Aug. 20, 1940. F. J. WOOD 2,212,219

PICKLING AND CLEANING APPARATUS

Filed May 8, 1939 3 Sheets-Sheet 1

Fig. 1

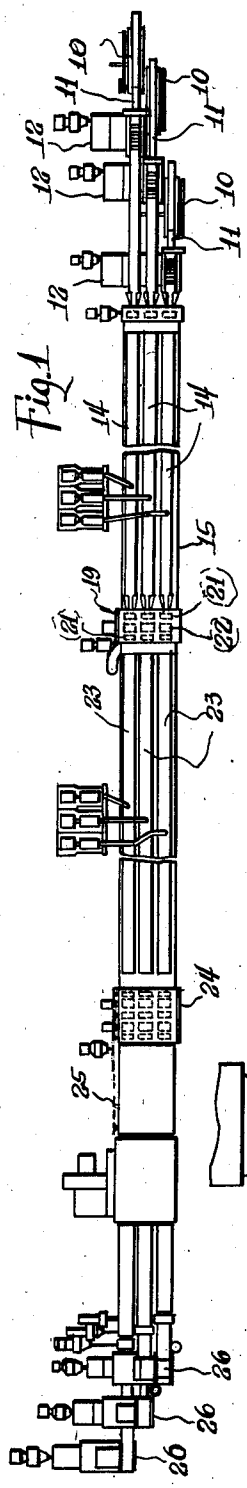
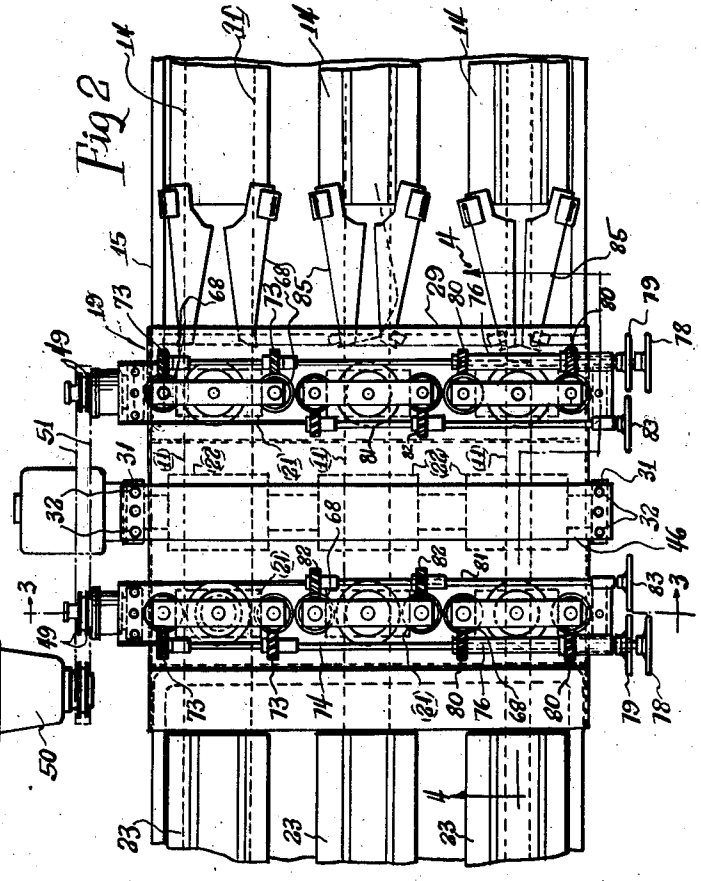


Fig. 2



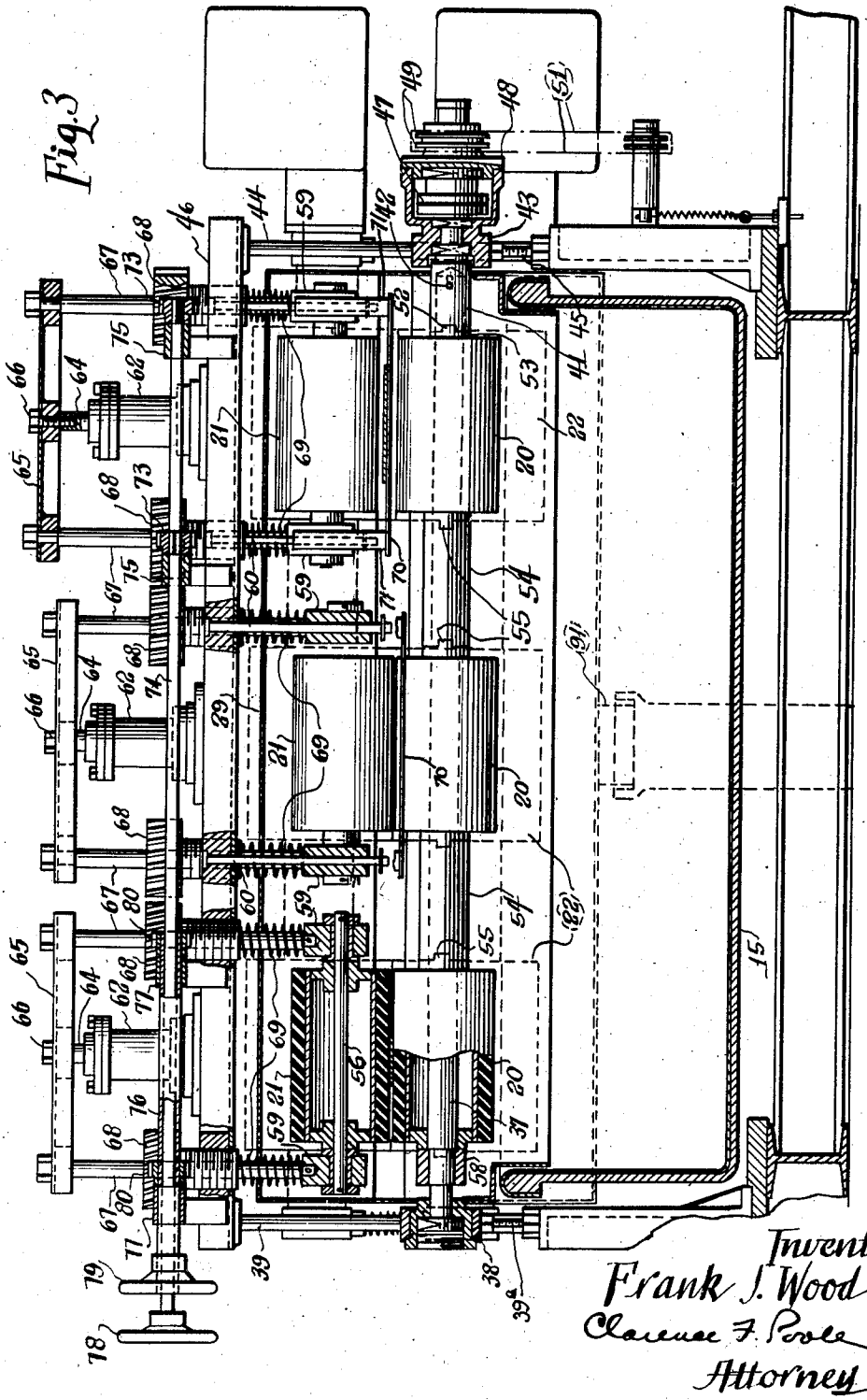
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Fig. 3



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Fig. 4

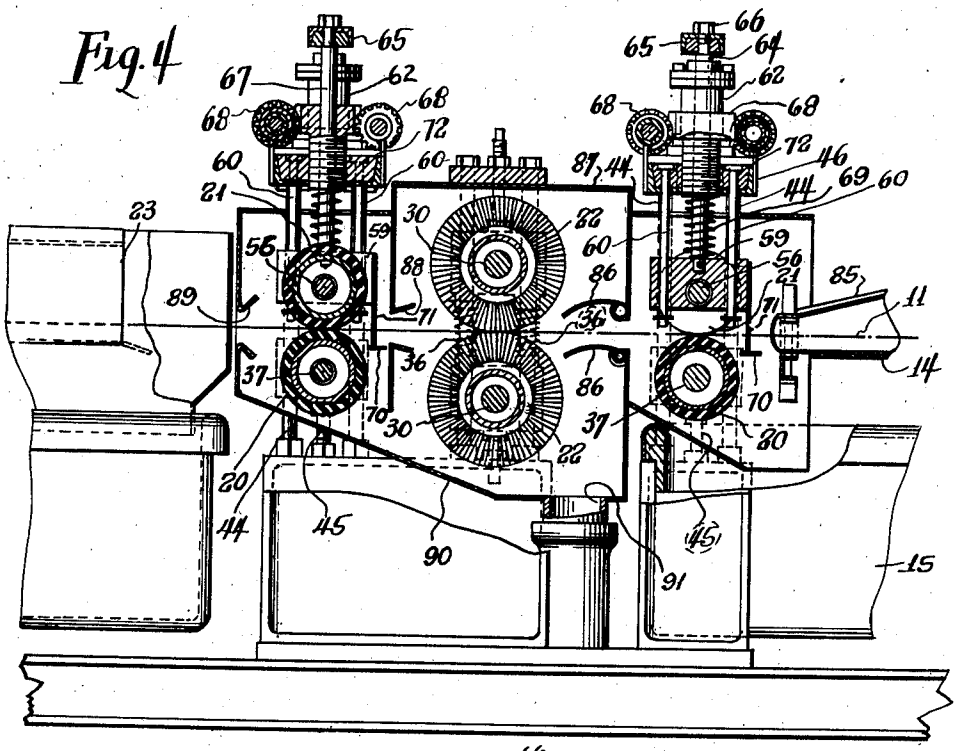
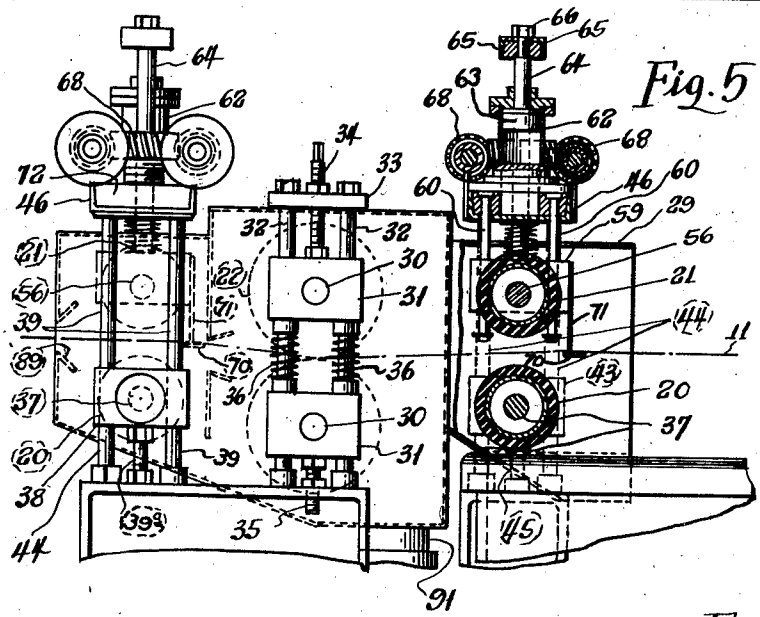


Fig. 5



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PICKLING AND CLEANING APPARATUS

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Application May 8, 1939, Serial No. 272,418

9 Claims. (Cl. 266—7)

This invention relates to improvements in pickling and cleaning apparatus, and more particularly relates to improvements in a squeegee and brushing stand adapted for use in a multiple strand pickling and cleaning line.

Among the objects of my invention is to provide a pickling and cleaning apparatus arranged to simultaneously pickle a plurality of strips of metal, which includes a squeegee and brushing stand adapted to remove foreign matter from the metal attacked by the pickling fluid, and to pull or push the metal through the cleaning system, and so arranged that the progress of any strip of material through the pickling apparatus may be stopped without disturbing the cleaning of the other strips of metal.

Another object of my invention is to provide a novel form of squeegee and brushing stand adapted to convey the metal through the apparatus and simultaneously remove foreign matter attacked by the pickling fluid from a number of strips of metal passing through the pickling apparatus and including a plurality of squeegee rolls arranged side by side and driven from a common drive member, and a novel arrangement whereby the movement of any strip of metal through the pickling apparatus may be stopped without stopping rotation of the squeegee rolls and without injury thereto, by raising the strip metal and upper squeegee roll out of contact with the lower driving roll.

Other objects of my invention will appear from time to time as the following specification proceeds and with reference to the accompanying drawings wherein:

Figure 1 is a diagrammatic plan view of a multiple strand pickling and cleaning apparatus constructed in accordance with my invention;

Figure 2 is an enlarged fragmentary plan view of a portion of the apparatus, showing the squeegee and brushing stand in plan and also showing the entering and receiving ends of pickling troughs disposed at opposite ends of the squeegee and brushing stand;

Figure 3 is an enlarged transverse sectional view of the apparatus taken substantially along line 3—3 of Figure 2;

Figure 4 is a longitudinal sectional view of the apparatus taken substantially along line 4—4 of Figure 2, and drawn to substantially the same scale as Figure 3; and

Figure 5 is a view somewhat similar to Figure 4, showing the squeegee rolls in an elevated position, with the strip metal lifted above the drive rollers.

The embodiment of my invention shown in the drawings is illustrated as a part of a continuous strip pickling and cleaning device consisting of a plurality of coil supporting boxes 10, 10 disposed at the entering end of the cleaning apparatus. Said coil supporting boxes are arranged one in advance of the other for convenience. Each of said boxes forms a support for a coil of metal 11, permitting it to be unwound and passed through the cleaning apparatus. A leveler 12 is provided in advance of each coil supporting box and consists of a plurality of power driven leveling rolls (not shown) engaging opposite sides of the metal, for leveling and breaking the scale on the metal before the cleaning operation, in a manner well known to those skilled in the art. A pickling bath is provided in advance of said levelers and, as herein shown, includes three pickling and cleaning troughs 14, arranged side by side and disposed over a tank 15. The metal is cleaned when passing through said trough by the spraying of pickling fluid on each side thereof. A squeegee and brushing stand 19, including squeegee rolls 20, 20 and 21, 21 and brushing rolls 22, 22, is disposed in advance of said cleaning troughs, for removing the loosened scale and other foreign matter which has been attacked by the pickling solution, from the metal by scrubbing with water. From said cleaning and brushing stand the metal may pass through another set of pickling troughs 23, 23, another squeegee and brushing stand generally indicated by reference character 24, through a drier 25, to a coiler, generally indicated by reference character 26, which recoils the metal. The leveler rolls and coilers for each strand of metal are independently driven by a separate motor and are independently controlled by separate controls so that any strip of metal going through the system may be stopped independently of the other strips. Said levelers, coilers, coil supporting boxes, pickling and cleaning troughs and tanks, driers, and cleaners are only shown in an illustrative manner, since they form no part of the present invention except in so far as the apparatus of the present invention may be a part of an entire pickling system.

With reference now in particular to the squeegee and brushing stand 19, said brushing stand, as herein shown, includes two sets of three pairs of spaced apart aligned squeegee rolls. Each of said sets of rolls consists of three similar coaxially arranged lower driving rolls 20, 20 and three corresponding upper pinch rolls 21, 21 adapted to engage said driving rolls, and together with said driving rolls serving to squeeze pickling fluid from the metal and helping to convey the metal through the cleaning system. Said rolls are of a usual construction having a face which may be made from any acid resisting resilient material, which face is herein preferably shown as being made from rubber. The squeegee rolls adjacent the discharge end of the pickling trough are mounted so as to overhang an end of the pickling tank 15 and are enclosed in a casing 29, open towards said pickling tank, and having an inclined bottom arranged to permit pickling fluid

squeezed from the metal to drain into said pickling tank (see Figures 4 and 5).

Three pairs of rotary brushes 22, 22 are disposed between the three pairs of advance and discharge squeegee rolls, and each pair of said brushes is in alignment with the line of travel of the metal through said sqeegee and brushing stand, so that the metal will first be engaged by a set of squeegee rolls and will then be brushed by a set of brushes, and then again will be engaged by another set of squeegee rolls at the discharge end of the squeegee stand. The brushes 22, 22 are of a usual rotary type brush and each of said brushes is mounted on a transverse shaft 30. The shafts 30, 30 for each pair of brushes are vertically spaced and are journaled at their ends in spaced apart bearing support members 31, 31. Said bearing support members are each adjustably mounted for movement along a pair of parallel spaced vertically extending rods 32, 32, mounted in the frame for the squeegee stand and connected together at their upper ends by a cross beam 33. The means for adjustably moving said bearing members towards and from each other includes a threaded shaft 34 rotatably secured to said upper bearing member and projecting upwardly therefrom and threaded within the cross beam 33. In a like manner a threaded shaft 35 extends downwardly from the lower bearing member 31 and is threaded within a portion of the pickling stand, for vertically adjusting said lower bearing member along the rods 32, 32. A spring 36 encircles each rod 32 and is interposed between said upper and lower bearing members, to take up slack in the adjusting means for said bearing members.

The forward and rear sets of squeegee rolls are of a similar construction, so one only will herein be described in detail and the same part numbers will be applied to each of said sets of rolls. The drive rolls 20, 20 are mounted on a transverse shaft 37, in spaced apart relation with respect to each other. Said shaft is journaled at one of its ends in a suitable ball bearing, which is mounted in a bearing support member 38. Said bearing support member is adjustably mounted on a pair of spaced apart vertically extending rods 39, 39. A threaded rod 39a is provided to adjustably move said bearing support member along said rods. The opposite end of said transverse shaft is mounted in a socket formed in a drive member 41, and is flexibly secured to and driven from said drive member by means of a pin 42.

The drive member 41 is provided with a projecting end, which is journaled in a bearing support member and housing 43, in suitable spaced apart ball bearings. Said housing is adjustably mounted on a pair of parallel spaced vertical rods 44, 44 which are mounted on the opposite side of the brushing stand from the rods 39, 39. A threaded rod 45 is provided to vertically move said housing along said rods in the usual manner. The rods 44, 44 and 39, 39 are connected together at their upper ends by means of a cross beam 46.

The drive member 41 has a coupling member 47 of the flexible type, connected thereto and journaled in a cover 48 of said housing. Said coupling member is rotatably driven from a pair of coaxial spaced apart sprockets 49, 49. The sprockets 49, 49 are drive from a motor 50 by means of chain and sprocket drives 51, 51. It should be noted that Figure 2 shows one motor only for driving each set of squeegee rolls, and that the same chain and sprocket drive serves to drive the sprockets 49, 49 for driving the squeegee rolls at both the entering and leaving side of the squeegee and brushing stand.

The drive member 41 has a plurality of slots or grooves formed in the inner end face thereof which are engaged by tongues 52, 52 projecting from a sleeve or hub 53, forming a part of the roll 20, for driving said roll from said sleeve. Sleeves 54, 54 are interposed between the center and outer rolls 20, 20 for driving said rolls from the drive member 41. Said sleeves are each provided with grooves formed in the end faces thereof, which are adapted to be engaged by tongues 55, 55 projecting from the hubs of said rolls. The roll adjacent the rods 39, 39 abuts a collar 58 to hold said tongues in engagement with the respective slots in said sleeves and drive member so that all three rolls may be simultaneously driven from the driving member 41.

Referring now in detail to the idler or pinch rolls 21, 21, and the novel arrangement whereby said rolls may independently be disengaged from the strip of metal passing through the system, and whereby the metal may be lifted from the driving roll at the same time the pinch roll is disengaged therefrom, the pinch rolls 21, 21 are each mounted on a transverse shaft 56. Each of said shafts is journaled at its ends in bearing blocks 59, 59. Said bearing blocks are each guided on a pair of parallel spaced vertical guide rods 60, 60 which are mounted at their upper ends in the cross beam 46.

The means for vertically moving each pair of bearing blocks 59, 59 along the associated guide rods 60, 60 includes a cylinder 62. Three of said cylinders are herein shown as being mounted on the cross member 46, and each one of said cylinders is mounted midway between a pair of guide rods 60, 60. Said cylinder is provided with a piston 63 which has a piston rod 64 projecting upwardly therefrom. Said piston rod is provided with a shouldered upper portion, to which is secured a transversely disposed lifting member 65 by a machine screw 66. Said lifting member projects transversely in opposite directions from said piston rod and has a plurality of supporting rods 67, 67 depending from opposite ends thereof. Each of said depending rods extends through the hub of a helical gear 68, and is secured at its lower end to the bearing blocks 59 in a suitable manner. A spring 69 encircles each rod 67 and is interposed between the bearing block 59 and a lower end of the hub of the helical gear 68. Said springs are adapted to continually exert pressure on the bearing block 59 to tend to move the bearing members 59, 59 in a downward direction and resiliently engage the upper pinch roll 21 with the lower driving roll 20. It is thus apparent that the admission of fluid under pressure to the lower end of the cylinder 62 will lift the pinch roll 21 upwardly and disengage it from the drive roll 20, and that release of pressure from said cylinder will permit said springs to return said pinch roll to a lowered position and engage it with said drive roll.

The tension of the springs 69, 69 is adjusted by the helical gears 68, 68, the hubs of which helical gears are threaded and have threaded engagement with stationary blocks 72, 72, mounted in the cross frame member 46. Rotation of the helical gear 68 in one direction or another will thus cause vertical movement of said gear and hub to vary the force with which the spring 69 engages the upper pinch roll 21 with the lower

driving roll 20, by engagement of the lower end of its hub with the upper end of said spring.

Adjustment of the springs 69, 69 associated with the end pinch roll 21, which in Figure 3 is on the right hand end of the machine, is effected by a pair of helical pinions 73, 73 keyed on a transversely extending shaft 74 and meshing with the helical gears 68, 68. Said shaft is mounted in suitable bearing support members 75, 75 and extends through a sleeve 76 disposed adjacent the end of the squeegee stand opposite from the helical pinions 73, 73. Said sleeve is likewise mounted in suitable bearing members 77, 77. A hand wheel 78 is secured to the outer end of said shaft to rotate the helical gears 68, 68 and change the amount of compression of the springs 69, 69 as desired. It should be noted that the helical gears 68, 68, upon turning movement of the hand wheel 78, will rise or lower with respect to the helical pinions 73, 73, since said gears are formed integral with the threaded hubs thereof. Such movement of said helical gears with respect to said pinions is possible since said gears and pinions are helical, providing line contact between the teeth of said gears and pinions, which permits driving of the gear from the pinion when the face of the pinion is not fully a line with the face of the gear.

The sleeve 76 is rotated by a hand wheel 79 on the outer end thereof and is provided with a pair of spaced apart helical pinions 80, 80, which mesh with the helical gears 68, 68, for adjusting the amount of compression of the associated springs 69, 69.

The force with which the center pinch roll engages its associated drive roll is adjusted by means of a transverse shaft 81. Said shaft is mounted on the opposite side of the cross beam 46 from the transverse shaft 74, and has a plurality of helical pinions 82, 82 secured thereto, which mesh with the helical gears 68, 68 of the center roll. Said shaft and helical pinions are rotatably moved by means of a hand wheel 83 on the outer end thereof.

A means is provided to lift the strip of metal from the respective drive roll 20, upon elevation of the associated pinch roll 21, to render it unnecessary to stop the drive motor 50 or disconnect said drive roll from said motor, and thus to permit all of the drive rolls to be driven from a single source of power and also render any of said drive rolls inoperative without stopping the others. Said means includes a lifting member 70 mounted on the lower ends of a pair of depending brackets 71, 71 which brackets are mounted on opposite bearing blocks 59, 59. The length of said brackets is such that when the rolls 20 and 21 are engaged with each other, said lifting member is beneath the line of contact of said rolls. Thus, upon lifting movement of the bearing blocks 59, 59, the member 70 will engage the underside of the metal and lift it above the associated drive roll 20, as is clearly shown in Figure 5. This will render said drive roll 20 inoperative and prevent scarring of said drive roller caused by rotation thereof against the stationary strip of metal.

Referring now in particular to Figures 2 and 4, it may be seen that as the strips of metal pass through the pickling troughs 14, 14 and telescopic guides 85, 85 at the discharge end of said troughs, they are engaged by the respective pinch and drive rolls 21, 21 and 20, 20, which squeeze the pickling acid from the metal and aid in pulling it through the tank. Said squeegee rolls push the ends of the metal through guides 86, 86 formed in a box 87 which encloses the upper part and entering and discharge ends of the brushes 22, 22, to minimize the splashing of water by said brushes. The free end of the metal passes between said brushes through an opening 88 in the box 87 to and between the squeegee rolls 20 and 21 at the discharge end of the brushing stand. Said squeegee rolls push the end of the metal through an opening 89, in an enclosing housing for said rolls, and push it to the next pickling trough. A common inclined bottom 90 is provided for the enclosure for the squeegee rolls 20 and 21 at the discharge end of the pickling stand and the box for enclosing the brushes 22, 22. Said bottom leads to a drain 91, for the scrubbing water.

When it is desired to stop the progress of either strip of metal through the system, the sets of pinch rolls engaging the metal are lifted by the operation of a suitable fluid pressure valve (not shown) which at the same time lifts the metal above the drive rolls 20, 20 by means of the lifting member 70, in the hereinbefore described manner. At the same time, the leveler at the entering end of the apparatus is stopped, as well as the coiler at the discharge end of the apparatus. It is, of course, obvious that where the metal is not of sufficient length to be engaged by either the leveler or coiler, it may only be necessary to lift the proper pinch rolls to stop the travel of the metal through the machine.

It may thus be seen that a new and improved multiple strand pickling and cleaning apparatus for continuous strips of metal has been provided, which includes a novel form of squeegee and brushing stand so arranged as to take care of a number of strips of metal at the same time, and to permit the progress of one strip of metal through the system to be stopped without injury to the drive rolls and without stopping operation of the squeegee and brushing stand while the other strips of metal continue through the system; and that this is effected by simply raising the desired pinch roll above its associated drive roll and at the same time lifting the metal above this roll.

While I have herein shown and described one form in which my invention may be embodied, it will be understood that the construction thereof and the arrangement of the various parts may be altered without departing from the spirit and scope thereof. Furthermore, I do not wish to be construed as limiting myself to the specific embodiment illustrated, excepting as it may be limited in the appended claims.

I claim as my invention:

1. In a pickling and cleaning device, a plurality of pickling troughs arranged side by side, a brushing and squeegee stand at the discharge end of said troughs including a pair of engaging squeegee rolls at the discharge end of each trough, said rolls being disposed one above the other and said upper roll yieldably engaging said lower roll, a common drive member for simultaneously driving the lower of said rolls, means for raising any one of said upper rolls out of engagement with said lower driving roll, and means for raising the metal out of engagement with the lower driving roll upon rising movement of the associated upper roll, to prevent injury to the lower roll caused by rotation thereof against the metal and to permit movement of the metal through either pickling line to be stopped without disconnecting said common drive member from said lower rolls.

2. In a pickling and cleaning device, a plurality of pickling troughs arranged side by side, a brushing and squeegee stand including a pair of engaging squeegee rolls at the discharge end of each trough, said rolls being disposed one above the other and said upper roll yieldably engaging said lower roll, a common drive member for simultaneously driving said lower rolls, means for raising any one of said upper rolls out of engagement with said lower driving roll, and means for raising the metal out of engagement with the lower driving roll upon rising movement of the associated upper roll, to prevent injury to the lower roll caused by rotation thereof against the metal and to permit movement of the metal through either pickling line to be stopped without disconnecting said common drive member from said rolls including a separate member having connection with each of said upper rolls and extending beneath the line of travel of the metal when said rolls are in an engaged position, and adapted to engage the underside of the metal upon upward movement of said upper roll.

3. A squeegee and brushing stand for a plurality of strips of sheet metal including a plurality of rotatably driven rolls arranged side by side, a plurality of pinch rolls disposed above said driven rolls and adapted to yieldably engage said driven rolls to squeeze fluid from the metal and convey the metal through the system, a plurality of brushing rolls spaced from said pinch rolls, and means for permitting the travel of any desired strip of metal through said squeegee and brushing stand to be stopped including means for independently raising any one of said pinch rolls above said associated driven roll and means for raising the metal above any of said driven rolls upon upward movement of said associated pinch roll.

4. A squeegee and brushing stand for a plurality of strips of sheet metal including a plurality of rotatably driven rolls arranged side by side, a plurality of pinch rolls disposed above said driven rolls and adapted to yieldably engage said rolls for squeezing fluid from the metal and for conveying the metal through the system, a plurality of brushing rolls spaced from said pinch rolls, and means for permitting the travel of any desired strip of metal through said squeegee and brushing stand to be stopped including means for independently raising any one of said pinch rolls above said associated driven roll and means for raising the metal above any of said driven rolls upon upward movement of said associated pinch roll including a separate lifting member having connection with each of said pinch rolls, said lifting members extending beneath the line of travel of the metal, when said pinch and driven rolls are in an engaged position with respect to each other.

5. In a squeegee and brushing stand of the class described, a plurality of brushes rotatable about vertically spaced horizontal transverse axes, a plurality of coaxial rotatably driven rolls arranged side by side and spaced from said brushes, a pinch roll disposed above and adapted to yieldably engage each of said driven rolls, a plurality of pairs of spaced apart bearing support members, each pair of said bearing support members forming a bearing support for one of said pinch rolls and being guided for vertical movement with respect to said driven rolls, means for vertically moving said bearing support members in an upward direction, and a separate member having connection with each pair of said bearing support members and disposed beneath the line of travel of the metal, when said rollers are in an engaged position, for raising the metal above its associated driving roll upon upward movement of said associated bearing support members and pinch roll.

6. In a pickling and cleaning device, a plurality of pickling troughs arranged side by side, a pair of engaging squeegee rolls at the discharge end of each pickling trough for engaging opposite sides of the strip metal and conveying the strip through said troughs, the rolls of each pair of said rolls being disposed one above the other, a common drive member for driving said rolls, and means for permitting the movement of metal through any pickling trough to be stopped without disconnecting said drive member from said rolls including means for positively raising any one of the upper rolls above its associated strip of metal.

7. In a pickling and cleaning device, a plurality of pickling troughs arranged side by side, a pair of engaging squeegee rolls at the discharge end of each pickling trough, for engaging opposite sides of the strip metal and conveying the strip through said troughs, the rolls of each pair of said rolls being disposed one above the other, a common drive member for driving said rolls, and means for permitting the movement of metal through any pickling trough to be stopped without disconnecting said drive member from said rolls including means for positively raising any one of the upper rolls above the associated strip of metal and a separate guide member associated with each of said upper rolls and engageable with the underside of the metal, for lifting the metal out of engagement with the lower roll upon lifting movement of the associated upper roll.

8. In a pickling and cleaning device for strip metal, a plurality of pickling troughs arranged side by side, a pair of engaging rolls adjacent one end of each pickling trough, the rolls of each pair of said rolls being disposed one above the other and the upper roll being adapted to yieldably engage the metal with said lower roll, a common drive member for simultaneously driving the lower of said rolls, and means to permit the movement of metal through any one of said pickling troughs to be stopped without disconnecting said drive member from said rolls including means for independently disengaging any one of said upper rolls from its associated strip of metal.

9. In a pickling and cleaning device for strip metal, a plurality of pickling troughs arranged side by side, a pair of engaging rolls adjacent one end of each pickling trough, the rolls of each pair of said rolls being disposed one above the other and said upper roll being adapted to yieldably engage said lower roll, a common drive member for simultaneously driving the lower of said rolls, and means to permit the movement of metal through any one of said pickling troughs to be stopped without disconnecting said drive member from said rolls including means for independently disengaging any one of said upper rolls from its associated strip of metal and a separate member associated with each of said upper rolls and adapted to disengage the metal from said driving roll upon disengagement of said upper roll from the metal.

FRANK J. WOOD.