March 23, 1943. J. B. BAIRD 2,314,754

SPRAY HEAD

Filed July 25, 1941

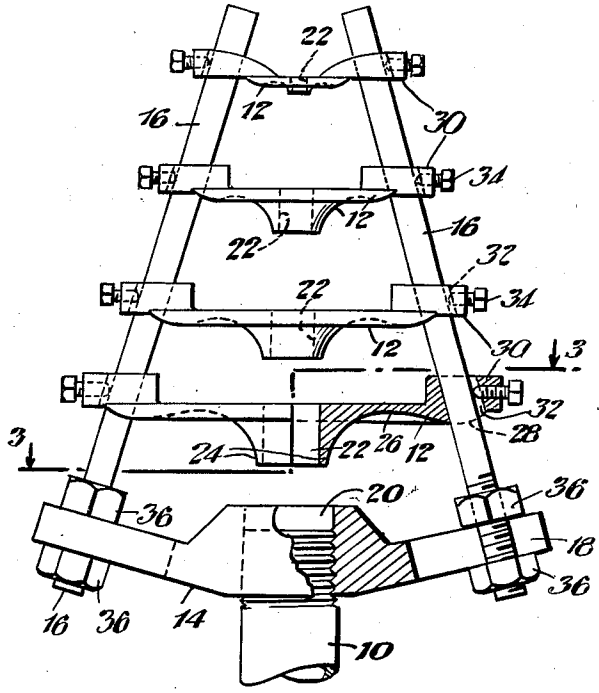


Fig. 1.

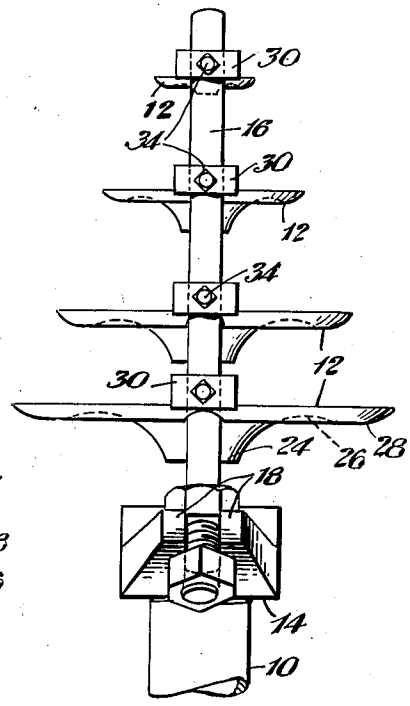


Fig. 2.

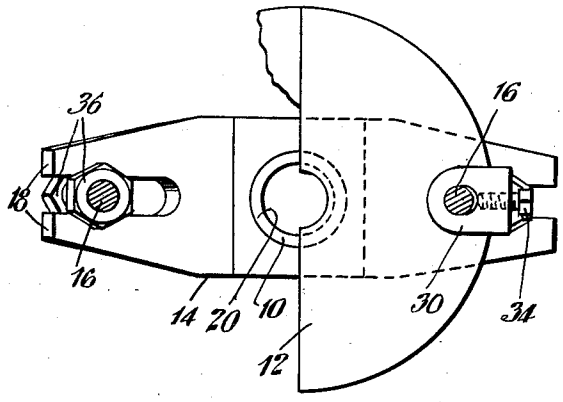


Fig. 3.

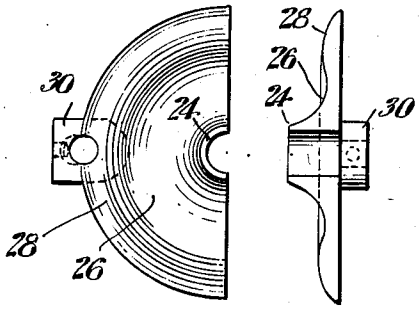


Fig. 4.

Fig. 5.

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Patented Mar. 23, 1943 2,314,754

UNITED STATES PATENT OFFICE

2,314,754

SPRAY HEAD

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Application July 25, 1941, Serial No. 403,964

5 Claims. (Cl. 299—130)

This invention relates to spray heads which are used more particularly for water cooling towers.

Where water is used for condensing or cooling in powerhouses, oil refineries, distilleries, and other industries, it is important to cool the water and use it over and over.

One effective method of cooling water is to break the water into a spray to set up an evaporation and the evaporation and recondensation act to cool the water.

When the water to be cooled is circulated under a pressure it is a simple matter to break it into a fine spray as it issues from a nozzle. Circulation of water under a high pressure or with a high velocity entails much expense and it is desirable therefore to provide a distributor head that will produce a fine spray when the water is delivered under a low head or low pressure.

The primary object of the present invention is to provide a spray head that will effectively break water into a fine spray as it is delivered to a spray head under a comparatively low pressure.

Another object of the invention is to provide a spray head that is adjustable to more effectively distribute the spray in a cooling tower.

Another object of the invention is to provide a spray head with adjustable parts to obtain the distribution of spray for water delivered under different pressures.

A further object of the invention is to provide a spray head that will more effectively utilize the velocity head of the water in forming and distributing the spray.

With these and other objects in view the invention consists in the spray head illustrated in the drawing, described in the accompanying specification, and particularly defined in the claims.

The various features of the invention are illustrated in the drawing in which

Figure 1 is a front view in vertical elevation with parts in section illustrating the preferred form of the spray head of the present invention;

Figure 2 is a vertical side elevation of the spray head;

Figure 3 is a horizontal sectional view of the spray head taken on the line 3—3 of Figure 1 illustrating the supporting yoke and half of a distributing plate in plan view;

Figure 4 is a top plan view; and

Figure 5 is a view in side elevation of one of the distributor plates.

The distributor head illustrated in Figure 1 is shown in elevation in the reverse position from which it is usually used for forming a water spray in a cooling tower. The usual position of use is to introduce the water through a pipe 10 and cause it to flow downwardly against a series of distributing plates 12. The spray head is made up of a supporting yoke or member 14 adapted to be threaded onto the end of an intake pipe 10 and the series of distributing plates 12 which are fixed in position on supporting rods 16 that are secured in the slotted ends 18 of the yoke 14.

As illustrated in Figure 1 it will be seen that the distributor plates 12 have a progressively smaller diameter as the plates are supported on the rods 16 more and more remotely from the supporting members 14. A delivery port 20 in the yoke 14 is arranged centrally with respect to the center of the distributing plates 12, the port 20 being arranged to direct a stream of water into a series of openings 22 formed in the central portion of each of the distributing plates 12. The diameters of the openings 22 in the distributing plates become progressively smaller as the plates are positioned more and more remotely from the supporting yoke. The opening 22 in the bottom plate 12 is very small so that a very small amount of water will issue through this hole.

The shape and construction of the distributor plates 12 forms an important part of the present invention. All of these plates have a similar upper and lower surface shape or contour. The upper surface of each plate has a raised portion 24, a concave portion 26 and a convex portion 28. The raised portion 24 surrounds the opening 22 and forms a shearing surface for cutting off a portion of the stream of water issuing from the port 20 or a portion of the stream which has passed through one of the openings 22 that has a larger diameter than the diameter of the raised portion. The peripheral portion of the stream which is separated by the raised portion 24 passes over the concave surface 26 and thereby retains its mass momentum and velocity because the concave surface sets up a comparatively low resistance to the flow of the water. After the water passes over the concave surface it flows onto the convex surface 28 where it is broken up and distributed into spray. The bottom surface of each of the plates is substantially flat.

Each of the distributing plates is made up in two parts or halves. Each half has a supporting boss 30 containing a slot 32 to receive the supporting rods 16. In the boss 30 is mounted a setscrew 34 by which the plate half may be locked in fixed position upon the rod 16. When the plates are arranged in horizontal alignment, as

illustrated in the drawing, they form a substantially unitary plate and the spray formed by the plate is distributed substantially uniformly around the entire circumference of the plate. The plate halves, however, may be positioned in different vertical positions with reference to one another whereby the spray will not be distributed uniformly on all parts of the circumference of the two halves of the plate. This adjustment of the parts of the plate permits a comparatively large latitude of distribution of the spray influenced by the plates. However, the central opening portions 22 of the plates act to remove a predetermined proportion of water from the main stream.

If the water to be broken into spray is under comparatively high pressure it may be desirable to have a large number of distributing plates. With lower pressures or heads, however, the breaking of the water into spray may be effectively accomplished by a few number of distributing plates. To accomplish this, the lock nuts 36 for clamping the rods 16 in the slots 18 may be used for adjusting the angle of the rods 16 so that the plates may be locked in position in different distances from the delivery port 20 and thus vary the nature and size of spray distribution of the spray head. If desirable the lowermost distributing plate may be a flat solid plate. In the drawing four distributing plates are illustrated as making up the spray head but two or more plates may be effectively used in getting the desired form of spray.

The spray head construction illustrated in the drawing and described above provides many advantageous features. The concave surface maintains and induces a high velocity of water flowing across the surface to provide a large effective area of distribution of the spray. The convex surface is effective in breaking up and distributing the water passing over the concave surface and thus helps in forming a spray of very fine droplets. The slotted construction of the yoke plates with the independent locking mechanism permits the lateral adjustment of the supporting rods and vertical adjustment of the distributor plates. By having the plates in two parts, vertical adjustment of each of the parts can be used in effecting the maximum breaking of the water into spray and the distribution of the spray in a cooling tower. By having the spray head made up of a plurality of parts any one part may be replaced if it becomes worn or broken without requiring an entirely new spray head.

By adjusting the rods 16 to different angles the orifices or openings in the plates 12 will permit the use of different numbers of plates and permit each orifice to separate a predetermined amount of water from the issuing stream in effecting the desired form of spray and distribution of the spray. This is accomplished by providing elongated slots 32 in the bosses 30 by which the parts of the plate may be adjusted along a horizontal plane toward and away from the central axis of the distributor head. It will be apparent, however, that if the upper face of half of a plate is vertically out of alignment with the lower face of the other half, then the two halves will tend to decrease the area of the opening 22 and thus increase the amount of water which each half will cut off of the stream issuing along the axis of the distributor head.

As illustrated in the drawing the distributor plates are shown as formed in two parts. It is apparent, however, that the distributor plate may be made up in three, four or even a larger number of parts with provision being made for supporting each part independently and for locking each part independently on a supporting member. Each group of parts must have its supporting rod 16 and this would, in turn, require a different shape of the yoke 14 to provide a support for each of the rods 16 that are used for supporting the various parts of the spray head.

The preferred form of the invention having been thus described, what is claimed as new is:

1. A spray head comprising a supporting member having a delivery port and an annular distributing plate held in spaced relation to the member with a central opening coaxial with and having a smaller diameter than the delivery port, the upper face of the plate having a spray forming contour comprising a raised portion surround the central opening, a flaring annular surface extending outwardly from the raised portion to form a concave surface and a convex annular surface forming a continuation of the concave surface and extending to the outer edge of the plate said surfaces being substantially uniformly distributed with reference to the central axis.

2. A spray head comprising a supporting member having a delivery port and a series of annular distributing plates held in spaced relation to the supporting member, each plate having a central opening coaxial with the delivery port, the upper face of each of the plates having spray forming annular contours comprising raised portions surrounding the central opening, flaring surfaces extending outwardly from the raised portions to form concave surfaces and convex surfaces forming continuations of the concave surfaces and extending to the outer edges of the plates, said plates progressively decreasing in diameter with the plate of smallest diameter being most remote from the supporting member and the central openings in the plates progressively decreasing in diameter wherein the opening in the smallest diameter plate is the smallest, said surfaces being substantially uniformly distributed with reference to the central axis.

3. The combination of claim 2 in which the distributing plates are supported on rods and slots formed in the plates and supporting members for receiving the rods by which the number of plates and the spacings of the plates with reference to the supporting member may be varied to arrange the plates in a plurality of different distributing arrangements.

4. A spray head comprising a supporting member having a delivery port, a series of annular distributing plates supported in spaced relation with reference to said member, said plates progressively decreasing in diameter with the plate of smallest diameter being most remote from the member, and central openings in the plates progressively decreasing in diameter with the opening of smallest diameter in the plate of smallest diameter, said plates being formed of a plurality of parts and supported on rods adjustably mounted in the supporting member for movement toward and from the central opening, slots in the plates arranged to receive the supporting rods, said slots being sufficiently long to permit the spacing of the plates and adjustment of the rods with reference to the supporting member to permit the plates to be adjusted toward and from the supporting member, and locking devices for holding each part of the plates in a plurality of different spray distributing positions.

5. A spray head comprising a supporting member having a delivery port, a series of annular distributing plates mounted in spaced relation with reference to said member, said plates progressively decreasing in diameter with the plate of smallest diameter being most remote from the member, central openings in the plates progressively decreasing in diameter with the opening of smallest diameter in the plate of smallest diameter, a pair of supporting rods adjustably mounted in the supporting member for movement toward and from the central opening therein, elongated slots in the plates to receive the rods, said slots permitting adjustment of the rods toward and from the central opening of the plates, and means for locking the plates in adjusted position on the rods.

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