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METHOD AND APPARATUS FOR SPRAYING LIQUIDS ON THE SURFACE OF CYLINDRICAL ARTICLES

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FIG. 1

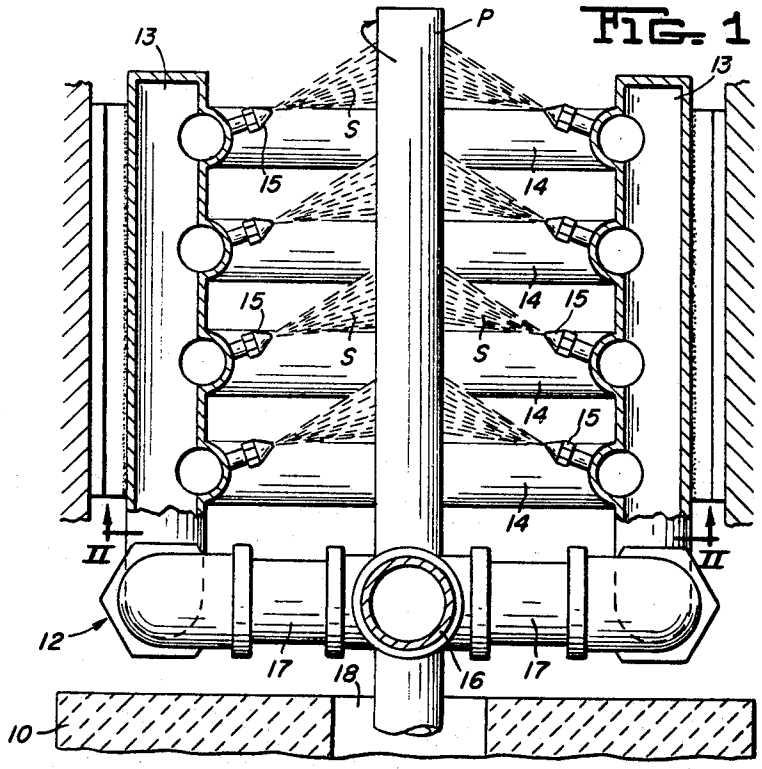
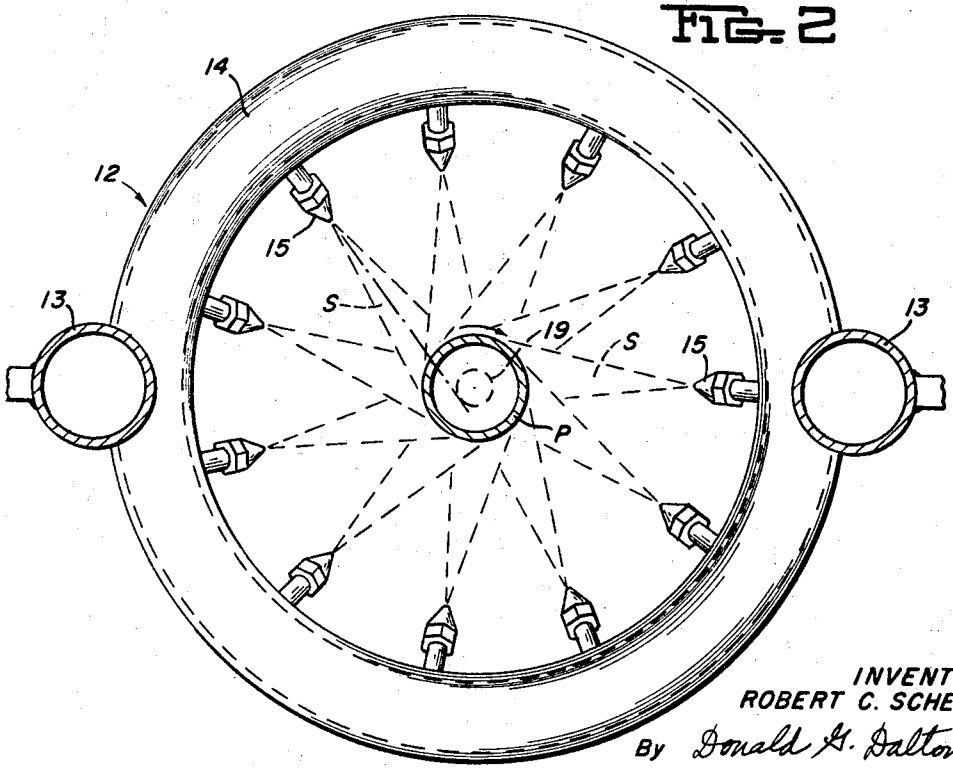


FIG. 2



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METHOD AND APPARATUS FOR SPRAYING LIQUIDS ON THE SURFACE OF CYLINDRICAL ARTICLES

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ABSTRACT OF THE DISCLOSURE

An improvement over a known method and apparatus for spraying liquid on pipes. In the previous arrangement pipe traveled through spray nozzles supported on manifolds surrounding the pipe. Nozzles were directed radially of the pipe. Improvement consists in offsetting the nozzles so that they are aimed tangentially of an imaginary circle within the pipe. Purpose is to prevent sprays from entering leading end of pipe.

This invention relates to an improved method and apparatus for spraying liquids on the surface of cylindrical articles, for example, quenching steel pipes during their manufacture.

As applied to pipe-quenching, my invention is an improvement over the method and apparatus shown in Scott Patent No. 2,776,230. The Scott patent shows a quenching apparatus which includes a series of manifold rings and a plurality of spray nozzles projecting inwardly from each ring. The apparatus is located where each pipe, as it leaves a heat-treating furnace, travels lengthwise through the rings with its central longitudinal axis lying approximately along the central axis of the rings. Each nozzle projects at an acute angle of about 30° from the plane of its ring toward the direction of pipe travel. This arrangement is intended to prevent water from the sprays from backing up into the furnace, or contacting a pipe prematurely, but there is still a problem that water gets into the ends of pipes and causes defects which may necessitate excessive cropping or even scrapping whole pipes. Nevertheless it is apparent my invention may have other applications, such as in coating pipes or other cylindrical articles.

An object of my invention is to provide an improved method and apparatus for spraying liquids on the surface of cylindrical articles as they travel in the direction of their longitudinal a xis and efficiently covering the surface, but eliminating any backward component from the sprays.

A further object is to provide an improved pipe-quenching method and apparatus of the type shown in the Scott patent, but which effectively prevents water from entering the leading ends of pipes.

A more specific object is to provide an improved pipe-quenching method and apparatus in which I aim the nozzles in directions such that their sprays have no backward component to enter the leading ends of pipes, that is, I aim the nozzles in direction that the center lines of their sprays are tangential to an imaginary circle concentric with the ring axis.

In the drawing:

FIGURE 1 is a top plan view, partly in section, of a pipe-quenching apparatus which embodies my invention; and

FIGURE 2 is a vertical section on a larger scale on line II—II of FIGURE 1, omitting background structure.

As typical environmental structure for my invention, FIGURE 1 shows a portion of a conventional heat-treating furnace **10** for steel pipes P, and a quenching apparatus **12**. The latter includes a pair of tubular headers **13**, a series of axially aligned spaced parallel manifold rings **14** communicating with the headers, and nozzles **15** connected to the inner circumferences of the rings. A water line **16** supplies water to the headers via branches **17**. Heated pipes P leave the furnace through an opening **18** and travel lengthwise through the rings with their central longitudinal axes lying as nearly as possible along the central axis of the rings. Preferably the apparatus includes conventional means (not shown) for rotating the pipes on their longitudinal axes to compensate for any inaccuracies in centering. Initially the pipes are at a temperature above their transformation temperature, but the nozzles emit water sprays S, preferably in the shape of solid cones, against the outside surface of the pipes to quench them below this temperature. The nozzles project at acute angles from the planes of their respective rings in the direction of pipe travel to prevent water from backing up, as already explained. The foregoing method and apparatus are similar to the showing of the Scott patent, and hence I have not shown and described them in greater detail.

The Scott patent shows nozzles aimed directly at the central axis of the rings. The center line of each conical spray is radial of and intersects this axis. After the trailing end of each pipe P leaves the furnace, there is an interval before the leading end of the next pipe appears. The sprays of course operate continuously. During intervals while there is no pipe within the sprays, most of the water travels away from the furnace, but the sprays have a small backward component. Some water travels toward the furnace and may enter the leading end of the next pipe where it is detrimental. Once the pipe is fully within the sprays, no more water travels backward.

In accordance with my invention, I aim the nozzles **15** slightly away from central axis of the rings **14**, as FIGURE 2 shows. I aim the nozzles in directions that the center lines of their sprays S are tangential to a small imaginary circle **19** which is concentric with the ring axis and of smaller radius than the pipe P or other article. The center lines of the sprays meet the radii of the rings or the extended radii of the articles at angles of about 3° to 8°, or preferably about 4°. FIGURE 2 shows the pattern which the sprays form. These sprays have no backward components, whereby no liquid enters the leading ends of the pipe. I aim the nozzles so that the sprays oppose rotation of the articles; that is, if the articles rotate clockwise, as FIGURE 2 shows, I aim the nozzles at the top toward the left of the central axis. In this manner the sprays exert a greater scrubbing action on the surface of the article, whereby their efficiency is increased. I also find I can attain the benefits of the invention by constructing the nozzles of only the first two or three rings of the series the way FIGURE 2 shows. The nozzles of subsequent rings can be aimed directly at the axis of the rings without detrimental effect.

The Scott patent shows the nozzles projecting at acute angles of about 30° from the planes of the rings. By aiming the nozzles away from the central axis, I find I can lower this angle to about 15° to 25° or preferably 20° without causing liquid to back up along the article surface. The smaller angle enables the sprays to meet the article more directly and further increases the efficiency of the operation.

While I have shown and described only a single embodiment of my invention, it is apparent that modifications may arise. Therefore, I do not wish to be limited to the disclosure set forth but only by the scope of the appended claims.

I claim:

1. In an operation in which liquid is sprayed on the

outside surface of elongated hollow cylindrical articles as a succession of the articles travels lengthwise in the direction of their central longitudinal axes, but the liquid desirably is excluded from inside the articles, there being an interval after the trailing end of each article passes the sprays before the leading end of the next article arrives, in which operation the sprays emanate from points surrounding the article in a series of spaced parallel planes and are directed at acute angles from their planes toward the direction in which the articles travel, an improved method of preventing liquid from the sprays from entering the leading ends of the articles, said method comprising aiming the sprays in directions such that their center lines are tangential to imaginary circles concentric with the central longitudinal axis of the articles and of smaller radii than the articles, thereby eliminating a backward component from the sprays during said interval.

2. A method as defined in claim 1 in which the center lines of the sprays meet the extended radii of the article at angles of about 3° to 8°.

3. A method as defined in claim 2 in which the angles between the center lines of the sprays and said planes are about 15° to 25°.

4. A method as defined in claim 2 in which the articles rotate on their longitudinal central axes and the sprays oppose such rotation.

5. A method as defined in claim 2 in which the articles are steel pipes leaving a heat-treating furnace at a temperature above their transformation temperature and the liquid is water which quenches the pipes.

6. A method of quenching steel pipe heated above the transformation temperature, in which method liquid is sprayed on the outside surface of pipes as they travel lengthwise in the direction of their central longitudinal axes, there being an interval after the trailing end of each pipe passes before the leading end of the next pipe arrives, and in which method the sprays emanate from points surrounding the pipe in a series of spaced parallel planes and are directed at acute angles of about 15° to 25° from their planes toward the direction of pipe travel, the improvement comprising a method of eliminating a backward component from said sprays during said interval by directing the sprays such that the center lines of the sprays are tangential to imaginary circles concentric with the central longitudinal axis of the pipe and of smaller radii than the pipe, and the center lines of the sprays meet the extended radii of the pipe at angles of about 3° to 8°.

7. A method as defined in claim 6 in which the pipes rotate on their central longitudinal axes and the sprays oppose such rotation.

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