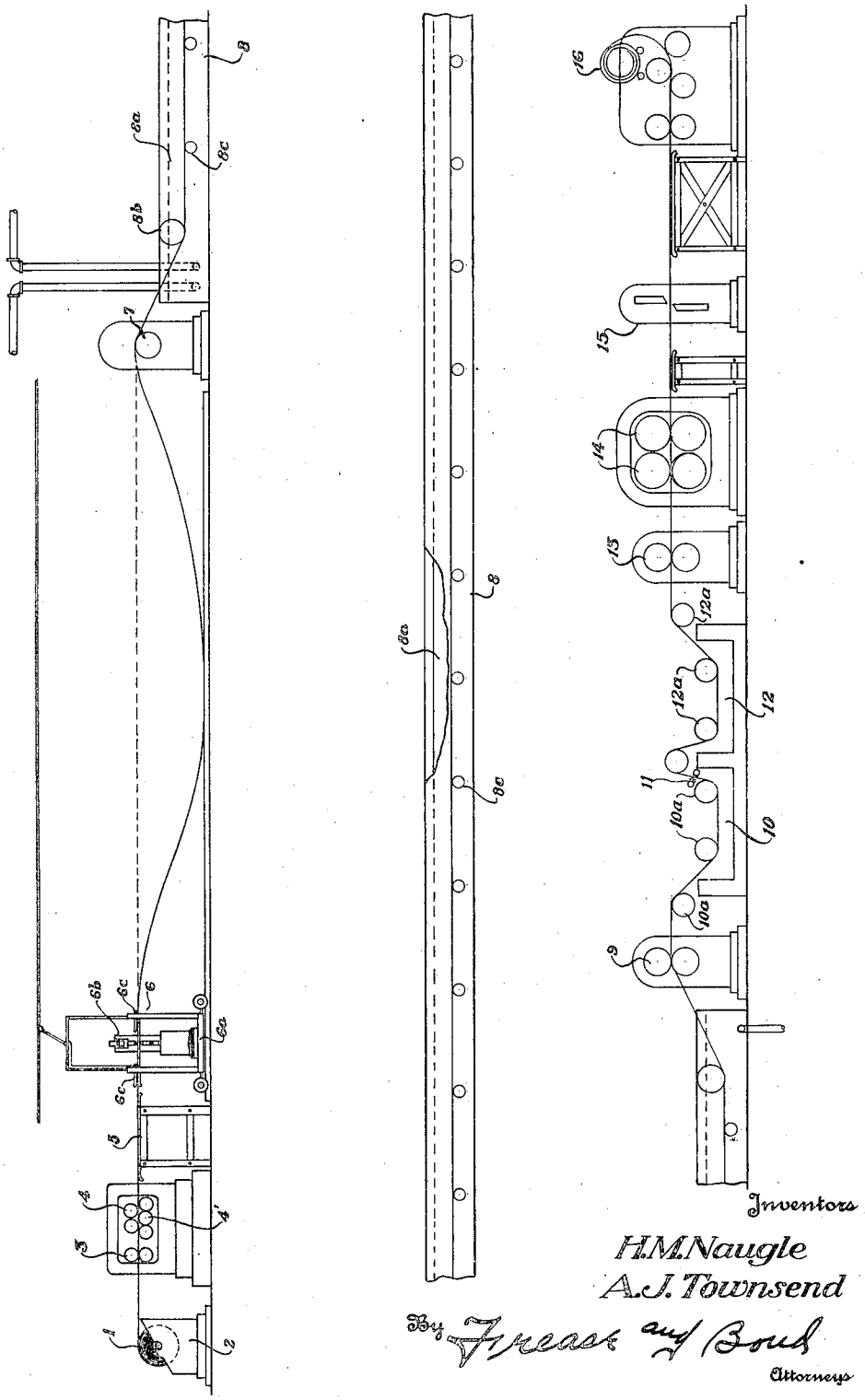
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CONTINUOUS PICKLING PROCESS

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CONTINUOUS-PICKLING PROCESS

Application filed November 12, 1926. Serial No. 147,878.

The invention relates to a continuous process for pickling steel strip sheets and the like from the coils into which the strip sheets are wound at the end of hot rolling processes; and the object of the improvement is to avoid imperfections and overcome difficulties which attend the ordinary methods of still or agitated pickling and the continuous operations by which steel wire and bands and the narrower steel strips have heretofore been pickled.

The well known difficulties and imperfections which attend the pickling of a wound coil, include the varying action of the pickling solution upon laterally different portions of the coiled strip, the production of unpickled streaks or spots abutted by the separators used for spacing the coils of the strip, and the impossibility of inspecting the various portions of the strip during the pickling process and until after the coil has been unwound.

These imperfections and difficulties are greatly increased when dealing with the wider steel strips now known as "stripsheets" which have been produced by methods heretofore devised by us; and the present invention is more particularly concerned with the pickling of strip sheets having a width of ten inches and upward.

In dealing with coils of narrower strips, the layers can be separated by the insertion of spacers which hold the adjacent layers apart and permit the pickling solution to come into contact with all parts of the surfaces of the strips; but in dealing with the heavier coils of wider strips, a complete separation of the layers cannot be caused by the insertion of spacers, which must necessarily be inserted from the top and permit the lower portions and the intervening portions of the layers to come into contact with each other.

The methods which have been used for continuously pickling narrower steel bands or strips or less than ten inches in width, are not practical or satisfactory for the continuous pickling of wider strip sheets, for the reasons among others, that the wider strips are so cumbersome that they cannot be connected together by ordinary means; and the curvature caused by the hot roll coiling prevents the ends of successive strips from being connected while in motion without a previous straightening of the strips.

Moreover, the travel of a strip through the pickling vat at irregular and uneven rates of speed, prevents a uniform action of the pickling solution upon the same, and the pickling solution has not been entirely removed from the surface of the strips to properly clean them from the requirements of certain uses, as for instance, a cold roll reducing operation.

And finally, the several necessary operations cannot be successfully carried out in a satisfactory manner, unless the stripsheets are drawn steadily at a uniform speed during and throughout each and every step of the process.

The objects and purposes of the present improvement may be and preferably are attained by drawing the wide stripsheet from a hot rolled coil by a roller leveller, which may include a pair of guide rolls and series of rolls staggered and positioned to reversely bend the strip, which not only straightens the curvature thereof, but breaks the scale on both sides, which facilitates the removal of the scale by the pickling process:

Then connecting the ends of successive strips together, as by a traveling welder which may secure together abutted or overlapped ends during and without stopping or affecting the continuous endwise movement or speed of either one of the connected strips; which speed is uniformly maintained by a pair of pinch rolls located at the delivery end of the apparatus:

Then passing the end connected strips through a pickling solution in an elongated pickling vat, at the rear end of which a considerable portion of the adhering acid solution is eliminated by a pair of wringer rolls, after which the strip is passed through a water bath and between sprays of water for completely- and cleanly removing the remainder of the adhering acid solution from both sides of the strip sheet:

Then passing the strip through an alkali bath for neutralizing any trace of acid solu-

tion which may remain on or in the surface thereof, and producing a protective film to prevent subsequent oxidation thereof; whence the strip is positively drawn by a pair of pinch rolls adjustable to operate at a constant and uniform speed the same as the roller leveller at the receiving end of the apparatus, for maintaining a continuous travel at a uniform rate of speed throughout:

Then cutting out the joint between the ends of strips by suitable shears, whenever the character of the joint requires an elimination of the same; and finally, passing the strip to a coiler of the differential roll type operating with a regulated speed, which may be accelerated after the cut is made so as to readily remove one severed strip when coiled without impeding the progress of the next succeeding strip.

The successive steps of the improved process thus outlined in a general way, may be carried out by the apparatus illustrated in the accompanying drawings made part hereof, in which the figure illustrating the same is broken into three successive sections located one above the other.

As shown in the drawings, the hot roll coil 1 mounted in a box 2, is located in front of a roller leveller including a pair of guide rolls 3, which lead the strip to series of positively driven straightening rolls 4 and 4′ located respectively above and below the strip and so staggered and positioned in well known manner, for bending the strip successively in reverse directions and not only straightening the curvature of the same, but breaking the scale on both sides thereof.

The straightened and scale broken strip is then carried over a table 5 to a traveling welder 6, which may be of the type set forth in our application for welding machines, filed September 18, 1926, Serial No. 136,360, and matured in Letters Patent No. 1,694,555 granted December 11, 1928, and may include a movable carriage 6^a with welding means 6^b transversely movable thereon and gripping means 6^c on each end operable independent of the welding means; which may be referred to as a cross welding of the ends of successive strips.

The continuous strip is directed by guide roll 7 from the traveling welder into the forward end of an elongated pickling vat 8 containing a pickling solution 8^a, with transverse guide rolls 8^b in each end and a series of transverse supporting rolls or bars 8^c, for submerging and supporting the strip in the pickling solution while it is moving endwise therethrough, preferably in a single continuous direction.

A pair of wringer rolls 9, which may be made of rubber, is located at the rear or exit end of the pickling tank, and operate by pressure on both sides of the strip to eliminate the greater portion of the pickling solution adhering thereto, whence the strip is passed through a water bath 10, guided by rolls 10^a below and above the strip, and upon emerging therefrom, the strip may be impinged on both sides by hot water sprays 11 for removing the remainder of the pickling solution adhering thereto.

The strip may then be passed through an alkali bath 12, guided by rolls 12^a, for neutralizing any trace of the pickling solution which may remain thereon, and forming a protecting film to prevent further oxidation of the strip; whence the strip is drawn through another pair of wringer rolls 13, which may be made of rubber, to remove the surplus alkali solution and dry the surfaces of the strip sheet.

One or more pairs of pinch rolls 14 are located at the rear of the second pair of wringer rolls and are positively driven to draw the continuous strip through the preceding apparatus at the same constant rate of speed which is continuously imparted to the strip by the straightening rolls 4 and 4′.

On the rear side of the final pinch rolls may be located a pair of shears 15, for severing each side of a joint when it is necessary to cut out the same, and the pickled, cleaned and coated strip is then wound into a coil of suitable size, by a differential roll coiler 16; upon and from which the coil can be made and removed without impeding the progress of the strip which is passing through the pickling apparatus.

The straightening rolls serve not only to draw the strip from the original coil, but act to propel the same forward for the welding operation until the ends to be connected are clamped and joined by the welding apparatus, and from this point the strip is positively drawn through the intervening parts of the apparatus by the pinch rolls 14 at the delivery end thereof.

The wider strips are too heavy and the resistance of unwinding the coil is too great to permit the strip to be drawn or pulled from the coil through all the parts of the apparatus by pich rolls at the delivery end thereof, without imposing too great a strain upon the different parts of the apparatus and requiring the use of such connecting means as will unduly retard the continuous operation.

For this reason it has been found desirable if not necessary for the purpose of the present invention, to employ separate means, as the roller leveller, for pulling the strip from the original coil, in advance of the pinch rolls at the delivery end of the machine which draw the strip through the remaining portions of the apparatus.

We claim:

The method of continuously pickling coiled steel strips having a width of ten inches and upward, which includes straightening the

coil curvature, connecting the ends of successive strips, and then pulling the same straight through a liquid pickling solution, all during continuous endwise movement of the strips.

In testimony that we claim the above, we have hereunto subscribed our names.

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