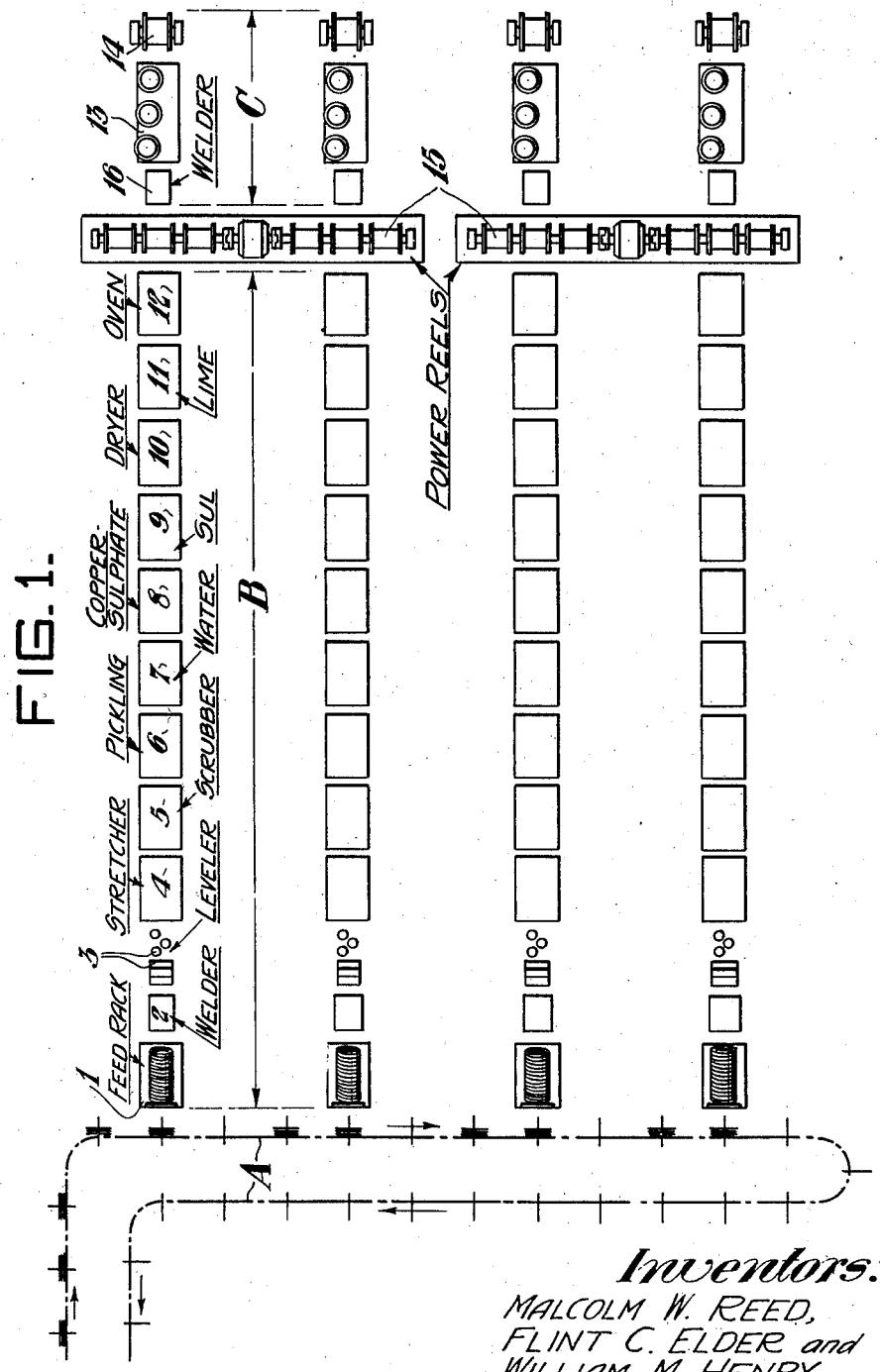
Sept. 26, 1944. F. C. ELDER ET AL 2,359,095

CONTINUOUS PRODUCTION OF ELONGATED METAL STOCK

Filed Oct. 17, 1939 5 Sheets-Sheet 1

FIG. 1.



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CONTINUOUS PRODUCTION OF ELONGATED METAL STOCK

Filed Oct. 17, 1939 5 Sheets-Sheet 2

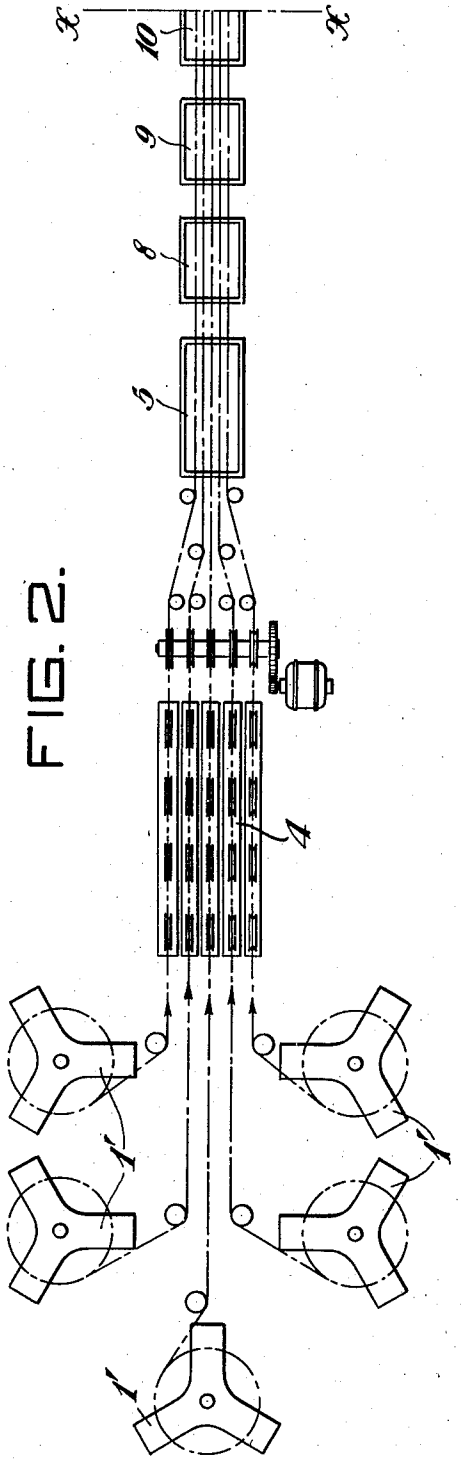


FIG. 2.

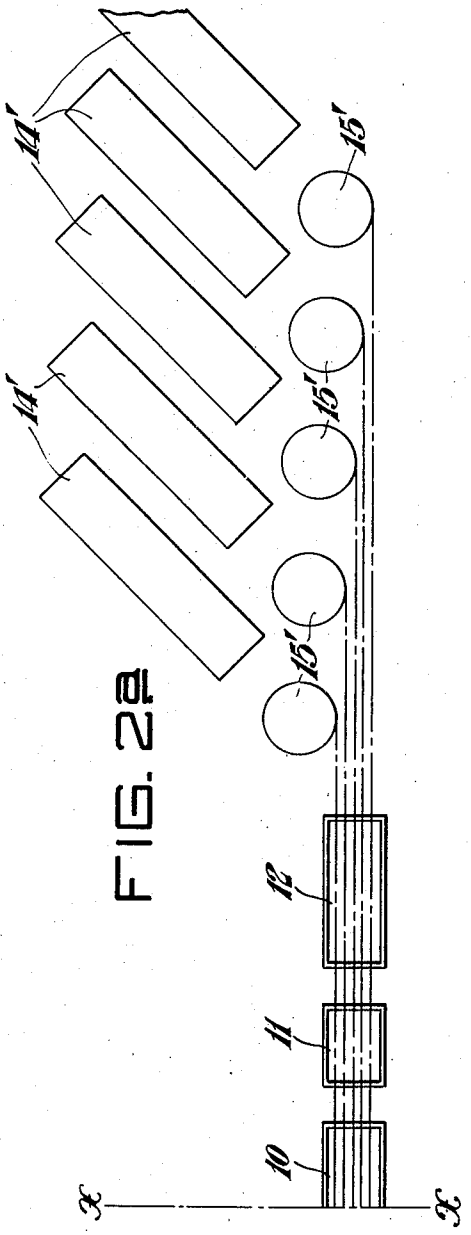


FIG. 2a

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CONTINUOUS PRODUCTION OF ELONGATED METAL STOCK

Filed Oct. 17, 1939 5 Sheets-Sheet 3

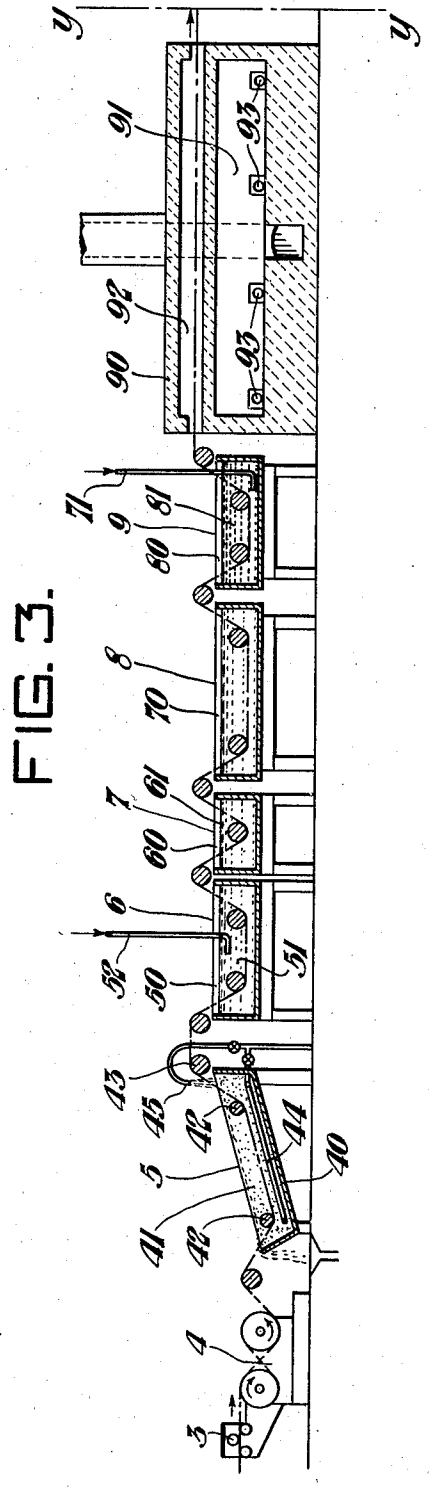


FIG. 3.

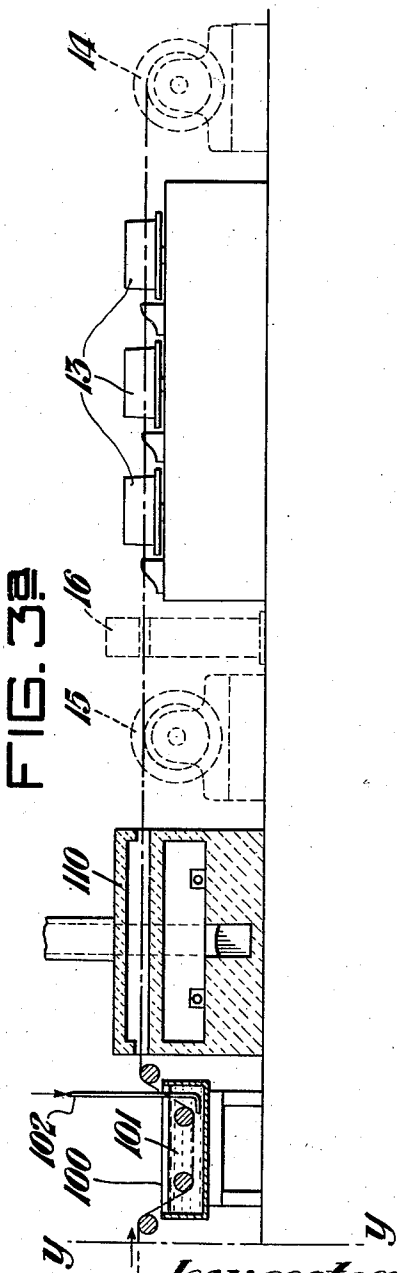


FIG. 3a.

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CONTINUOUS PRODUCTION OF ELONGATED METAL STOCK

Filed Oct. 17, 1939 5 Sheets-Sheet 4

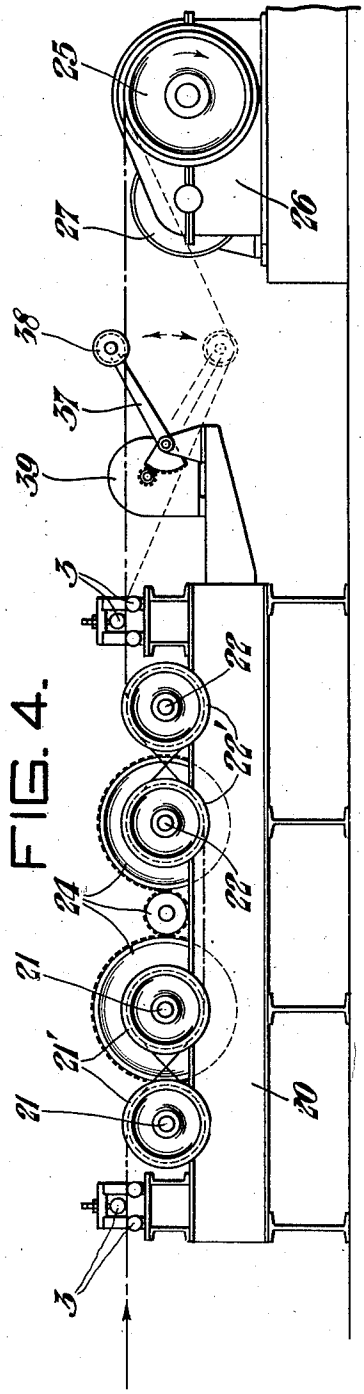


FIG. 4.

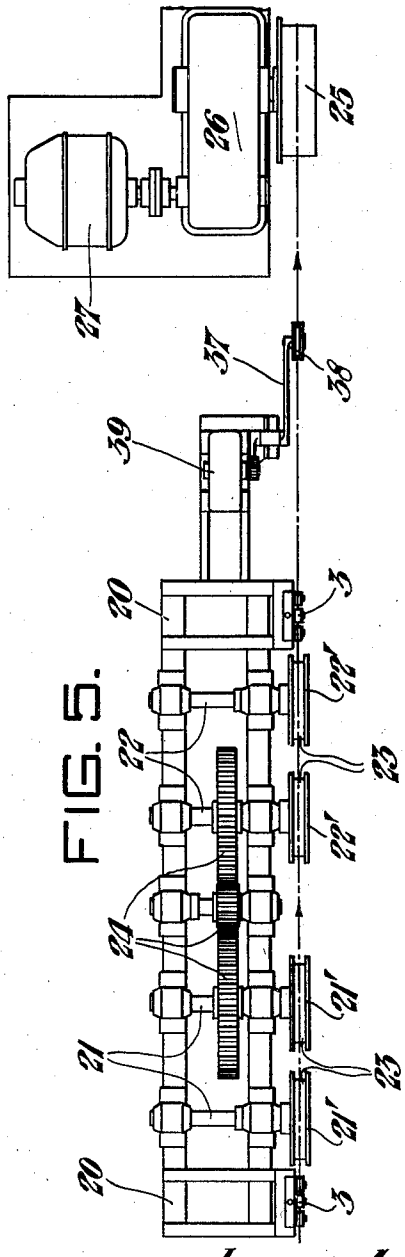


FIG. 5.

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CONTINUOUS PRODUCTION OF ELONGATED METAL STOCK

Filed Oct. 17, 1939 5 Sheets-Sheet 5

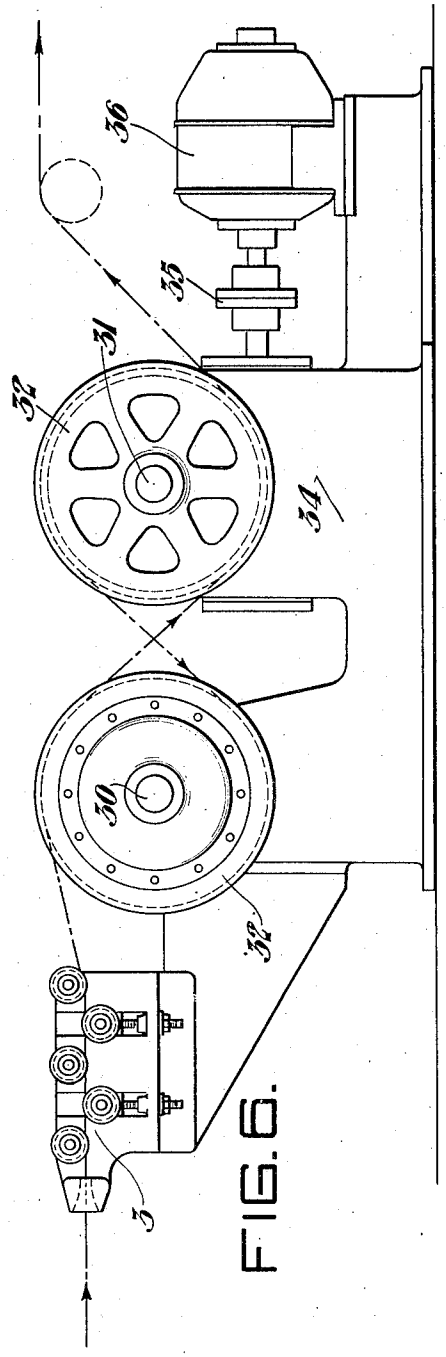


FIG. 6.

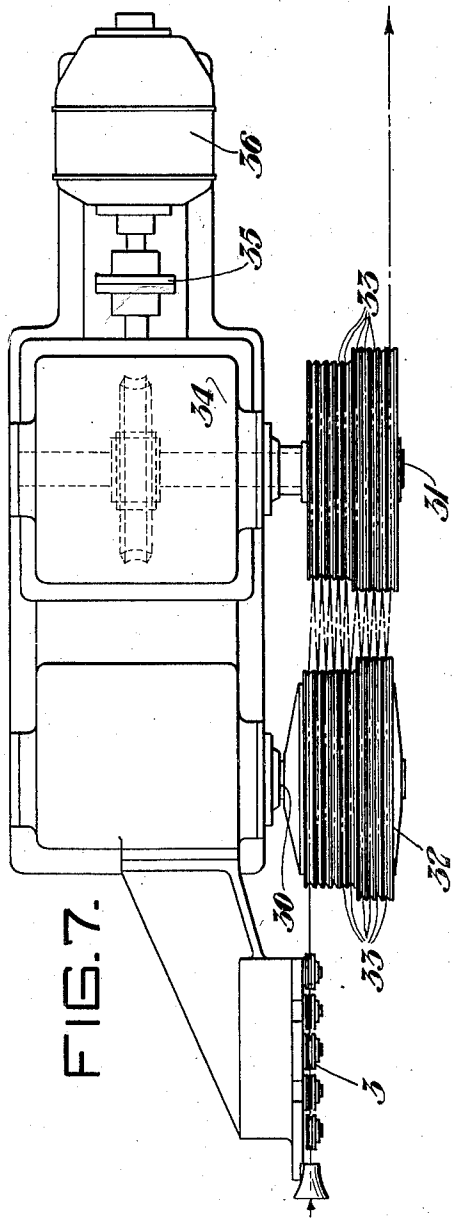


FIG. 7.

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Patented Sept. 26, 1944

2,359,095

UNITED STATES PATENT OFFICE

2,359,095

CONTINUOUS PRODUCTION OF ELONGATED METAL STOCK

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Application October 17, 1939, Serial No. 299,902

7 Claims. (Cl. 205—21)

This invention relates to the processing of elongated bodies of ferrous metal, such as rods, wire, strip, etc., after such stock has been delivered from the hot mills, or from heat treatment. The invention contemplates treatment of such stock or material in a continuous and improved manner for effectively removing undesirable incrustations of oxides and/or other surface matter, so that it is properly conditioned for subsequent working to finished or semi-finished size.

In accordance with current practices, bundles or coils of rod, wire, strip, etc. (hereinafter called rod), are received from a hot mill, or from hot mill storage, and are treated so as to free the surface of the rod from oxides and foreign matter commonly referred to as "scale." This treatment includes handling the rods in bundle form, and successively immersing them in vats of acid, water, and lime solution. For certain types of products, it is sometimes customary to provide the cleaned rod with a light oxide coating called "sull," preparatory to liming the same, and, in other instances, a light covering of copper is provided by dipping in a copper sulphate solution. In any event, rods that have been dipped in the lime solution are baked in a suitable oven to dry the lime thereon, thus completing the final step in the preparation of the rod for subsequent cold drawing operations.

In the production of the so-called common products, it is usual to provide only the pickling, rinsing, liming and baking steps, the sulling treatment and the copper sulphate treatment being reserved for certain special classes of products such as those which are to be subjected to heavy cold reductions without annealing.

The disadvantages of treating rods in bundle form, as above described, includes the difficulty of cleaning the internal coils of the bundle when pickling in acid, without subjecting the outer coils to over-cleaning, which results in the common fault called acid or hydrogen brittleness. The size and weight of the bundles require heavy apparatus for their handling, and the labor and time required in their treatment is excessive. The bundles must be handled each time they are to be subjected to an ensuing step of the preparatory treatment, as when they are removed from the pickling tank and set in the rinse, and, thereafter, transferred to the lime bath in a slow and cumbersome manner. This is obviously a slow, laborious and costly method of preparing metal stock for subsequent treatment, and it is incompatible with the present day production capabilities of the modern hot mills and cold reduction apparatus. Furthermore, the tanks, bakers, and handling equipment must be large and costly, requiring a vast amount of mill space for their accommodation.

It is an object of the present invention to provide for the production, cleaning, coating, and finishing of elongated metal stock such as rods, wire, strips, etc., in a continuous and improved manner.

It is another object to expose successive portions of a continuous length of elongated metal stock to cleaning, coating, baking, and, if preferred, finishing operations, simultaneously and without interruption.

It is still another object to provide for continuously processing elongated metal stock between the producing unit and the finishing unit in such a way that the stock is delivered to the finishing unit and treated by it as rapidly as the producing unit delivers the same.

It is a further object to provide for the continuous production of elongated metal stock in a more efficient manner, and in a way that is less costly in labor, time and equipment than is the case in the practices now in vogue.

Other objects, advantages and characteristics of the invention will become apparent from the following specification and claims when considered in conjunction with the attached drawings, in which:

Figure 1 is a schematic plan view showing a proposed form of production unit for the manufacture of wire or strip.

Figure 2 is a view corresponding to Figure 1 showing a modified form of layout.

Figure 2a is an extension of the view of Figure 2 continued beyond line x—x.

Figure 3 is a side elevational view of one form of apparatus that may be employed intermediate the production and finishing units A and C, which has been generally designated at B in Figures 1 and 2.

Figure 3a is an extension of the view in Figure 3 continued beyond line x—x.

Figure 4 is a side elevational view of a part of the equipment illustrated in Figure 3.

Figure 5 is a top plan view of the apparatus shown in Figure 4.

Figure 6 is a side elevational view of the modified form of apparatus shown in Figure 4.

Figure 7 is a plan view of the modified form of apparatus shown in Figure 6.

The invention contemplates that one or more lengths of elongated metal stock be delivered

from a source of supply, as from reels constantly supplied by the hook conveyer from a continuous rod or strip mill, and passed first through tensioning rolls, which may be similar to those commonly employed in straightening or leveling stock, that are effective in loosening the scale, and eliminating some of it from the surface thereof, but are, in the case of rod, primarily designed to snub the stock upon the stretching drums that immediately follow. The stock is passed without interruption through a stretching device of any suitable construction, whereby the metal stock is elongated and reduced in cross sectional area a substantial amount as, for example, up to about 10%. This is effective in freeing scale and oxide from the surface of the stock irrespective of how firmly united therewith it may have been, and permits it to be removed by mechanical action without, in most cases, resorting to acids or other pickling solutions. From the stretcher, the stock passes through a washer, scrubber, or abrader, whereby any scale dust remaining on the surface is removed. If the stock is to be used in the production of so-called common products, it may then be immersed in a bath of hot lime solution, which is effective to dispose a film of lime upon the surface of the cleaned stock, and, thence, passed for a suitable distance through air or through a continuous heating furnace or baker, which causes the lime to become dried on the wire. At this point, the stock may be passed on without interruption to cold reducing means, which, in the case of rod, may be the regular form of wire drawing apparatus of single or multiple die construction.

The present invention contemplates that the rods be stretched a substantial amount, as herein indicated, and it is to this step that the clean state of the rods is obtained, thus making it possible to effectively practice the continuous method herein outlined.

In accordance with the present invention, the washer, scrubber, or abrading means, specified above for receiving the material from the stretcher, may be replaced by a pickling bath, if, under certain conditions, this is deemed to be desirable. Similarly, for special products, such as liquor-finished wire, and for subsequent processing where a sull coating is required, a copper sulphate bath and an artificial sull bath, with an appropriate dryer therefor, may be included in the train.

Referring now more specifically to the drawings in which like reference characters refer to like parts throughout:

In the schematic plan view of Figure 1, there are pictured four units for receiving the production of a rod mill in accordance herewith. Since one of these units is typical of all, the description of one will serve for all of the units illustrated.

Bundles of rod, or other suitable material, are delivered, as by hook conveyer A, to a rod bundle feed rack 1. From this feed rack individual lengths of rod are unwound and fed successively through a welding machine 2, where the leading end of a succeeding bundle is welded to the receding end of the preceding bundle; on through straightening or leveling rolls 3, which serve to loosen the scale on the stock and eliminate some of it, but which are primarily employed to impose a drag on the material so as to tension it. The stock is then passed on to the stretcher 4, where it is subjected to sufficient tension in excess of its yield point to effect an elongation and reduction of the cross sectional area thereof. This is effective in removing all adhering scale. From the stretcher, the stock passes into a washer and scrubber 5, which may advantageously take the form of a box of quartz sand through which water is continuously flowed. This is effective to remove scale dust and other particles of matter that might rest on the surface of the material. If desired, a pickling tank may be substituted for the washer and scrubber unit 5, or may be included in addition thereto, as at 6. After being cleaned, the stock, if having been exposed to acid, is rinsed in water bath 7, otherwise, is passed directly to a bath of copper sulphate solution 8, and/or an artiffcial sull tank 9, by which a coating of copper, and/or of sull, is obtained on the surface of the stock. In the eventuality that the sull is applied, a dryer or oven 10 is provided to bake the sull on the wire so as to render it adherent thereto. If the copper sulphate dip is employed, it is desirable to introduce the stock thereto with acid, as from the pickle, remaining thereon, since this practice seems provident of a more adherent copper coating.

Thereafter, the stock is passed through a lime tank 11 wherein it is coated with lime. In the production of common products, it is only necessary that the wire be subjected to the liming treatment immediately following the washing and scrubbing thereof in the unit 5. The copper sulphate treatment and/or the sulling treatment are optional, and may be included where the ensuing finishing operations require a special surface on the stock being acted on.

After the lime is disposed on the stock in accordance with the foregoing, it is then delivered to, and continuously passed through, an oven or baker 12 that is in length and temperature related to the speed of the stock, as will later be explained, in order to assure that the proper baking time is had to dry the lime on the wire. From the baker the wire may be passed direct to cold reduction apparatus which, in the case of rod, may be a wire drawing machine 13 of one or more drafts. If a multiple draft machine is used, it is possible to produce the wire to finished size and to coil the same, as on suitable reels 14, ready for the market as it stands, or ready for galvanizing, tinning, subsequent fabrication, etc.

Under some circumstances, in lieu of delivering the stock directly to the cold reduction stage, it may be preferable to wind it upon one or more power reels 15, which would be driven to pull the stock through the system. This alternate arrangement is illustrated in Figure 1. Where two or more reels are provided, one may be used to pull the material through the system, while another is delivering material already wound to succeeding processing steps. Additional reels can provide additional storage; in any event, the use of reels serves to correlate the production and the finishing stages, and to compensate for any differences in production rates therebetween. When this arrangement is adopted, a welder 16 may advantageously be employed to weld the trailing end of the stock being paid out by one reel to the leading end of the next previously wound reel, thus, continuously to deliver stock from the several reels without interrupting the ensuing processing.

The apparatus illustrated in Figures 2 and 2a resembles that already described in Figure 1 except that in lieu of the several individual units for accommodating one line of material each, a

larger unit is provided for the accommodation of several lines of material. The ways in which this device differs from that illustrated in Figure 1 is in the manner in which the source of supply is handled, and the manner in which the finishing apparatus is arranged. Thus, a plurality of "turn-stile" coil holders 1' is arranged for feeding stock to the system, which in its elemental parts is identical with that already described in connection with Figure 1, and to which the same reference numerals have been applied. As to the finishing machines, a preferential arrangement is illustrated in Figure 2*a*, for accommodating the several lines of material being run. Several cold reduction units 14', of multiple draft construction, are arranged at requisite angularity to the axis of movement of the material so that the incoming lines may be accommodated without mutual interference. In this manner it is possible to accommodate the entire output of a hot mill and continuously to process the stock therefrom down to finished size without interruption. Storage reels 15' may be arranged, as shown in this figure, if employed at all.

In Figures 3 and 3*a*, there is shown in side elevation the intermediate processing units from the rod supply to the finishing steps. The same reference numerals have been applied here as appear in the description of Figures 1 and 2, with the general arrangement of Figure 1 having been adopted for purposes of illustration in these figures.

The details of one form of stretching machine will be best understood by reference to Figures 4 and 5, in which it will be seen that this device is composed of a frame 20 in which are journaled two pairs of shafts 21 and 22 in parallel relation. Upon the corresponding ends of each of the shafts 21 is disposed a drum 21' of equal diameter, and upon each of the shafts 22 is disposed similar drums 22'. The surface of each of the drums is provided with annular grooves 23 in which the stock to be treated is adapted to be seated.

At the opposite ends of the shafts, there is provided gearing 24 which is effective in maintaining the speed of the first set of drums 21' equal as to themselves, but at lesser speed than the second set of drums 22', which are made to rotate, if rotated at all, at the same higher rate. A 10% speed differential has proved to be satisfactory, as between the two sets of drums, in this respect, and, although, a speed differential varying more or less from this amount is permissible, whatever differential is finally adopted, the gearing 24 should be designed to maintain this relationship between the two sets of drums.

The stock is threaded in figure-8 fashion around the first two drums 21' so that each turn occupies one of the grooves 23 on the surface thereof. It is then delivered across to the second set of drums 22', about which it is wound similarly in figure-8 fashion. The stock is then passed to a capstan 25, which is positively rotated through a suitable reduction gear 26 by a prime mover 27, so as to be effective in pulling the wire from the stretcher and delivering it to the next succeeding stage of treatment in the system. It will be noted that, in this arrangement, the intergeared stretching drums are idle, and that the capstan 25 is driven to pull the wire about these drums, whereby the fixed differential of rotational speed thereof causes the stock to elongate.

An alternative form of stretcher is shown in Figures 6 and 7. This device differs from that previously described in being made with but a single pair of shafts 30 and 31; the latter of which is driven, and the former of which is idle. Disposed upon the outer ends of each of these shafts is a stepped drum 32, of corresponding size, having stock accommodating grooves 33 disposed in each of the surfaces thereof.

In this type of stretcher, the stock is advanced through tensioning rolls, similar to those previously described, and is delivered to the step of smaller diameter on the idle drum 32, about which it is passed in the innermost groove 33 thereof, for something less than 360° therearound. Thence, it passes to the step of smaller diameter of the driven drum 32, about which it is wrapped in corresponding manner, and returned to the idle drum. Thus, figure-8 turns are built up on the steps of smaller diameter, and, then, on the steps of larger diameter until the two drums are filled; whereupon, the stock is then led away in the direction of the next processing instrumentality in the train.

The drum 32 is, through a suitable reduction gear 34, and shafting 35, driven by prime mover 36, which may advantageously be an electric motor of a variable speed, constant torque type. In order properly to correlate the speed of the stretching device relative to the take-up at the opposite end of the train, a slack control lever 37 having an idle sheave 38 may be disposed to bear by its own gravity upon the stock issuing from the driven drum. A suitable rheostat 39 may be associated with the lever, whereby the motor 36 may be controlled to cause the driven block 32 to deliver the requisite amount of stock.

Stretching

It has been determined that scale is completely eliminated if the material being acted on is stretched so as to elongate it and reduce its cross-sectional area in any amounts ranging from an indeterminable minimum, which, for the sake of convenience, may be set at a half of one percent., up to a practicable maximum of 10%. Anything in excess of 10% has been found to over-stress the material in most cases, so that it breaks, and causes an interruption in the sequence of the operations. In the case of rod or wire, when stretchers similar to those described above are employed, three to four turns about each drum, or about each periphery of a stepped drum, have been found to be the optimum. Any lesser amount of turns might permit some slippage to occur, while any greater number, though capable of being employed without any harm, is superfluous.

Mechanical cleaner

The stock as it issues from the stretching device has all scale and other foreign matter freed from its surface so that it is only necessary to provide means for wiping the residual dust, and other particles, that might repose on the surface loosely, therefrom. As has been hereinbefore stated, one suitable arrangement has been to employ a box-full of abradant material, such as sand, through which water is passed to prevent the stock from channeling therein, and which is effective to float out the oxides, and other materials sought to be eliminated. There does not seem to be anything critical about the dimensions of this equipment, nor about the time to which the stock must be subjected thereto. A ten foot container has

proved to be satisfactory for the purpose, similar to that shown in Figure 3. An ordinary container 40, open at the top, may be tilted, or provided with a sloping bottom, to assure a flow of water. Sand or other abradant material 41 is disposed in the box. A suitable sinker 42 is provided to guide the material through the most effective area of the box, while the exit guide sheave 43 is provided to lead the stock therefrom. To maintain the sand properly agitated so as to preclude channeling of the material therethrough, thus to insure that the surface of the stock is well contacted thereby, a perforated pipe or spray head 44 is preferably disposed in the bottom of the box so as to spray water upwardly through the sand. This is not only effective to agitate the sand for purposes already set forth, but also serves the purpose of eliminating oxides, and other matter removed from the surface of the stock, by flotation. These foreign particles are inclined to form as a scum on the surface of the sand, and to prevent this from being carried out of the box on the surface of the stock, a jet of water 45 is disposed on the exit sheave roller so as to flow upon the material as it leaves.

Although the foregoing has proved satisfactory for the purposes stated, it is not contemplated that the invention shall be limited thereto, since it is believed that other mechanical means, such as, revolving brushes, or high-pressure jets of sand, air, or steam, or even conventional pressure wipes, may be applied effectively in eliminating the residual scale and other matter from the surface of the stock.

Acid bath

This is one of the treatments to which the stock may be optionally subjected, either to supplement the mechanical cleaner just described, or as a substitute therefor. It is particularly applicable in cases where the stock, in ensuing processing, is to be subjected to a copper sulphate solution for the purpose of acquiring a covering of copper thereon. The acid seems to be effective in securing the adherence of copper to the base metal, and, thus, is productive of a better coating.

Here, again, there does not appear to be anything critical about the length of time to which the stock must be subjected to the acid. Of course, if by the previous steps the material is not presented to the acid scale free, then the time of exposure to the acid must be directly related to the amount of time required to dislodge the scale remaining thereon. However, since the stretching operation, above described, is effective in freeing from the surface of the stock all adherent scale, the acid bath is, by nature, a sort of rinse or flux for ensuing coating steps. A container ten feet long has proved satisfactory, and this is indicated at 50 in Figure 3. In this container there is a solution 51, ordinarily comprised of a solution of hydrochloric acid and water, of about 6° acidity, or about 4% by weight. Other suitable acids may be substituted for the hydrochloric acid, although, it should be noted that, when sulphuric acid is used, the results have not been quite as satisfactory because, apparently, there is a condition whereby the wetting action of sulphuric acid is inhibited.

A steam pipe 52 is arranged to deliver live steam beneath the surface of the solution so as to maintain it at a temperature around 170–180° F. A fairly hot solution is known to be more efficacious, for the purpose outlined, than a cold solution; although it is not intended to suggest that there is anything critical about these temperatures.

Water rinse

Where the acid bath is used in the production of common products, when no copper coating is to be applied, the stock is introduced into a tank 60 containing a level of fresh water 61, which is effective in eliminating residual acid from the surface of the material. If the copper sulphate dip is to follow, preferably the water rinse is omitted, and the residual acid allowed to remain on the stock as it is introduced to the copper sulphate solution.

Copper sulphate dip

As has been mentioned above, the treatment of the material with the copper sulphate solution, for the purpose of acquiring a coating of copper, is entirely optional, and is not used in the production of common products. Where it is used, however, it has been found desirable to provide a container 70 for a slightly acid, saturated solution of copper sulphate in cold water. Best results are obtained when the solution is completely saturated, as is evidenced by the presence of copper sulphate crystals at the bottom of the container. It has been observed that three seconds' exposure to a solution of this type is sufficient to produce a complete and thoroughly adherent covering of copper on the stock, although a lesser interval of time, such as two seconds, has proved to be inadequate. Hence, if the stock travels at 300 feet a minute, a fifteen foot tank similar to that represented at 70 is required to give the requisite immersion.

Sull coating

In certain classes of material, where formerly it has been the practice to dispose a light oxide coating called "sull" thereon, it is necessary in the present invention to accomplish the equivalent of this by disposing a coating of material on the stock that gives the surface characteristics of such a sull coating. It will be understood that previous sulling practices, being oxidizing steps, are essentially slow, and not readily adapted to a continuous process of this kind. This difficulty is circumvented by disposing a synthetic sull upon the stock. For this purpose a tank 80 is provided which may advantageously be about 7½ feet long so as to permit the stock to be immersed about the distance of 5 feet therein. Disposed within the tank is a heavy liquid or sludge 81 that is made up of equal parts of ferrous sulphate and calcium hydroxide (lime), with enough added water to form a smooth mass similar to a very thick paint, that, at the outset, is of a very dark green color. It has been observed that when this color characteristic is lost, after a protracted operating period, at which time the mass turns black, its satisfactory properties are lost, and it is then customary to provide a fresh mixture. The reason for the change in color has not been fully explained, although it is thought to be due to the presence of copper sulphate, which, in carrying over from preceding steps, causes a chemical reaction with the synthetic sull ingredients to form calcium oxide, which is responsible for the change in color. A live steam pipe 71 is immersed in the sull box so as to maintain the mixture at about 200° F. so as to keep it properly agitated and mixed.

Sull baker

A suitable furnace or oven 90 is preferably employed when the synthetic sull is used. This may

be of conventional form, having a fire compartment 91 for the burning of combustible fuel disposed beneath the material chamber 92, or the latter may be heated electrically. It has been found necessary to expose the stock to a temperature ranging between 800–900° F. for a minimum of 7 to 8 seconds of time to insure adequate drying of the sull coating. In the drawings, for an operating speed of 300 feet a minute, the baker is shown to be about 30 feet long and capable of being maintained at between 800–1000° F. by burners 93. Air circulation within the baker, or the exposure of the material to large volumes of pre-heated air, greatly expedites the drying operation.

Lime coating

In the drawings the lime box has been designated at 100, and may be of any suitable length, the time of exposure of the stock thereto being not critical. A 7½ foot tank is illustrated, affording a 5-foot immersion. The contents 101 of the tank comprise a suspension of calcium hydroxide in hot water, wherein the former is present in amounts ranging from 8 to 16% of the latter. A live steam pipe 102 is disposed beneath the surface of the suspension to maintain a temperature of about 200° F. A thin wash of lime adheres to the stock as it is withdrawn, which is substantially inappreciable until after it is dried, after which a white film may be observed. Since this is purely a mechanical adhering action, it it believed that there is practically no limit to the shortness of the immersion that may be employed in effecting this operation. It is also contemplated that in lieu of the bath, a lime solution may be sprayed, brushed, or flowed, onto the stock in any suitable way.

Lime baker

Although it is apparent that, if suitable spacing or lapse of time is afforded between the time the material emerges from the lime bath until it reaches the cold reduction apparatus, the lime on the wire will dry by natural evaporation, nevertheless, in the interests of conserving time and space, a suitable continuous baker is provided, which may be of a construction similar to that already described in connection with the drying of the synthetic sull coat. At an operating speed of 300 feet a minute, and depending to a large extent on the steps to which the stock has been previously subjected as a matter of residual heat, a three-second exposure to a temperature around 750° F. has proved sufficient to bake the lime on the stock. Under these operating conditions, the ten-foot furnace 110 is satisfactory for the purpose. When operating speeds are 175 feet a minute or less, the material may be passed through air at room temperatures for a distance of about 60 feet without requiring the application of heat, thus making it possible to dispense with the baker. Even at higher speeds, if the material is preheated in a steam chest, or any other type of heater, before being dipped into the lime tank, the drying of the lime is thereafter greatly accelerated thereby, rendering it unnecessary to employ a baker, and allowing the distance for passing the material through air to be substantially minimized.

Finishing operations

There is nothing of a special nature entering into this practice. In the case of strip, the material may be passed right into the first stand of a cold reducing train, after which it may be wound into coils cut to proper length. In the case of rod to be drawn into wire, the lubricant employed in the drafting practice must be of a kind not to char or cake, since the material is delivered from the baker in warm condition; that is, about 120° F. Sodium stearate and magnesium stearate have proved satisfactory lubricants for use in this connection. It is contemplated that the cold reduction steps may be of a single or multiple character, as desired. In the drawings, continuous wire drawing machines are illustrated for reducing rod to finished size, although anything less than all of the blocks of these machines may be used to terminate the practice at any desired intermediate size.

Although the foregoing has reference to subjecting the material to cold reducing operations after the finishing step, it is, of course, apparent that the stock may be further treated as by coating with zinc, tin, cadmium, or other metal, either by dipping the stock in a molten coating bath, or, else, by passing it through an electrodepositing apparatus in a continuous manner after it leaves the final cold reducing stage. Where lubricants of a kind incompatible with the procurance of an adherent coating are employed, an acid cleaning tank may be used after the last cold reducing stage in order to prepare the surface of the stock for the coating operation. To conform with current practices, this alternative finishing treatment will require the insertion of an annealing furnace between the final pickling step and the coating apparatus, so that stresses and strains in the material, as a result of the cold reducing operations, can be eliminated.

As a corollary to the practice last outlined above, it has proved entirely feasible to subject the stock to a suitable coating operation before the cold reduction to finished size is engaged in, as where the copper sulphate and the sull tanks are replaced by a suitable coating tank, preferably of molten coating metal, since the slowness by which electrodeposited coatings are acquired is not readily adaptable to the speed of the continuous operations here contemplated. After such coating, the material may be deemed completed, and reeled for distribution to the trade in this form, or it may be passed on continuously to the cold reduction operations for cold working to finished size after coating.

From the foregoing description it will be seen that the various objects and advantages set forth in the forepart of this specification have been achieved. Other objects and advantages in addition to those specifically set forth are realized from the operation of the method herein outlined. As an example of these, in the case of the present-day production of wire from rods, it is customary that the rods that are to be drawn into wire issue from the baker not more than twenty-four hours of the time they are drawn. If there is a greater elapsed time than this, it is customary for the rods to be returned to the baker before being turned over to the wire drawers. Since the rods are baked in coil form on buggies that are pushed end for end through the baker in such a manner that, when one is introduced at the entrance of the baker, a buggy of rods is displaced from the exit end thereof, it is obviously quite a problem to coordinate the introduction of rods to the baker (which is determined by the output of the hot mill) with the consumption of rods by the wire drawing machines. Frequently, this results in more rods being passed from the baker than can be accommodated in twenty-four hours. All of this overage must, before being drawn into wire,

be returned to the baker at the cost of extra time and handling, extra labor, and considerable trouble.

In the novel continuous process of the present invention, the limed rods reach the wire drawer still warm, and are thus ideal for the purpose of the latter.

While we have described quite specifically the embodiment of the invention illustrated, it is to be understood that various modifications may be made without departure therefrom, as defined in the appended claims.

We claim:

1. The method of continuously processing elongated metal stock in cold condition which includes stretching the stock, cleaning the surface thereof, copper coating the cleaned surface, sull-coating the coppered surface, and then cold-reducing the stock.

2. The method of continuously processing elongated metal stock in cold condition which includes stretching the stock, cleaning the surface thereof, copper coating the cleaned surface, sull-coating the coppered surface, lime coating the sulled surface, and then cold-reducing the stock.

3. Apparatus for continuously processing elongated metal stock in cold condition including, in combination with means for tensioning the stock, a pair of revoluble surfaces, means for fixing the peripheral speeds of said surfaces at a predetermined differential when in motion, and means for receiving stock therefrom successively to clean, coat, and reduce the stock to finished size without interruption.

4. The continuous processing of hot-rolled material to final cold-reduced gauge without recoiling into portable coils, which includes subjecting successive portions along the length of such material to a substantial stretching operation which elongates and reduces its cross sectional area a substantial amount so as to effectively loosen adherent surface matter, removing the loosened matter, lightly and uniformly pickling the material, coating the pickled material, and cold-reducing the coated material continuously to final gauge without interruption.

5. The method of continuously processing elongated metal stock in cold condition, comprising stretching the stock, cleaning the surface thereof, fluxing said stock, passing said stock through a molten metal coating bath to deposit a coating thereon, and then cold reducing the stock.

6. The method of continuously processing elongated metal stock in cold condition, which includes subjecting successive portions along the length of such stock to a tensile stretching operation which elongates and reduces its cross-sectional area a substantial amount so as to effectively loosen adherent surface matter, removing the loosened matter, lightly and uniformly pickling the stock, and coating the cleaned surface thereof with a non-metallic coating.

7. The method of continuously processing elongated metal stock in cold condition, comprising stretching the stock lengthwise so as to effectively loosen adherent surface matter, cleaning the surface thereof, fluxing said stock, and passing it through a molten metal bath to deposit a coating thereon.

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