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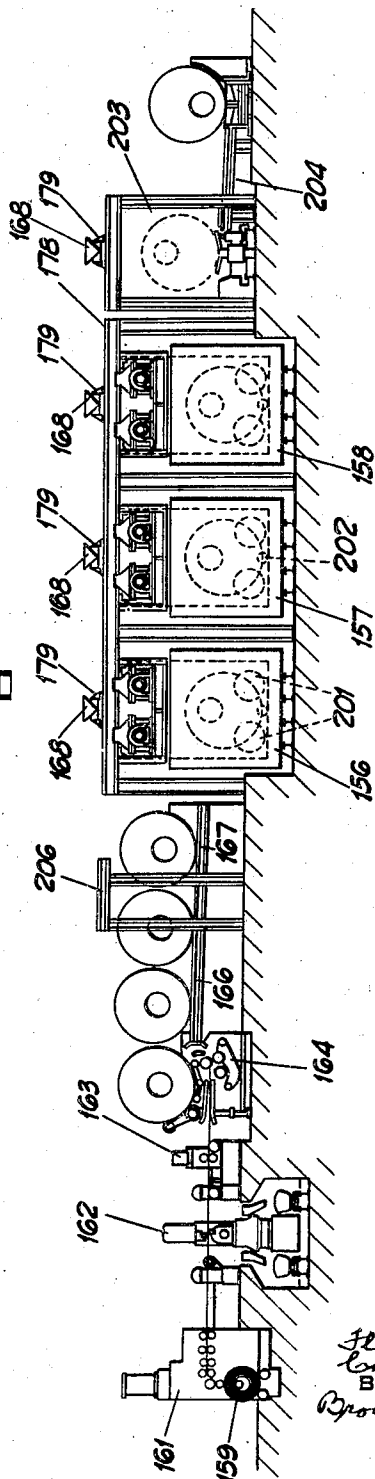
2,181,503

METAL TREATING APPARATUS

Original Filed May 29, 1936

2 Sheets-Sheet 1

Fig. 1



WITNESSES

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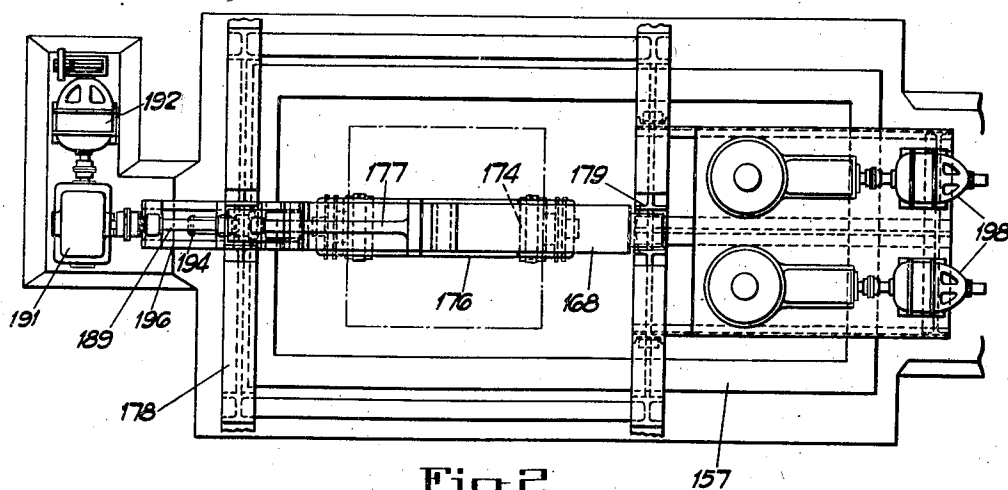
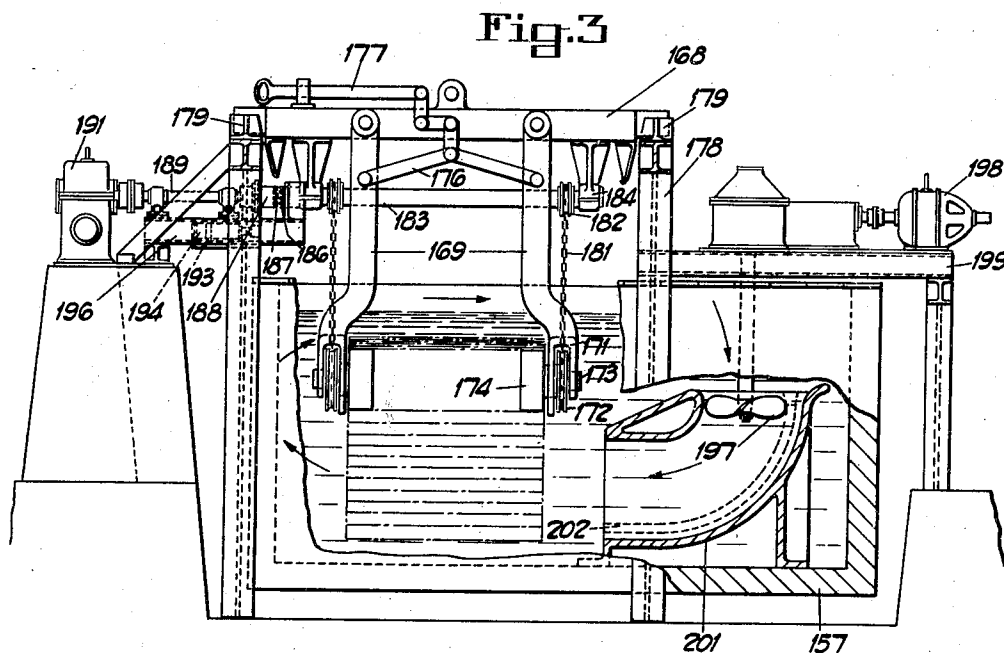
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2 Sheets-Sheet 2



WITNESSES

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## UNITED STATES PATENT OFFICE

2,181,503

## METAL TREATING APPARATUS

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Original application May 29, 1936, Serial No. 82,542. Divided and this application November 25, 1938, Serial No. 242,346

7 Claims. (Cl. 266—6)

This invention relates to apparatus for treating metal with a fluid, and more particularly to the pickling of coils of metal strip. This application is a division of our copending application S. N. 82,542, filed May 29, 1936.

It is among the objects of this invention to provide apparatus for treating metal in a bath by which the metal is thoroughly treated in a minimum length of time. Other objects are to provide apparatus for rapidly and readily immersing coils of metal strip in a series of tanks and rotating them therein while the fluid in the tank is circulated between the convolutions of coils.

According to this invention there is provided a plurality of metal-treating tanks for receiving treating-baths and articles to be treated. Each tank is provided with means for circulating the fluid bath therein, and is adapted to support a portable coil-carrying and rotating device which is also used to pick up and release the coils. When this device is mounted on a tank it is connected with rotating means mounted outside the tank by which the coil supported by the device in the bath is rotated. The metal strip is formed into a loose coil so that its convolutions spread apart, and the circulating bath in the tank is directed between the spaced convolutions as the coil is rotated so that the bath quickly and efficiently reaches the entire area of the strip.

Apparatus for practicing this invention is illustrated in the accompanying drawings in which Fig. 1 is a side elevation of our metal treating apparatus; Fig. 2 is an enlarged plan view of one of the tanks; and Fig. 3 is a side view of one of the tanks partly broken away to show it in vertical section.

Referring to Fig. 1 of the drawings, for pickling coils 159 of metal strip indicated more or less diagrammatically in the drawings, three treating tanks are sufficient, tank 156 containing a pickling bath, tank 157 cold rinse water, and tank 158 hot rinse water. These tanks are preferably disposed side by side in a straight line with their loading and unloading stations at opposite ends of the apparatus. For a reason presently to appear, tightly wound coils of metal strip are first unwound by unwinding apparatus 161 and then the strip passes through a combined end shear and welder 162 and on through pinch rolls 163 to a loose coil former 164 of conventional form, these three devices being shown somewhat diagrammatically. From this latter machine the loose coils are rolled onto inclined skids 166 down which they roll to a loading station 167 where each successive coil is picked up by a carriage

suspended from any suitable overhead traveling member, such as a crane or a monorail conveyor, to convey them to the opposite end of the apparatus.

As shown in Fig. 3, the carriage preferably comprises a horizontal beam 168 to which are pivoted the upper ends of a pair of depending arms 169 the lower ends of which are bifurcated to form recesses 171 in which sprockets 172 are rigidly mounted on shafts 173 journaled in the arms. The inner end of each of these shafts supports a stub mandrel 174 that projects into the coil to support it. To grip or release a coil the stub mandrels are moved toward and away from each other in any suitable manner, such as by a toggle mechanism 176 connected to the arms and beam 168 and operated by a rod 177 slidably mounted on top of the beam.

To rigidly support beam 168 above each tank so that the coil carried thereby will be immersed in the bath in the tank, a framework 178 is constructed above the tank, and a pair of socket members 179 is secured to the top of this framework above each tank for snugly receiving the ends of the beam. The coil is rotated in the tanks by the stub mandrels which are turned by sprockets 172 driven by endless chains 181 from sprockets 182 keyed on a shaft 183 journaled in bearings 184 projecting downwardly from the supporting beam. One end of this shaft is provided with teeth 186 adapted to be engaged by complementary teeth 187 on the end of a clutch sleeve 188 which is splined on the inner end of a drive shaft 189 driven through a speed reduction unit 191 by a motor 192 mounted outside of the tank. When the coil carriage is lowered into a tank with teeth 186 in line with teeth 187, the clutch sleeve is moved forward to cause the two sets of teeth to register, and the motor is started, whereupon shaft 183, the stub mandrels and the coil are rotated.

The clutch sleeve can be moved into and out of operative position by any suitable means, a convenient way of doing this being by means of a piston 193 connected to the bottom of the clutch and actuated by fluid pressure in a cylinder 194 mounted in a support 196 below drive shaft 189. Fluid pressure can be admitted to the cylinder in any suitable way, automatically or otherwise. If desired, the weight of the carriage as it is lowered into a tank can be used to set piston 193 in motion, or the same thing can be accomplished by a photoelectric cell on which shines a beam of light that is broken by the lowered carriage.

Each of the treating tanks is provided with

means for positively circulating the bath between the spaced convolutions of a coil rotating therein so as to rapidly bring the bath into contact with the entire surface area of the strip forming the coils. The circulating means shown is especially suitable for use in large tanks in which large coils are treated. It includes two propellers 197 extending downwardly into the bath at one end of the tank and being driven from above by a pair of motors 198 mounted on suitable supports 199. These propellers are disposed side by side and the circulating bath is directed into the coil by a pair of upwardly curved tubular members 201 likewise disposed side by side with their outlets adjacent one end of the coil and their inlets receiving the propellers. A steam jet 202 for heating the bath is preferably disposed between the tubular members. With the use of two propellers and tubes the entire bath throughout the width of a wide tank is set in motion and circulated through a coil in its path.

After a coil has been treated in each of the tanks it is set down by the carrier in a drying chamber 203 of any suitable construction, and the stub mandrels are spread apart to release the coil. When the coil is dry it is rolled out onto an inclined table 204 from which it is delivered to an oiler or to a storage point.

Upon being released from the coil, the carrier is transported from the drying chamber back to a point adjacent the loading station where it may be temporarily deposited on a frame 206 while the immediately preceding carrier is picking up a coil at the loading station. It will be understood, of course, that several carriers may be in use at once so that coils will be disposed in all of the tanks and the drier at the same time. One advantage of this apparatus is that it can be disposed in a straight line in a space too narrow to receive the apparatus disclosed and claimed in my copending application.

According to the provisions of the patent statutes, we have explained the principle and operation of our invention and have illustrated and described what we now consider to represent its best embodiment. However, we desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

We claim:

1. The combination with a tank for receiving a metal-treating bath, driving means mounted beside said tank, of stub mandrels adapted to extend into and support a loose coil of metal in said tank with portions of its convolutions spaced apart, rotatable means connected to said mandrels, and means for detachably connecting said driving means to said rotatable means to impart rotation to the mandrels.

2. Metal-treating apparatus comprising a tank for receiving a metal-treating bath, mandrel means disposed therein and spaced from the bottom of the tank, rotatable means connected to said mandrel means, means for conveying all of said means to and from said tank, rotating means mounted beside said tank for rotating said rotatable means when the latter is brought into operative engagement therewith, and means for positively circulating said bath through said coil as it is rotated in said tank

3. Metal-treating apparatus comprising a tank for receiving a metal-treating bath, a horizontal beam detachably supported above said tank, a

pair of horizontally spaced arms pivoted at their upper ends to said beam, an inwardly projecting stub mandrel journaled in the lower end of each arm, said mandrels being adapted to project into and support a coil of metal strip, a horizontal shaft rotatably supported by said beam, driving means for said shaft mounted beside said tank, and means operatively connecting said shaft to said mandrels for rotating said coil.

4. Metal-treating apparatus comprising a tank for receiving a metal-treating bath, a horizontal beam detachably supported above said tank, a pair of horizontally spaced arms pivoted at their upper ends to said beam, an inwardly projecting stub mandrel journaled in the lower end of each arm, said mandrels being adapted to project into and support a coil of metal strip, a horizontal shaft rotatably supported by said beam, driving means for said shaft mounted beside said tank, means operatively connecting said shaft to said mandrels for rotating said coil, and means for spreading the lower ends of said arms to disengage the mandrels from the coil.

5. Metal-treating apparatus comprising a tank for receiving a metal-treating bath, a horizontal beam detachably supported above said tank, a pair of horizontally spaced arms pivoted at their upper ends to said beam, an inwardly projecting stub mandrel journaled in the lower end of each arm, said mandrels being adapted to project into and support a coil of metal strip, a horizontal shaft rotatably supported by said beam, driving means for said shaft mounted beside said tank, means operatively connecting said shaft to said mandrels for rotating said coil, a propeller blade disposed in said bath, means for rotating said blade to circulate the bath in the tank, and a conduit extending from said propeller to a point adjacent one end of said coil for directing said circulating bath through the coil.

6. Metal-treating apparatus comprising a series of tanks for receiving metal-treating baths, means for delivering coils of loosely wound metal strip to one end of said series of tanks, a supporting member adapted to be carried by an overhead carrier, means above each tank for receiving said supporting member, means carried by said member for projecting into the ends of a coil and rotatably supporting it, driving means mounted beside each tank, and means carried by said supporting member for operatively connecting said coil supporting means with said driving means when said supporting member is disposed on said receiving means.

7. Metal-treating apparatus comprising a series of tanks for receiving metal-treating baths, means for delivering coils of loosely wound metal strip to one end of said series of tanks, a supporting member adapted to be carried by an overhead carrier, means above each tank for receiving said supporting member, a pair of spaced depending arms hinged at their upper ends to said member, a rotatable stub mandrel journaled in the lower end of each arm, means carried by said supporting member for rotating said mandrels, and driving means mounted beside each tank and adapted to be operatively connected to said mandrel-rotating means when said supporting member is placed on said receiving means for rotating said mandrel-rotating means.

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