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PIPE COOLING AND HANDLING APPARATUS 2 Sheets-Sheet 1

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Fig. 1.

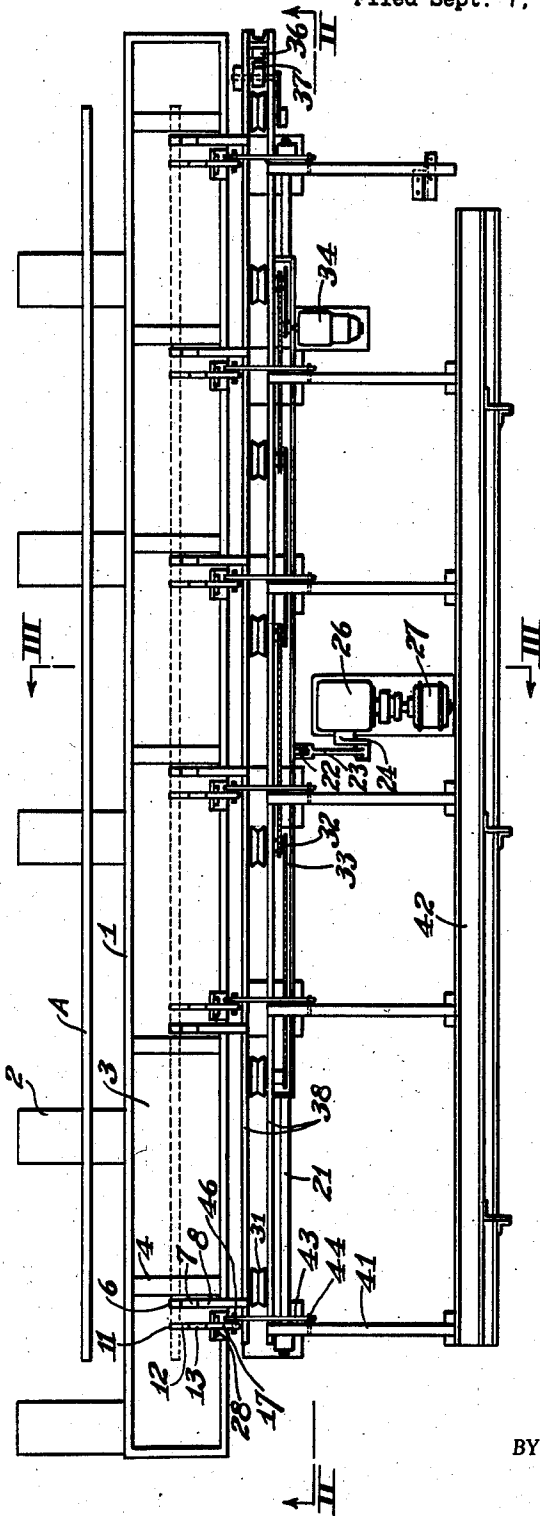
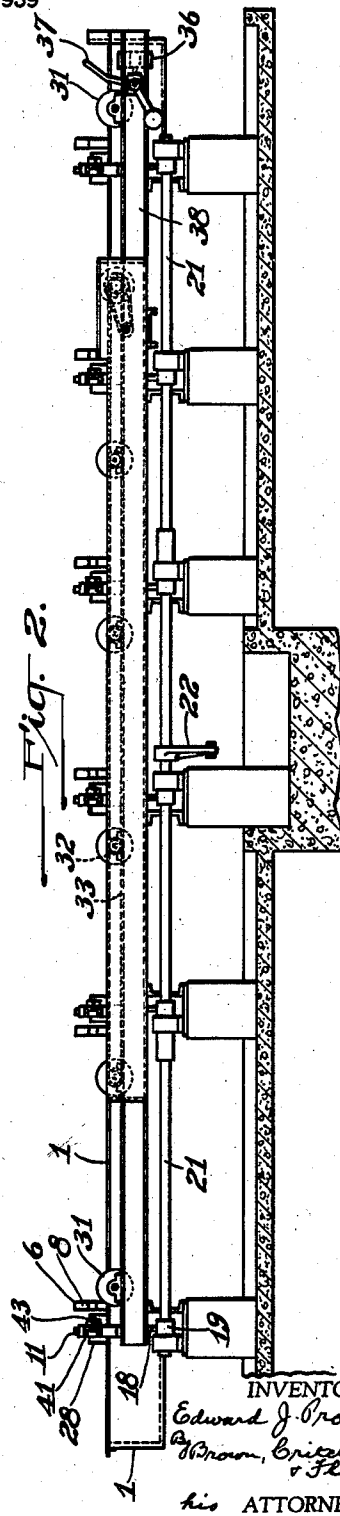


Fig. 2.



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UNITED STATES PATENT OFFICE

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PIPE COOLING AND HANDLING APPARATUS

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8 Claims. (Cl. 266—6)

This invention relates to apparatus for treating and handling metal articles, and more particularly to apparatus for effecting final cooling of hot cylindrical articles such as metal tubes.

In the manufacture of tubing, especially seamless tubes, it is the customary practice to permit hot formed tubes to cool completely upon cooling tables over which they are advanced slowly. When cooled they are straightened and then threaded or otherwise acted upon as desired. It requires considerable floor space for cooling tables large enough to carry the tubes until they are cool, and such tables are expensive. Furthermore, a material amount of time is necessary for cooling tubes in the air in this manner.

It is among the objects of this invention to provide apparatus which rapidly cools hot metal tubes and the like and delivers them to a straightening machine or other apparatus, which occupies relatively small space, and which is of comparatively simple construction. More specific objects are to provide a cooling tank for the tubes, and means for lifting the tubes out of the tank step by step so that they may drain properly before being entirely removed from it.

In accordance with this invention a tank containing a cooling liquid is disposed adjacent a cooling table which is only long enough to permit the tubes to cool down materially below their lower critical temperature, as for example, down to a temperature of about 600° F. The remainder of the cooling is done quickly in a small space by the liquid in the tank. Disposed within the tank is means for lifting cooled tubes above the liquid, together with means for temporarily supporting them in that position so that they may drain. The lifting means then raises the tubes out of the tank, whereupon they roll onto a driven conveyor by which they are moved longitudinally until they strike and open an electric switch that controls the motor which drives the conveyor. Each tube is thus moved to the same given point and is then lifted by movable arms from the conveyor from which it rolls. The movable arms preferably are operated in unison with the lifting means in the tank.

The preferred embodiment of the invention is illustrated in the accompanying drawings in which Fig. 1 is a plan view of my apparatus; Fig. 2 is a side view taken on the line II—II of Fig. 1; and Fig. 3 is an enlarged transverse section taken on the line III—III of Fig. 1.

Referring to Figs. 1 and 3 of the drawings, a long and narrow tank 1 is disposed below the delivery end of a relatively short cooling table 2

for receiving partially cooled tubes A as they roll off the table. The cooling table is only long enough to permit the tubes to cool down to a predetermined temperature at which the tubes will not be adversely affected when subjected to sudden cooling. The tank contains a suitable cooling liquid 3 that quickly completes the cooling of the tubes B immersed in it. The tubes are supported above the bottom of the tank by horizontally spaced transverse rails 4 inclined downwardly away from the tube-receiving side of the tank so that the tubes will roll across the tank through the cooling liquid.

It is a feature of this invention that cooled tubes are removed from the tank step by step so that they can drain adequately before leaving the tank. Accordingly, about half way across the tank the movement of each successive tube is arrested by a plurality of horizontally spaced upright supports 6 mounted in fixed position and each provided above the level of the liquid with a portion inclined downwardly toward the delivery side of the tank to form a step 7 as shown in Fig. 3. The tops of these supports project outwardly and downwardly across the adjacent side of the tank in the form of short skids 8.

For lifting the cooled tubes out of the tank a plurality of horizontally spaced vertically reciprocable lifting members are disposed in the tank adjacent the fixed supports. Each of these lifting members preferably is a plate 11 the inner portion of which is provided with a step 12 disposed below the upper surface of rails 4 when the lifting member is in its lower position. This step crosses the adjacent portion of the support 6; that is, it projects laterally from both sides thereof toward the opposite sides of the tank. The lifting member is also provided with a second step 13 which, in its lower position, extends outwardly from below the outer half of step 7 of the fixed support. Steps 12 and 13 are likewise inclined downwardly toward the delivery side of the tank for a purpose to be described later. Each reciprocable lifting member 11 is guided in its vertical movements by pairs of horizontally spaced vertical guide members 28 attached to the inner surface of the delivery side of the tank.

For raising and lowering the lifting members, they have upper portions 17 projecting outwardly across the top of the tank and pivotally connected to the upper ends of upright rods 18. The lower ends of these rods are pivoted in arms 19 projecting from a line shaft 21 extending parallel to the tank and on which they are

rigidly mounted. This shaft is oscillated by an arm 22 connected by a pitman 23 to a crank 24 driven through a speed-reducing unit 26 by an electric motor 27.

5 When the lifting members are raised by rods 18 their lower steps 12 lift tube B (Fig. 3) until it clears steps 7 of fixed supports 6, whereupon it rolls on the inclined lifting steps 12 outwardly toward the delivery side of the tank to the dotted
10 line position C in which it is above steps 7. When the lifting members are lowered the tube is deposited on steps 7, and as soon as upper steps 13 of the lifting members drop below steps 7 the tube on the latter rolls farther toward the de-
15 livery side of the tank to position D. During the time the tube is on stationary steps 7 above liquid 3, it is draining. The next time the lifting members are raised their upper inclined steps 13 raise tube D to a point above the top of skids 8,
20 whereupon it rolls to a position E over the latter. At the same time the lower steps of the lifting members raise the next succeeding tube B to position C above steps 7. As the lifting members are lowered the upper tube E is deposited on the
25 skids on which it rolls outwardly across the top of the delivery side of the tank, and the lower tube C is deposited on steps 7 as previously described.

As a tube rolls away from the tank on skids 8
30 it rolls onto a plurality of grooved rollers 31 journaled at horizontally spaced intervals in a line along the side of the tank where they are driven by chains 32 and sprockets 33 from a motor 34 near one end of the tank. The purpose of these
35 rollers is to convey each successive tube longitudinally to the same predetermined point so that after it has been moved laterally from this point it will be in correct position for feeding into a straightening machine or other apparatus. To
40 stop the rotation of the grooved rollers when a tube conveyed by them reaches the desired point, a flag switch connected to the driving motor 34 for the rollers is mounted in the path of the longi-
45 tudinally moving tube as shown in Figs. 1 and 2. This switch comprises a switching mechanism 36 operated by a counterweighted flag 37 pivotally mounted between the supports 38 for the
50 roller at the point where it is desired that the front end of the tube be positioned. When a tube strikes this flag it opens the switching mechanism and thereby stops motor 34 and the rollers. The rollers remain idle as long as the tube rests on them waiting for the preceding tube to pass through the straightening machine or other ap-
55 paratus to which it has been fed.

To remove a tube from the rollers so that it may roll down skids 41 to a trough 42 from which it is fed into a straightening machine or the like, a plurality of lifting arms 43 are disposed be-
60 tween the grooved rollers and normally below a tube carried thereby. The outer ends of these arms are pivotally connected to the skids at 44, and their inner ends are adapted to be raised sufficiently to lift the tube off the rollers and
65 cause it to roll down the arms onto the skids. The arms are raised for this purpose preferably by supporting their inner ends on the projecting pins 46 that connect upright rods 18 to the out-
70 wardly projecting portions 17 of lifting members 11. Therefore, whenever motor 27 is started by the operator in order to lift a tube D from the draining steps 7 of supports 6 to the top of the tank, the lifting arms simultaneously rise and remove the preceding tube from the grooved
75 rollers and thus make way for the next tube which

will roll onto the rollers as soon as lifting mem-
bers 11 and arms 43 are lowered. As a tube is
lifted off the rollers the counterweighted flag
closes the switch 36 and thereby starts motor 34
5 that drives the rollers, so that the next tube will
be carried longitudinally to the flag switch.

It will be seen that apparatus constructed in
accordance with this invention cools hot tubes
and the like rapidly and in a much smaller space
than heretofore. Valuable savings in both time
10 and space are thereby effected. By combining
the cooling tank with a comparatively small cool-
ing table the hot articles are cooled sufficiently
in the air before being immersed in the tank to
prevent the sudden cooling by the liquid from
15 affecting them adversely. This apparatus also
takes care of the draining of the cooled article,
and the proper positioning of them for feeding
to the next machine.

According to the provisions of the patent stat-
utes, I have explained the principle and construc-
tion of my invention and have illustrated and
described what I now consider to represent its
best embodiment. However, I desire to have it
25 understood that, within the scope of the appended
claims, the invention may be practiced otherwise
than as specifically illustrated and described.

I claim:

1. Tube cooling apparatus comprising a cooling
30 tank having a tube-receiving side and a delivery
side, a plurality of horizontally spaced upright
members mounted in the tank and each provided
with upright portions connected by a step facing
said receiving side and sloping downwardly
35 toward the delivery side, a plurality of horizon-
tally spaced vertically reciprocable members dis-
posed in the tank and each provided with two
steps normally disposed below said first-men-
tioned step with the lower one projecting beyond
40 it toward said receiving side of the tank and the
other one projecting toward the opposite side of
the tank, said two steps sloping downwardly
toward said delivery side of the tank, and means
for reciprocating said reciprocable members
45 whereby tubes are raised step by step to the top
of the tank.

2. Tube cooling apparatus comprising a cooling
50 tank having a tube-receiving side and a delivery
side, a plurality of horizontally spaced upright
members mounted in the tank and each provided
with upright portions connected by a step facing
said receiving side and sloping downwardly
55 toward the delivery side, a plurality of horizon-
tally spaced vertically reciprocable members dis-
posed in the tank and each provided with two
steps normally disposed below said first-men-
tioned step with the lower one projecting beyond
it toward said receiving side of the tank and the
60 other one projecting toward the opposite side of
the tank, said two steps sloping downwardly
toward said delivery side of the tank, the upper
portions of said reciprocable members extending
outwardly over the top of the tank, means for
65 receiving a tube from the top of the tank and
moving it longitudinally to a predetermined point,
lifting arms normally disposed below said receiv-
ing means and pivotally mounted at their outer
ends, the inner ends of the arms being operatively
70 supported by said upper portions of the recipro-
cable members, and means for raising said re-
ciprocable members, whereby said arms are si-
multaneously raised for lifting a tube off said
receiving means.

3. Apparatus for treating metal articles, com-
75 prising a liquid-containing tank, means for lift-

ing a treated article above the liquid in the tank, means for temporarily supporting the raised article to permit it to drain, said lifting means being formed to subsequently lift said article to the top of the tank, means for receiving said article from the top of the tank and moving it to a predetermined point, lifting arms for lifting said article off said receiving means, and means for simultaneously raising said lifting means and arms.

4. Apparatus for treating metal articles, comprising a liquid-containing tank, means for lifting a treated article above the liquid in the tank, means for temporarily supporting the raised article to permit it to drain, said lifting means being formed to subsequently lift said article to the top of the tank, rollers for receiving said article from the top of the tank, electrically operated means for driving said rollers to move said article longitudinally, an electric switch controlling said electrically operated means and adapted to be opened by said longitudinally moving article to stop the movement of the latter at a predetermined point, lifting arms for lifting said article off the rollers, and means for simultaneously raising said lifting means and arms.

5. In a liquid-containing tank for treating cylindrical metal articles, vertically reciprocable means disposed in the tank and having an article-supporting surface inclined downwardly toward the adjacent side of the tank for lifting a treated article above the liquid therein, means for retaining said article on the higher end of said inclined surface until the article is raised above said liquid, whereupon the article is free to roll toward the lower end of the inclined surface, and means extending laterally toward said side of the tank from the top of the retaining means for receiving said article from the lower end of said inclined surface from which it rolls as the reciprocable means is lowered.

6. In a liquid-containing tank for treating cylindrical metal articles, vertically reciprocable means disposed in the tank and having an article-supporting surface inclined downwardly toward the adjacent side of the tank for lifting a treated article above the liquid therein, means for retaining said article on said inclined surface until the article is raised above said liquid,

means extending laterally toward said side of the tank from the top of the retaining means for receiving said article from said raised inclined surface from which the article rolls onto said laterally extending means to permit it to drain, and vertically reciprocable means having an article supporting surface inclined downwardly toward said side of the tank for lifting the drained article a predetermined distance above said receiving means.

7. In a liquid-containing tank for treating metal articles, an upright member mounted in the tank and provided with upper and lower upright portions connected by a step sloping downwardly from the top of the lower upright portion, a vertically reciprocable member disposed in the tank at one side of said upright member and provided with two steps normally disposed below and sloping in the same direction as said first-mentioned step, said reciprocable member being offset relative to the upright member whereby each of said reciprocable steps extends laterally in opposite directions from the adjacent upright portion of the upright member when the reciprocable member is in its lower position, and means for reciprocating the reciprocable member to raise articles step by step to the top of the tank.

8. In a liquid-containing tank for treating metal articles, an upright member mounted in the tank and provided with upper and lower upright portions connected by a step sloping downwardly from the top of the lower upright portion, a vertically reciprocable member disposed in the tank at one side of said upright member and provided with two steps normally disposed below and sloping in the same direction as said first-mentioned step, said reciprocable member being offset relative to the upright member whereby each of said reciprocable steps extends laterally in opposite directions from the adjacent upright portion of the upright member when the reciprocable member is in its lower position, and the upper end of said reciprocable member projecting laterally over the top of the tank, and means connected to the outer end of said laterally projecting portion for raising and lowering the reciprocable member.

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