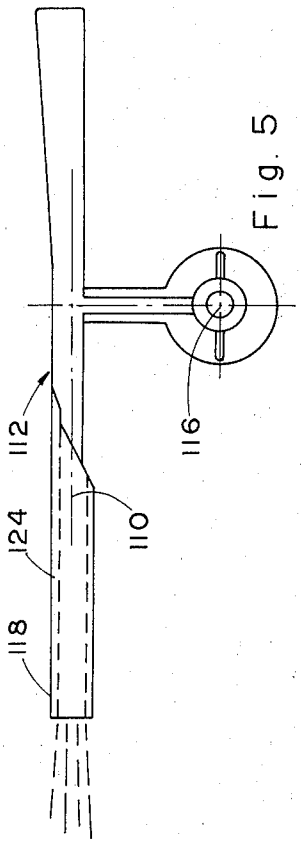


Fig. 5

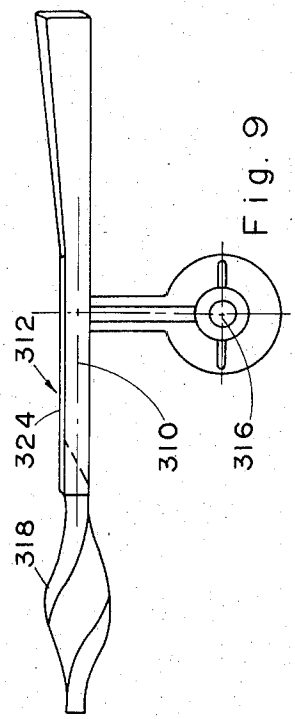


Fig. 9

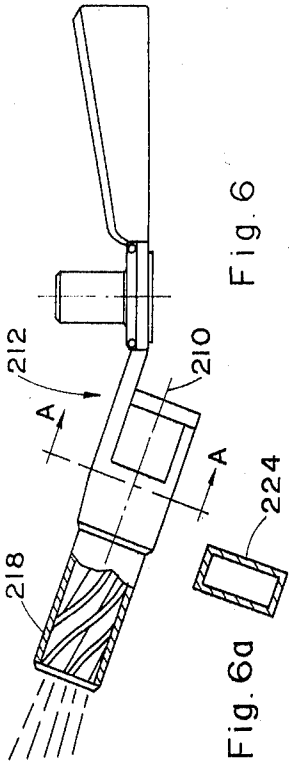


Fig. 6

Fig. 6a

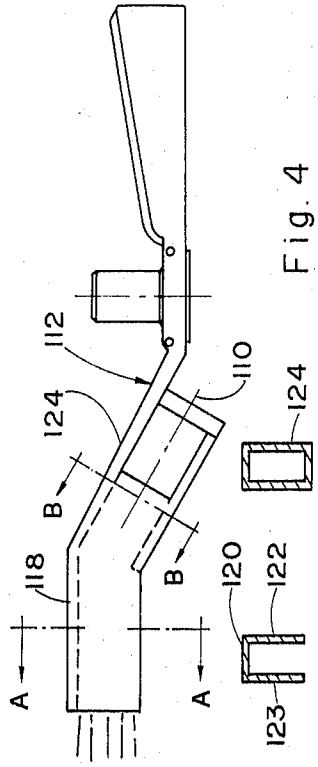


Fig. 4

Fig. 4a

Fig. 4b

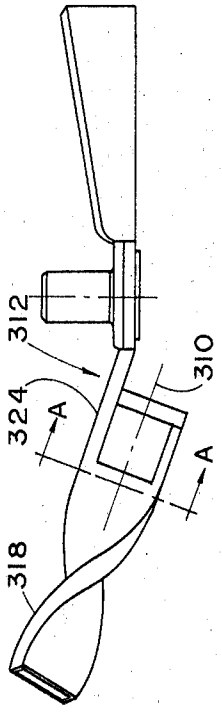


Fig. 8

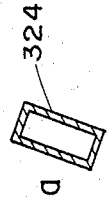


Fig. 8a

ROTARY SPRINKLERS

BACKGROUND OF THE INVENTION

The present invention relates to rotary sprinklers, and particularly to rotary sprinklers of the type in which an arm is oscillated by the water jet impinging thereon to rotate the sprinkler head in a series of short angular movements.

In one form of rotary sprinkler of the foregoing type, the oscillating arm impinged by the water jet is mounted in the same vertical plane as the nozzle axis, usually on the axis of rotation of the sprinkler head, and is made to oscillate by the impingement of the water jet on a surface of the arm which is at an angle, in the horizontal plane, to the water jet line. The impingement of the water jet on such a surface drives the arm in one direction, the arm being returned by a spring. The oscillation of the arm in the jet stream thus not only breaks-up the jet stream, but also effects a rotational movement of the head by means of a hammer carried by the oscillating arm striking an abutment carried by the sprinkler head.

Such a rotary sprinkler has been highly developed and has gained widespread use throughout the world. Nevertheless, I have noted a number of drawbacks. One drawback is that the impingement of the water jet on the oscillating arm, namely on the surface thereof which is angled in the horizontal plane to the jet line in order to produce the rotary torque, causes considerable water splash laterally of the water jet line. This produces an uneven distribution of the water over the area being irrigated, in that more water tends to collect close to the sprinkler because of this side-splash. In addition, where the sprinkler is of the sector-type, to irrigate a predetermined sector rather than a full circle (e.g. when irrigating the side of a field, lawn or golf course bordering a road or sidewalk), the sidesplash wets surfaces (e.g. the road or sidewalk) which may not be desired to be wetted, and which may even create a nuisance or a hazardous condition if wetted.

BRIEF SUMMARY OF THE INVENTION

An object of the present invention is to provide an improved rotary sprinkler of the foregoing type having advantages in the above respects.

According to the present invention, the oscillating arm of the sprinkler is mounted on a pivotal axis parallel to but spaced laterally of the vertical plane of the nozzle axis, that is, the line along which the water jet issues from the nozzle. The arrangement is such that the impingement of the water jet on the arm produces a vector force coaxial with the nozzle axis and thereby a rotary torque about the pivotal axis of the arm for oscillating the arm, while producing relatively little splash of the water laterally of the water jet line.

In some embodiments, the impinged portion of the arm is vertically inclined with respect to the water jet line. Thus, the impingement of the water jet on the vertically inclined portion of the arm produces a vector force on the arm in the direction of the water jet line, i.e. coaxial with the nozzle axis. Since the pivotal axis of the arm is laterally spaced from this water jet line, a rotary torque is produced on the arm tending to rotate it about its pivotal axis. The side-splash can thus be substantially reduced while still producing the required rotational torque for oscillating the arm.

According to a further feature of the invention, the portion of the arm impinged by the water jet includes baffle means substantially blocking splash of the water laterally of the water jet line. Many different arrangements of baffle means can be provided, some of which are described below.

Further features and several variations of the invention are described below.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is herein described, by way of example only, with reference to the accompanying drawings, in which:

FIG. **1** is a side elevational view of one form of rotary sprinkler constructed in accordance with the invention, FIGS. **1***a* and **1***b* being sectional views along lines A—A and B—B, respectfully;

FIG. **2** is an end elevational view partially in section along lines II—II of FIG. **1**;

FIG. **3** is a top plan view of the sprinkler of FIG. **1**;

FIG. **4** is a side elevational view of another form of oscillating arm that may be used in the sprinkler of FIG. **1–3**, FIGS. **4***a* and **4***b* being sectional views along lines A—A and B—B, respectively;

FIG. **5** is a top plan view of the oscillating arm of FIG. **4**;

FIG. **6** is a side elevational view, partly in section, of another form of oscillating arm that may be used, FIG. **6***a* being a section along lines A—A;

FIG. **7** is a top plan view, partly in section, of the oscillating arm of FIG. **6**, FIG. **7***a* being a section along lines A—A;

FIG. **8** is a side elevational view of another form of oscillating arm that may be used, FIG. **8***a* being a section along lines A—A;

FIG. **9** is a top plan view of the arm of FIG. **8**; and

FIG. **10** is a top plan view of a still further form of oscillating arm that may be used:

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The rotary sprinkler illustrated in FIGS. **1–3** is of the sector, oscillating-arm, hammer type commonly used in irrigating predetermined sectors of a field, lawn or golf course, such as the sides thereof bordering a road or sidewalk.

The sprinkler includes a head, generally designated **2**, mountable by a threaded nut **4** to a vertical pipe (not shown) so as to be rotatable about the vertical axis **6**. The sprinkler head carries a nozzle **8** from which the water supplied by the vertical pipe issues in the form of a jet along line **10** which represents the nozzled axis. It will be seen, particularly from FIG. **3**, that the water jet line or nozzle axis **10** is in the same vertical plane as the rotational axis **6** of the sprinkler, so that no rotary torque results from the reaction forces produced by the issuance of the water jet from nozzle **8**.

The oscillating arm, generally designated **12**, of the sprinkler is fixed via a short right angle extension **14** (FIG. **3**) to a hub **15** (FIG. **1**) pivotable about vertical axis **16**, which is parallel to but laterally spaced from the vertical plane of the nozzle axis **10** and of the axis **6** of rotation of the sprinkler head. Extension **14** of the arm overlies an extension **17** (FIG. **2**) formed at the top of sprinkler head **4**. As shown in FIG. **3**, in the normal (non-pivoted) position of arm **12**, the axis of the im-

pinged portion **18** of the arm is aligned with (i.e. in the same vertical plane as) the nozzle axis **10.**

This impinged portion of arm **12** is of U-section, open at the top, and is inclined upwardly with respect to the nozzle axis **10** (see FIG. **1**). The water jet thus impinges on the inner surface of the web **20** of the U-section and is splashed upwardly in line with the nozzle axis. The sides **22,23,** block the splash of the water laterally of the nozzle axis **10.**

The oscillating arm **12** further includes a rectangular sleeve portion **24** (FIG. **1***b*) through which the water jet passes before impinging on the upwardly inclined web **20** of the arm.

Arm **12** is driven in one direction (counter-clockwise in FIG. **3**) by the impingement of the water jet on inclined web **18** thereof (as will be described more fully below) and is returned in the opposite direction by a return spring **26.** The upper end of the spring is fixed to a cap **28** and its lower end is fixed to the arm.

A hammer **30** is carried by oscillating arm **12** opposite to the jet-impinged portion of the arm. Hammer **30** strikes an abutment or anvil **32,** carried by the sprinkler head **2,** during the return stroke of each oscillation. This causes the sprinkler head to revolve about axis **6** (clockwise in FIG. **3**) in a series of short angular movements, there being one such movement for each strking of the hammer on the abutment.

The sprinkler, insofar as described, would continuously rotate about vertical axis **6.** To enable the sprinkler to be used for irrigating a predetermined sector, rather than a full circle, it is provided with a pair of stops **34,36** cooperable with a lever **38** extending from a housing **40** in the sprinkler head. Stops **34,36** are angularly displaced from each other and determine the boundaries of the sector being irrigated. Lever **38** is carried with the rotating sprinkler head, and when it engages one stop (e.g. **36**), it actuates mechanism within housing **40** to cause the sprinkler head to be driven by the oscillating arm during the forward oscillating stroke thereof, rather than during the return stroke, whereby the direction of rotation of the sprinkler head is reversed. This reversed rotation of the head continues until its lever **38** engages the other stop. Such a construction is well known in sector sprinklers of this type, and therefore further details are not deemed necessary.

The operation of the sprinkler of FIGS. **1–3** will be apparent from the above. It will be seen that the water jet issuing from nozzle **8** along line **10** impinges on the inner surface of the upwardly inclined web portion **20** of arm **12,** and thereby subjects the arm to a force in the direction of the nozzle axis **10.** Since arm **12** is pivoted on axis **16** which is laterally spaced from the vertical plane of the nozzle axis **10** (see particularly FIG. **3**), a rotational torque is produced on arm **12** tending to rotate it (counterclockwise in FIG. **3**) about its pivotal axis **16.** As soon as the arm moves out of the jet stream along line **10,** the water jet no longer impinges on it, but the arm continues to rotate by virtue of its inertia, thereby loading spring **26.** As soon as its inertia is spent, spring **26** returns the arm towards its original position, wherein its hammer **30** strikes abutment **32** causing the abutment and the sprinkler head to which it is affixed, to move a short angular distance (clockwise in FIG. **3**). Arm **12** thus oscillates back and forth very rapidly breaking-up the jet stream and causing the sprinkler head to revolve in a series of short angular movements.

It will also be seen that in the arrangement described, the impingement of the water jet on inclined web **20** of the impinged portion **18** of the oscillating arm **12** causes some upward splash but very little side-splash because the axis of this impinged surface of the arm is substantially in the same vertical plane as the jet stream line and is not angled horizontally thereto as in the conventional rotary sprinklers of this type. In addition, the sides **22, 23** of the impinged portion **18** of the oscillating arm act as baffles which block whatever side-splash is produced. Thus, the sprinkler illustrated provides a more uniform distribution of the water and substantially reduces the undesirable accumulation of water close to the sprinkler. It also eliminates the wetting of surfaces outside the predetermined irrigation sector when the sprinkler is used for sector irrigation.

FIGS. **4** and **5** illustrate a variation in the oscillatin arm construction. In this variation, the oscillating arm, generally designated **112,** includes a portion **118** impinged by the water jet, which portion is also of U-section (see FIG. **4***a*). In this case, however, the U-section is open at the bottom and is inclined downwardly with respect to the water jet line **110** representing the nozzle axis. The jet thus impinges on the inner surface of the upper web **120** to produce the force in the direction of the nozzle axis **110,** and thereby the rotary torque about the eccentric pivotal axis **116** (FIG. **5**) of the arm. Since the axis of surface **120** of the oscillating arm impinged by the water jet is substantially in the same vertical plane as the nozzle axis, there will be some downward splash but little side-splash of the water; but whatever side splash there is will be blocked by the sides **122, 123** of the U-section **118.** These sides thus serve as baffles similar to sides **22,23** of FIGS. **1–3.**

As in the oscillating arm construction of FIGS. **1–3,** the oscillating arm **112** of FIGS. **4** and **5** includes the rectangular sleeve **124** through which the water jet passes before impinging on surface **120** of the U-section **118.**

FIGS. **6** and **7** illustrate a still further variation in the construction of the oscillating arm. The oscillatin arm **212** in this variation includes a jet-impinging portion **218** which is in alignment with the water jet line **210** representing the nozzle axis. In this case, portion **218** is of circular section (FIG. **7**a), but includes internal spiral vanes **220** impinged by the water jet to produce the vector force in the direction of the nozzle axis **210.** The oscillating arm **212** is here also pivotably mounted on an axis **216** (FIG. **7**) which is laterally spaced from the vertical plane of nozzle axis **210,** so that this vector force produces a rotary torque tending to rotate the arm about its pivotal axis **216.**

As in the previous arrangements, oscillating arm **212** includes a rectangular section **224** through which the water jet passes before impinging on section **218** of the arm.

FIGS. **8** and **9** illustrate a still further variation, wherein the oscillating arm, **312,** is of rectangular section as shown at **324** (FIG. **8***a*), but the end **318** of the arm is given a longitudinal twist so that the water jet travelling along the jet axis **310** impinges on the inner surface of the twisted portion **318** to produce the vector force in the direction of the nozzle axis **310.** As in the previous arrangements, the oscillating arm **312** is

pivotably mounted on an axis **316** which is laterally displaced from the vertical plane of nozzle axis **310**, and therefore the force of the water jet produces a rotary torque around pivotal axis **316**.

Since in both the arrangements of FIGS. **6**, **7** and FIGS. **8**, **9**, the impinged portion of the oscillating arm completely encloses all the lateral sides of the water jet, side-splash of the water jet, as it issues from the open end of the oscillating arm, is substantially blocked.

FIG. **10** illustrates a still further variation. Here the impinged portion **418** of the oscillating arm and its mounting at pivotal axis **416**, may be according to any of the arrangements discussed earlier. The hammer **430**, however, carried by the oscillating arm at its opposite end, is substantially at right angles to the arm rather than being substantially coaxial with the arm as in the previous arrangements. The abutment **432** carried by the sprinkler head is suitably located to be engaged by hammer **430** at the end of the return movement of the oscillating arm, as in the previous arrangements.

Many other variations, modifications, and applications of the illustrated embodiments will be apparent.

What is claimed is:

1. A rotary sprinkler including a sprinkler head mountable on a pipe to be rotatable about a vertical axis, the sprinkler head carrying a nozzle from which the water issues in the form of a jet along the nozzle axis, the sprinkler head further including a spring and an arm urged in one direction by the spring, the arm having a portion impinged by the jet to move the arm in the opposite direction, thereby to oscillate the arm and to rotate the sprinkler head and the nozzle about said vertical axis, characterized in that said oscillating arm is pivotably mounted on an axis parallel to but spaced laterally of the vertical plane of the nozzle axis such that the impingement of the water jet on the arm produces a vector force coaxial with said nozzle axis and, thereby, a rotary torque about said pivotal axis of the arm for oscillating the arm.

2. A rotary sprinkler including a sprinkler head mountable on a pipe to be rotatable about a vertical axis, the sprinkler head carrying a nozzle from which the water issues in the form of a jet along the nozzle axis, the nozzle axis being in the same vertical plane as the axis of rotation of the sprinkler head, the sprinkler head further including a spring and an arm urged in one direction by the spring, the arm having a portion impinged by the jet to move the arm in the opposite direction, thereby to oscillate the arm and to rotate the sprinkler head and the nozzle about said vertical axis, said oscillating arm being pivotably mounted on an axis parallel to but spaced laterally of the vertical plane of the nozzle axis, the impinged portion of the arm being coaxial with the nozzle axis, the impingement of the water jet on the arm producing a vector coaxial with the nozzle axis and, thereby, a rotary torque about pivotal axis of the arm for oscillating the arm.

3. A sprinkler according to claim **1**, wherein said impinged portion of the arm includes baffle means substantially blocking splash of the water laterally of nozzle axis.

4. A sprinkler according to claim **3**, wherein said impinged portion of the arm is of U-section and is open at the top, the web of the U-section being inclined upwardly with respect to the nozzle axis so as to be impinged by the water jet, the sides of the U-section serving as said baffle means substantially blocking splash of the water laterally of the nozzle axis.

5. A sprinkler according to claim **3**, wherein said impinged portion of the arm is of U-section and is open at the bottom, the web of the U-section being inclined downwardly with respect to the nozzle axis so as to be impinged by the water jet, the sides of the U-section serving as said baffle means substantially blocking splash of the water laterally of the nozzle axis.

6. A sprinkler according to claim **3**, wherein the impinged portion of the arm is in the form of a sleeve, the water jet being directed therethrough and impinging on the inner surface thereof, the sides of the sleeve serving as said baffle means substantially blocking splash of the water laterally of the nozzle axis.

7. A sprinkler according to claim **6**, wherein the inner surface of the sleeve is formed with internal spiral vanes which are impinged by the water jet.

8. A sprinkler according to claim **6**, wherein said sleeve is of rectangular section and is twisted longitudinally thereof, the inner surface of the twisted sleeve being impinged by the water jet.

9. A sprinkler according to claim **1**, wherein said oscillating arm carries a hammer at the end opposite to the jet-impinged portion thereof and substantially coaxial therewith, said hammer engaging an abutment of the sprinkler head during the oscillation of the arm to rotate the sprinkler head and nozzle.

10. A sprinkler according to claim **1**, wherein said oscillating arm carries a hammer at the end opposite to the jet-impinged portion thereof and substantially at right angles thereto, said hammer engageing an abutment on the sprinkler head during the oscillation of the arm to rotate the sprinkler head and nozzle.

* * * * *