Dec. 15, 1931. J. H. FELLOWS 1,837,159

METHOD OF AND APPARATUS FOR PROCESSING STRIP METAL

Filed June 28, 1929

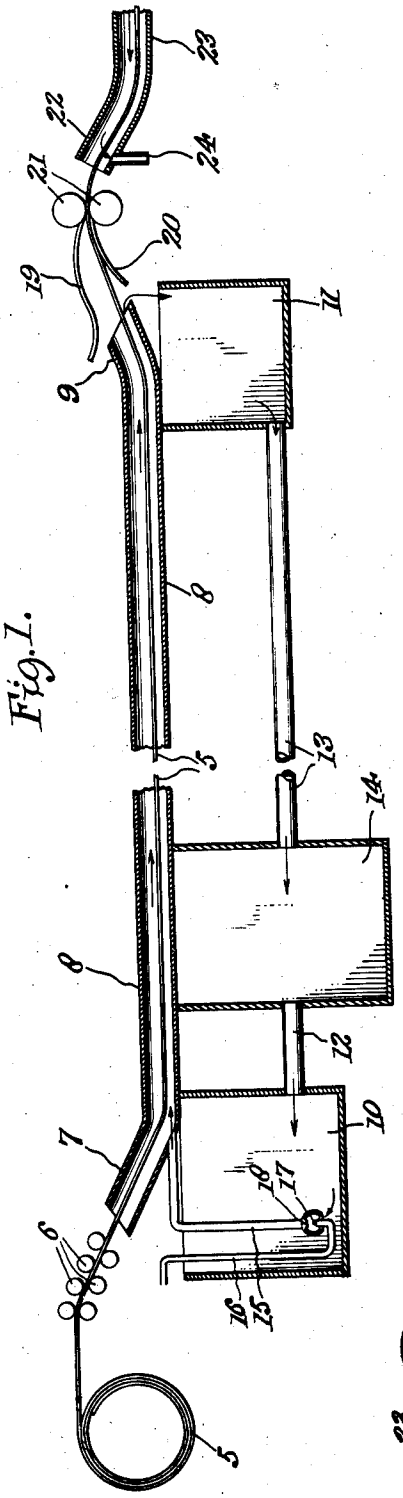


Fig. 1.

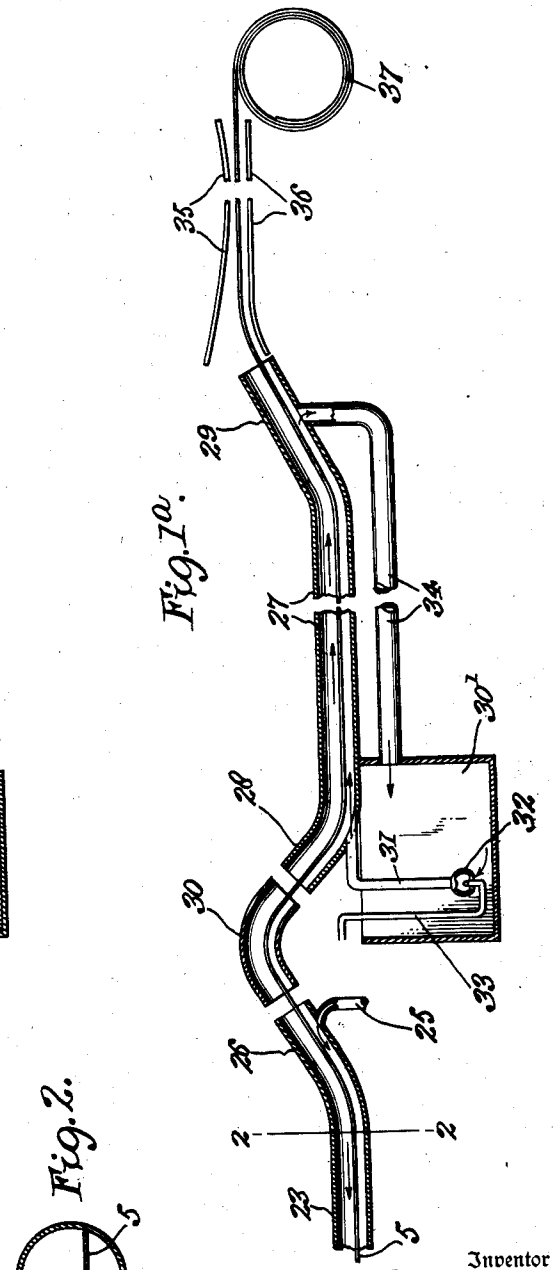


Fig. 1a.

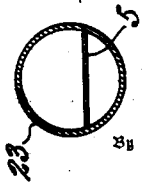


Fig. 2.

Inventor

John H. Fellows

By H. Clay Lindsey.

Attorney

Patented Dec. 15, 1931

1,837,159

UNITED STATES PATENT OFFICE

JOHN H. FELLOWS, OF NEW BRITAIN, CONNECTICUT, ASSIGNOR TO THE STANLEY WORKS, OF NEW BRITAIN, CONNECTICUT, A CORPORATION OF CONNECTICUT

METHOD OF AND APPARATUS FOR PROCESSING STRIP METAL

Application filed June 28, 1929. Serial No. 374,488.

The present invention relates to improvements in method of and apparatus for processing strip metal, and has for an object to avoid certain inconveniences and losses encountered in connection with the present method and machines.

As instances of uses to which the improvements of the present invention may be applied, reference may be had, for illustrative purposes, to the pickling of long strips of hot and cold rolled steel or strips similar thereto, and to the cleaning, washing, plating, etc., of long strips of relatively stiff material. In the present illustrative disclosure, the improvements of the present invention will be described in connection with the pickling of rolled strips of steel to which use the invention is peculiarly adapted, but it is to be understood that my improved method and apparatus are not limited to this specific application.

The practice heretofore, and now generally followed, in the pickling of long strips of hot and cold rolled steel requires that the strips be pulled through open troughs or tubs of approximately one hundred (100) feet frequently lined with lead and consequently expensive in original installation and necessity for frequent renewal. An operator is stationed at the front end of the tub, which contains the pickling solution, and is required to unite the rear end of one strip with the forward end of the next successive strip in order that continuity may prevail throughout the strips to the end that they may be drawn through the pickling solution contained in the long tub. As the joint made between the strips would injure the rolls when the strips are subsequently subjected to further rolling operations, and for other reasons, the trips must be disconnected and, for this purpose, another operator is required at the other end of the tank. Moreover, incident to the use of these open long tanks, considerable evaporation and other losses are entailed and difficulties are encountered in the heating and circulation of the solution.

The main object of the present invention is to provide an improved arrangement wherein the necessity of fastening the strips together to allow them to be pulled through the pickling and processing solutions and the subsequent disjoining of the strips are eliminated.

A further aim of the invention is to obviate evaporation and other losses, conserve heat and solution, and to accelerate the process.

In accordance with the present invention, the apparatus is provided with a chamber through which the strips are pushed by means located at the forward end of the chamber so that the individual strips may be separately passed through the processing solution without the necessity of first joining the strips together and then disconnecting the strips. By preference, the chamber through which the strips are pushed is in the form of a long bore open only at its ends so that the temperature of the solution may be more readily controlled and heat and evaporation losses and other difficulties avoided. The chamber may be of any suitable cross section, but it is preferably of such shape that the strips, as they pass therethrough, are supported at their edges only. In the present illustrative disclosure, the chambers, through which the strips are pushed, are in the form of tubes circular in cross section, but obviously the chambers may be of any suitable cross sectional shape. A square tube or an oval tube may be employed, it being desirable, however, that the bottom of the chamber be of trough shape so that the strips are supported at their edges only, thus reducing friction to a minimum and permitting all portions of the strips to be acted upon by the processing solutions.

Other objects will be in part obvious and in part pointed out more in detail hereinafter.

The invention accordingly consists in the features of construction, combination of elements and arrangement of parts which will be exemplified in the construction hereinafter set forth and the scope of the application of which will be indicated in the appended claims.

In the drawings, wherein like symbols

refer to like or corresponding parts throughout the several views:

Figure 1 is a longitudinal section taken through a portion of an improved machine constructed in accordance with the present invention;

Fig. 1—*a* is a similar view, being a continuation of the machine; and

Fig. 2 is a cross section taken on line 2—2 of Fig. 1—*a*.

Referring more particularly to the drawings, 5 designates an initial coil of the strip steel, the strip being led therefrom and passed through breaker, flattener and feed rolls 6 prior to entering the pickling chamber. In the present instance, this chamber constitutes the bore of a tube 8 having an upturned mouth end 7. The discharge end 9 of the pickling tube is also preferably given an upward bend. The tube 8 is of any desired length, and its end portions are disposed above tubs 10 and 11 which connect, by means of pipes 12 and 13, with a settling tank or tub 14, the pipes preferably connecting with the settling tub 14 at points intermediate the height thereof, while the pipe 13 may communicate with a low portion of the tub 11.

The pipe 12 preferably connects with the initial heating tub 10 at a point above the bottom thereof. The pickling solution is contained up to a desired height in the tubs 10, 11 and 14, and in the pipes 12 and 13, and is intended to be circulated in the system, including the pickling tube 8, in the direction indicated by the arrows. The pickling solution is initially furnished to the forward end portion of the pickling tube 8 by a pipe 15 which extends beneath the surface of the liquid in the tub 10 and preferably to a point near the bottom thereof.

The pickling or other processing solution may be circulated, heated, etc., in any suitable manner and by using any desired or improved means. In the present instance, there is shown, for illustrative purposes, a fluid pressure pipe 16 extending into the tub 10. This pipe is provided with an injector nozzle 17 projecting into the enlarged end portion 18 of the pipe 15, which enlarged portion is open about the injector nozzle 17 for the purpose of admitting the pickling solution. The pipe 16 is preferably connected with a source of steam supply or some other heated medium under pressure for the purpose not only of circulating the pickling solution, but also of raising the same to the requisite temperature. Obviously, air may be used in connection with the injector; or in place of the injector, a circulating pump may be employed and independent means may be used for heating the solution.

Guides 19 and 20 are provided for receiving the metal strip as it emerges from the discharge end 9 of the pickling tube, these guides being open and appropriately curved at the receiving ends thereof and converging toward the feed rolls 21 which then deliver the strip into the upturned receiving mouth 22 of a tube 23, in which the next step of the process is carried out, for example, the step of washing the pickled strip with cold water. A part of this tube is shown in Fig. 1, and the remainder in Fig. 1—*a*. As many sets of the rolls 21 may be provided as deemed advisable.

Cold water may be circulated through this tube 23 reversely to the direction of progress of the steel strip, the water being discharged through an outlet nipple 24 at the receiving end 22 of the tube. The water is introduced through an inlet nipple or connection 25 illustrated in Fig. 1—*a*. This connection 25 is made to the upwardly extending discharge end 26 of the cold washing tube 23.

After the cold wash, the strip may be passed on to another tube 27 in which the next step is carried out, for example, subjecting the strip to a hot wash. The upturned receiving end of the tube 27 is indicated at 28 and the upturned discharge end at 29. A guide 30 is preferably disposed between the tubes 23 and 27, and this guide will desirably take the form of a reverse curve with respect to the ends 26 and 28, whereby to divert the strip after issuing from the upwardly directed outlet end 26 of the cold wash tube. A tub 30′ is disposed below the forward portion of the hot wash tube 27 and may contain a hot wash solution to further wash the strip and to insure quick drying thereof and thus avoid rusting. The solution in the tank 30′ is introduced into the forward end of tube 27 through an induction pipe 21 having a pump or injector 32 coupled with the steam or other fluid pressure pipe 33. A return pipe 34 connects with the outlet end 29 of the tube 27 and an upper portion of the tub 30′. Guides 35 and 36 are provided in conjunction with the outlet end 29 of the tube 27 for receiving the strip and these guides constitute a drying section. There may be several hot washing units through which the strip may be successively forced or pushed.

The pickled and dried strip may be wound upon the reel or coil 37, or it may be fed at this point to a machine for cutting it to length. The tubes 8, 23 and 27 may be of any desired length, and guides may be placed wherever necessary and be in any form found suitable.

The improved device may be mounted in conjunction with associated instrumentalities and other processing units, such as units for liming or oiling. A complete machine may consist of one or more sets of pickling, washing and processing tubes, placed parallel.

The tubes are of small diameter, they being, by preference, of a diameter slightly greater than the width of the steel strip 5, as indicated in Fig. 2, so that the tubes support the strips in such manner (namely, by their

edges) that the processing fluids or solutions may uniformly come into contact with and circulate over all portions of the strip. Also, friction between the strip and the tube or tubes is reduced to a minimum so as to enable the strip to be pushed through the tubes by means of the feed rollers or equivalent means and thus avoid any necessity for linking the strips together. This linking together of the strips is a tedious, time consuming and expensive operation usually involving the welding, riveting or linking of the strips end to end.

The rolls 6 serve to break up the scale, flatten the strip, and force it through the tube 8. As the strip is pushed through the pickling tube 8, it will be subjected to the pickling solution. This pickling solution will be forced through the tube 8, thus immersing the strip and moving along all surfaces thereof and removing the scale. The narrow pickling tube 8 provides not only for the circulating of the pickle solution, but also for the agitation thereof which makes for a faster pickling operation. It is to be noted that the hot solution enters at the forward part of the tube 8, providing the higher temperature to the bath surrounding the cold entering steel and thus making for a faster pickle. Of course, the clean solution provided by the settling tank 14 also contributes toward the faster operation.

The solution will pass in a closed circuit through the pickling tube, the tubs 10 and 11 and the settling tank 14 and thus constantly fresh and pure solution will be furnished to the pickling tube 8. The scale and other impurities are separated out in the tank 14. As the system is closed except for the relatively small openings at the ends of the tube 8, evaporation losses are materially cut down over an open tank, thus effecting savings in acid and steam. If desired, the equipment may be insulated, cutting down radiation losses and consumption of steam. By the present device, the ventilation problem is practically solved as the small amount of vapor localized at the two points, namely the ends of the tube 8, is easily disposed of by ventilating fans or other ventilating apparatus.

After pickling the strip is then passed to the cold wash tube 23 through which it is pushed or forced by the feed rolls 21. In this tube 23, the strip is partially washed of the pickling solution with a fluid or solution, such as cold water, the water preferably traveling in the direction opposite to that of the strip.

Thence, the strip is pushed through the hot wash tube 27 in which it is subjected to the action of a hot solution in motion, whereby the steel strip is further washed and prepared for further operations, such as drying to avoid oxidation. Thereafter, the strip may be limed, oiled and dried and either wound into the coil 37 or fed to a cutting or other machine.

In short, the device provides for a faster pickle with a reduction in labor, acid and steam cost, and improved working conditions.

It is obvious that various changes and modifications may be made in the details of construction and design of the above specifically described embodiment of this invention without departing from the spirit thereof, such changes and modifications being restricted only by the scope of the following claims.

I claim as my invention:

1. In an apparatus of the character described, a chamber through which strips of metal are adapted to be pushed, the cross sectional shape of said chamber being so related to the cross sectional shape of the strips that the latter shall be supported within said chamber by the contact of their edges with the inner wall of said chamber, and means at the entrance end of said chamber for pushing the strips through said chamber.

2. In an apparatus of the character described, a tube for receiving the strips of metal to be processed and open only at its ends, tubs beneath and in communication with the ends of said tube, a settling tank in communication with said tube, and means to heat a pickling solution and promote the forced circulation of the solution through the tube, tubs and settling tank.

3. The herein described method of processing relatively stiff, long strips of steel and the like, which consists in pushing the strip through a chamber with the strip supported at its edges only on the walls of the chamber, and passing a processing fluid through the chamber.

4. In an apparatus of the character described, a horizontal tube open only at its end portions for accommodating the strips of metal to be processed, said tube being of such size as to prevent kinking, curling and entangling of the strip of metal within the tube as it is pushed therethrough, means for supplying a processing liquid solution to the tube adjacent one end and passing it through the tube to adjacent the other end, and means at the forward end of the tube for pushing the strips therethrough, said tube having means at its opposite ends for maintaining the level of the processing solution above the strip as it passes through the body portion of the tube.

5. In an apparatus of the character described, a horizontally disposed tube open only at its end portions for accommodating strips of metal to be processed, said end portions being raised above the body portion of the tube to maintain the level of the processing solution within the tube, means for passing a processing solution through the tube,

and means at the forward end of the tube for pushing the strips therethrough.

6. In an apparatus of the character described, a horizontally disposed tube open only at its end portions for accommodating long strips of metal to be processed, said tube being of such size as to prevent kinking, curling and entangling of the strip of metal within the tube as it is pushed therethrough and said tube constituting both a guide for the strips of metal to be processed and a chamber for the bath of processing solution, means for supplying a processing liquid solution to the tube adjacent one end and passing it through the tube to adjacent the other end, and means at the forward end of the tube for pushing the strips therethrough.

7. In an apparatus of the character described, a horizontally disposed tube through which the strips of metal are adapted to be pushed, the cross sectional shape of the bore of the tube being so related to the cross sectional shape of the strips that the latter shall be supported within said bore by the contact of their edges with the inner wall of the tube, means at the entrance end of said chamber for pushing the strips therethrough, and means for passing a processing liquid solution through the tube, said tube having means at its opposite ends for maintaining the level of the processing solution above the strip as it passes through the body portion of the tube.

JOHN H. FELLOWS.