Aug. 12, 1952 W. S. PEARSON 2,606,846

METHOD AND APPARATUS FOR REMOVING EXCESS GALVANIZING METAL FROM CONDUIT OR THE LIKE

Filed May 21, 1948 5 Sheets-Sheet 1

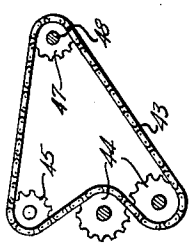


FIG. 8.

FIG. 1.

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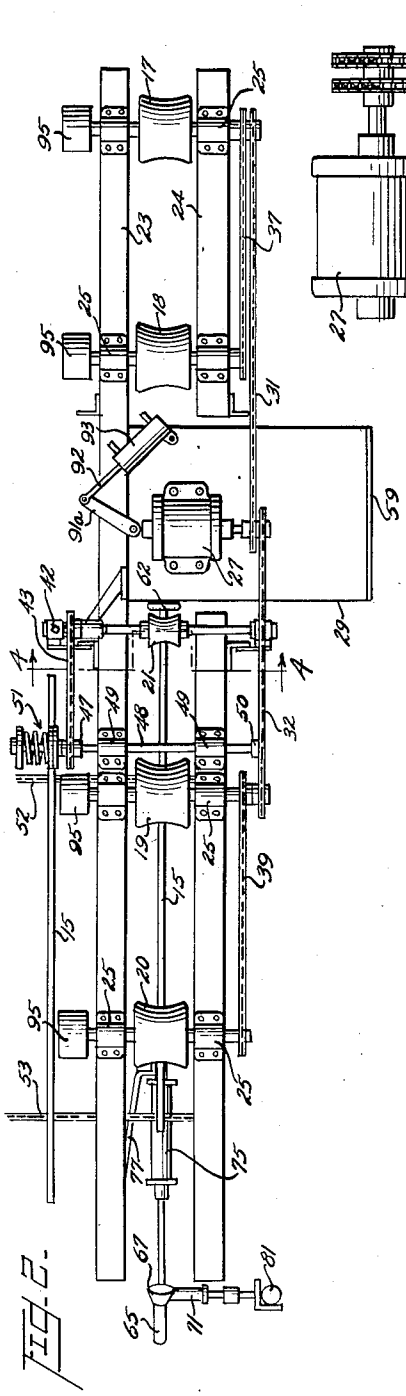


FIG. 2.

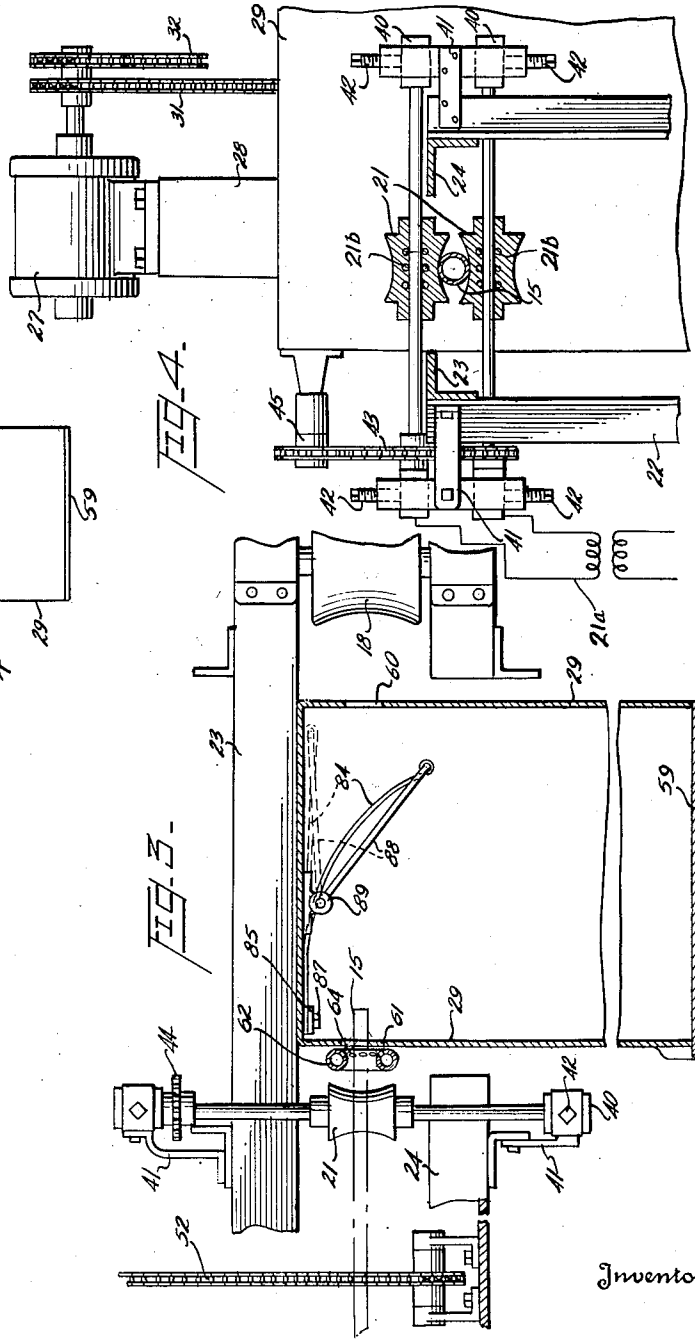


FIG. 4.

FIG. 3.

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METHOD AND APPARATUS FOR REMOVING EXCESS GALVANIZING METAL FROM CONDUIT OR THE LIKE

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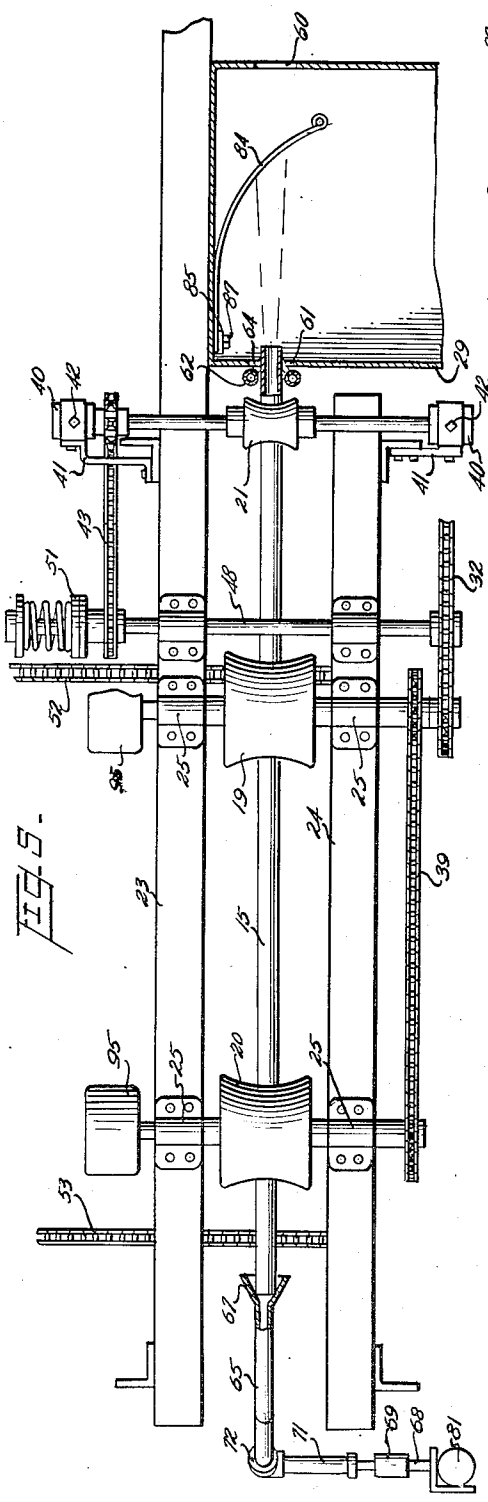


FIG. 5.

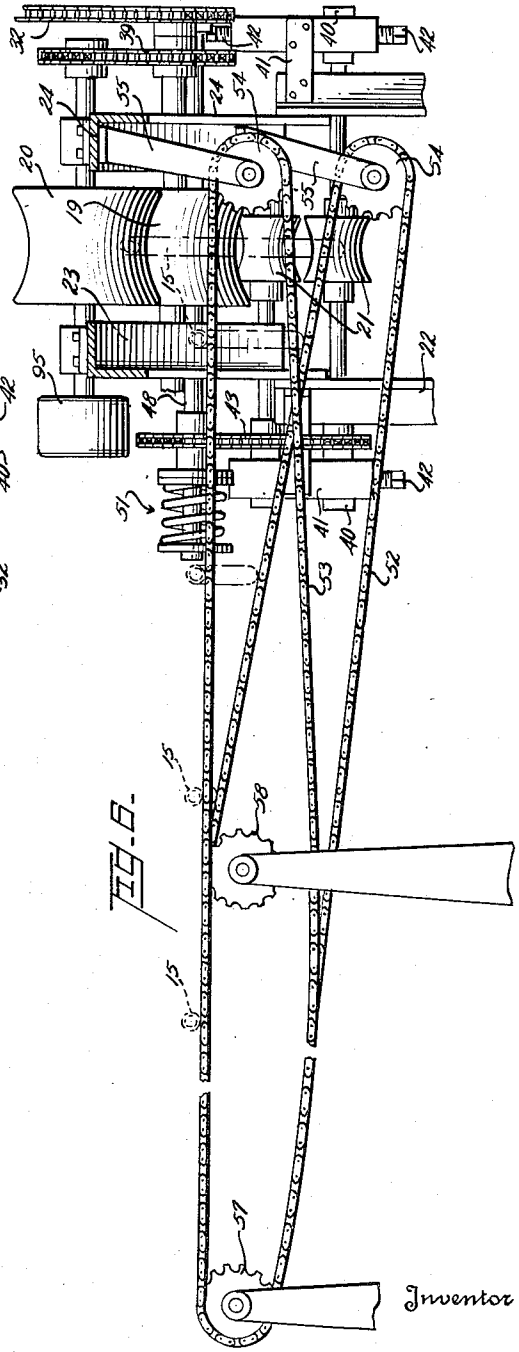


FIG. 6.

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METHOD AND APPARATUS FOR REMOVING EXCESS GALVANIZING METAL FROM CONDUIT OR THE LIKE

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FIG. 7.

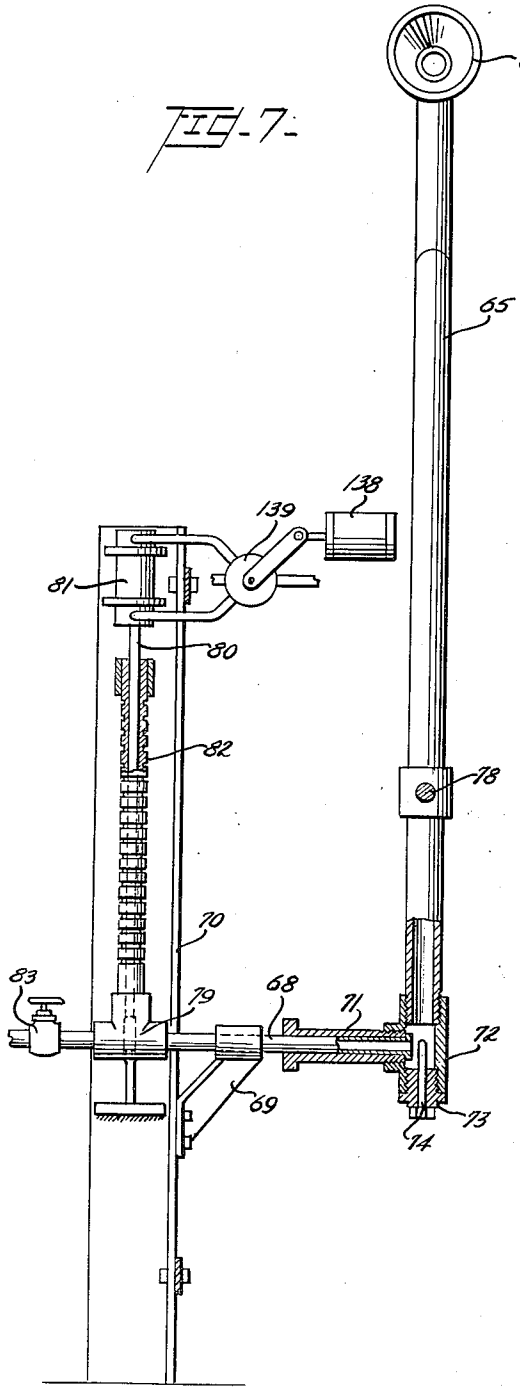


FIG. 9.

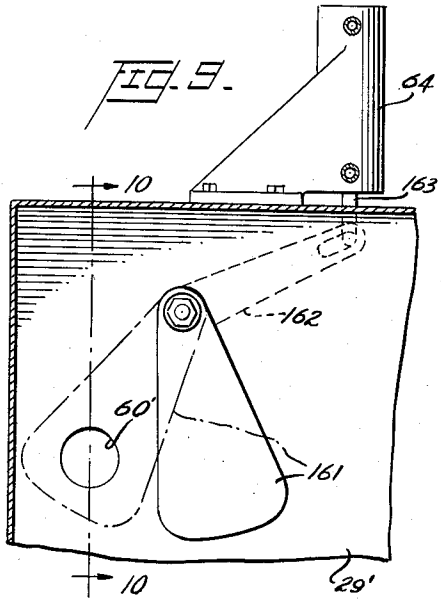
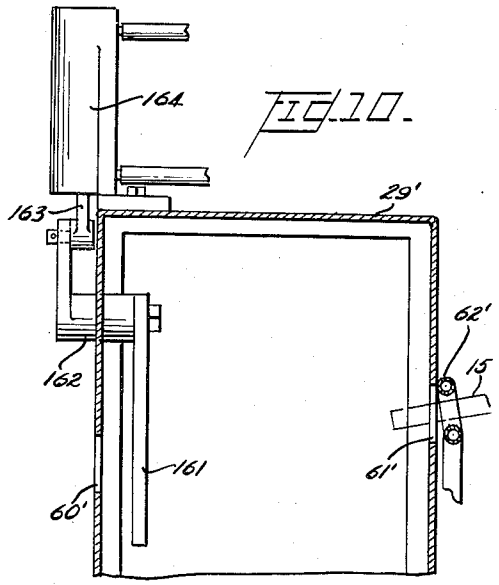


FIG. 10.



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METHOD AND APPARATUS FOR REMOVING EXCESS GALVANIZING METAL FROM CONDUIT OR THE LIKE

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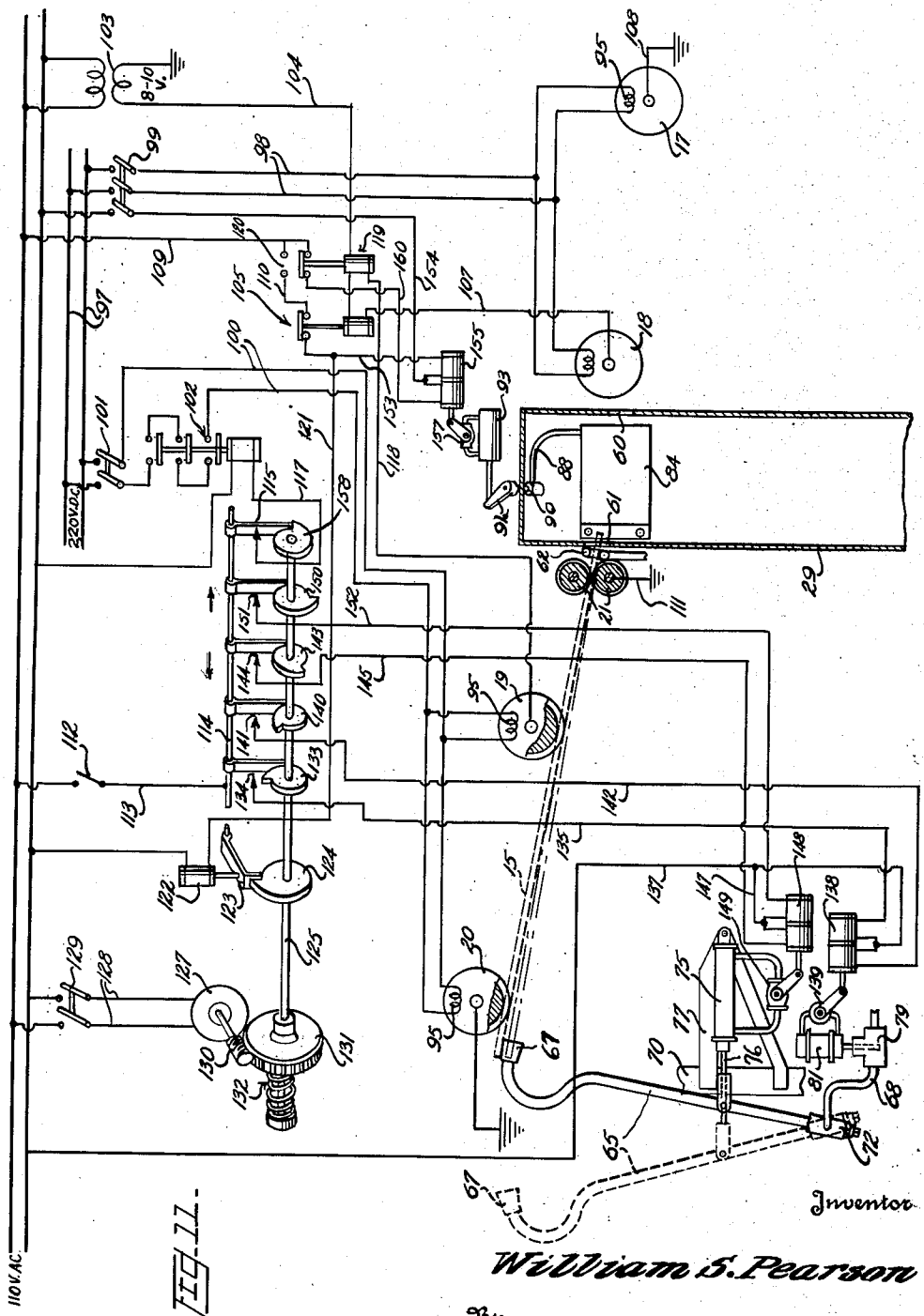


FIG. 11.

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Patented Aug. 12, 1952

2,606,846

UNITED STATES PATENT OFFICE

2,606,846

METHOD AND APPARATUS FOR REMOVING EXCESS GALVANIZING METAL FROM CONDUIT OR THE LIKE

William S. Pearson, Baltimore, Md., assignor to Clifton Conduit Company, Inc., Baltimore, Md., a corporation of Maryland

Application May 21, 1948, Serial No. 28,494

14 Claims. (Cl. 117—102)

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This invention relates to improvements in the removal of excess galvanizing metal from freshly galvanized pipe or conduit and more particularly concerns the removal of the excess galvanizing metal while the same is in a fluid condition.

In the galvanizing of pipe such, for example, as is used as conduit for electric wiring, the entire pipe section is immersed in the galvanizing metal comprising molten zinc. The end result desired is a uniform coating of the zinc on the pipe and any excess molten galvanizing metal that remains on the pipe after it has been removed from the galvanizing bath must be removed if stalactiform and lumpy adherences of the excess metal are to be avoided on the exterior of the tube or passage-blocking accumulations on the interior of the tube after cooling and solidification of the metal.

It is therefore an object of the present invention to provide an improved method of and apparatus for removing the excess galvanizing metal from conduit tubing or the like efficiently, rapidly, and safely.

Another object of the invention is to provide an improved method of and apparatus for removing excess galvanizing material from tubular articles operative in conjunction with a conveyor assembly for transporting the articles from the galvanizing tank to a receiving point.

A further object of the invention is to provide an improved system for removing excess galvanizing metal from sections of freshly galvanized conduit and in which means for removing the excess galvanizing metal are controlled in operation by the successive sections of conduit to be treated.

Still another object of the invention is to provide an apparatus for removing excess galvanizing metal from freshly galvanized conduit and including a plurality of interrelated components automatically operable in timed sequence under the control of each individual section of conduit to be treated and following a predetermined path of movement.

Yet another object of the invention is to provide in an improved apparatus for removing excess galvanizing metal from sections of conduit, novel safety means for avoiding danger of injury to adjacent workers from splatter of the excess molten metal incident to its removal from the conduit.

A still further object of the invention is to provide an improved control system for apparatus

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by which excess galvanizing metal is removed from freshly galvanized tubular articles.

It is another object of the invention to provide improved high pressure blow-out means for removing excess galvanizing metal from the interior of freshly galvanized tubular articles.

Other objects, features and advantages of the present invention will be readily apparent from the following detailed description of certain preferred embodiments thereof taken in conjunction with the accompanying drawings, in which:

Figure 1 is a side elevational view, partially in section, of apparatus for practicing the invention;

Figure 2 is a top plan view of the apparatus;

Figure 3 is an enlarged, fragmental sectional plan view taken substantially on the line III—III of Fig. 1;

Figure 4 is a fragmentary vertical sectional view taken substantially on the line IV—IV of Fig. 1;

Figure 5 is an enlarged fragmentary sectional plan view of the excess galvanizing metal removing portion of the apparatus disclosing the relationship of parts at the instant of blow out of a conduit section;

Figure 6 is a vertical sectional view taken substantially on the line VI—VI of Fig. 1;

Figure 7 is an enlarged vertical sectional view taken substantially on the line VII—VII of Fig. 1;

Figure 8 is an enlarged fragmentary elevational view, partially in section, of the pinch feed roll drive arrangement viewed from the opposite side of that shown in Fig. 1;

Figure 9 is a fragmentary sectional elevational view of a modified form of safety valve means that may be used in the apparatus of the present invention;

Figure 10 is a vertical sectional view taken substantially on line X—X of Fig. 9; and

Figure 11 is a schematic view including an electrical diagram for automatic operation of the apparatus.

According to the present invention, excess molten galvanizing material is blown from the interior of a freshly galvanized tubular article and the spatter of excess metal ejected from the tube is confined within a safety chamber. Superheated steam has been found to be an excellent blowing medium. Other heated gaseous medium, such as air or other gas may be used if desired.

The exterior of the tube is freed from excess galvanizing metal by subjecting the same to the action of a fluid swab which may comprise jets of superheated steam directed to converge circu-

larly about the tube while the tube is run through the fluid swab. By preference the external swab is so located that the excess galvanizing metal removed from the tube thereby is received in the aforesaid safety chamber.

The internal fluid swabbing or blow-out and the external swabbing steps of the present method of removing excess galvanizing metal from the tubular article are so related in practice that excess galvanizing metal ejected from the interior of the tube cannot whip around to the exterior of the tube about the exit orifice or cling to the tube extremity.

The excess galvanizing material removal process is carried out in a practical, efficient manner on successive freshly galvanized tubular articles in a timed cyclical sequence controlled by each of the successive tubular articles.

Moreover, removal of excess galvanizing material from the freshly galvanized tubular articles is effected coincident with transportation of the articles from the galvanizing bath from which they have been removed to a delivery or receival point.

When a tubular article such as a conduit 15 of the type which is commonly employed for housing electrical wires in building structures and the like, is removed from a galvanizing bath which may be contained in a tank 16 (Fig. 1) it is, of course, very hot. Excess galvanizing metal must be removed from the duct while it is still above the melting point of the galvanizing metal. Accordingly, it is highly desirable to handle the freshly galvanized sections of conduit 15 mechanically from both efficiency and safety standpoints.

For handling the freshly galvanized sections of duct 15, novel apparatus is provided including a magnetic conveyor comprising a pair of successively operable overhead conveyor rolls 17 and 18, a second pair of successively operable overhead conveyor rolls 19 and 20 spaced in advance of the first mentioned pair of rolls, and a cooperating pair of pinch feed rolls 21 located in the space between the pairs of magnetic conveyor rolls. Support for the conveyor and feed rolls is provided by a supporting framework 22 including spaced parallel top rails 23 and 24 disposed at an oblique angle upwardly. The shafts for the respective overhead conveyor rolls are journalled in bearing assemblies 25 secured to and carried by the frame rails 23 and 24.

All of the overhead conveyor rolls 17, 18, 19 and 20 are driven from a common source of motive power such as an electric motor 27 which may be supported upon a motor bracket 28 on top of a housing 29 disposed intermediate the companion pairs of conveyor rolls. Drive sprockets 30 on the motor shaft have respective sprocket chains 31 and 32 trained thereover, the sprocket chain 31 being further trained over a driven sprocket 33 on the shaft of the roll 17, and the chain 32 being further trained over a driven sprocket 34 carried by the shaft of the roll 19. Sprockets 35 on the shafts of the rolls 17 and 18 have a sprocket chain 37 trained thereover so that these rolls are driven in unison. The shafts of the rolls 19 and 20 have respective sprockets 38 thereon over which is trained a sprocket chain 39 by which these rolls are driven in unison. It may be observed at this point that the various sprockets are of such correlated diameters that all of the conveyor rolls 17, 18, 19 and 20 are driven at the same surface speed so as to avoid any scuffing of the freshly galvanized surfaces of the conduits. The speed of travel is also fast enough to avoid any area chilling of the conduits or overheating of the rolls.

The pinch feed rolls 21 are mounted adjacent to the side of the housing 29 nearest the conveyor rolls 19 and 20. The shafts for the rolls 21 are supported by appropriate bearings 40 (Figs. 3 and 4) carried by brackets 41 supported by the frame 22. For adjustment of the bearings or journals 40 to vary the spacing between the pinch feed rolls 21 and also to effect proper adjustment thereof with respect to the path of movement of the conduit sections 15, suitable adjusting screws 42 may be provided.

Means for driving the pinch feed rolls 21 at the same surface speed as the magnetic conveyor rolls is provided in the form of a sprocket chain 43 (Figs. 1, 2, 4 and 8) trained serpentine fashion over sprockets 44 on the respective shafts of the feed rolls, over an idler sprocket 45 above the upper of the roll shaft sprockets, and over a drive sprocket 47 on a drive shaft 48. Bearings 49 support the shaft 48 upon the frame rails 23 and 24, and the shaft has a sprocket 50 thereon which is in driving mesh with the roll driving motor actuated sprocket chain 32.

By preference the drive sprocket 47 is rotatably bearinged on the shaft 48 and is operatively coupled with the shaft by means of a slip clutch 51 so that in the face of resistance to rotation of the sprocket 47, it can lag behind the shaft 48.

For purposes which will presently appear, means are preferably provided for heating the pinch feed rolls 21. Such means may comprise any of a number of expedients such as flame heating, steam or water heating, but a desirable device comprises electrical resistance heating by means of a controlled electrical resistance heating circuit 21*a* (Fig. 4), including resistance elements 21*b* in the rolls 21. Thus, the rolls 21 are properly heated while in use but not excessively.

All of the conveyor rolls 17, 18, 19 and 20, and the feed rolls 21 are of arcuately annularly grooved periphery with the bights thereof aligned to accommodate each of the conduits 15 in a substantially straight longitudinal path.

In practice, the lower end of the overheat conveyor system is located adjacent to the galvanizing bath, vat or tank 16 and the successive hot duct sections 15 removed from the galvanizing bath are delivered to the magnetic conveyor rolls 17 and 18 to the lower sides of which the ferrous duct sections will adhere and find a centered position as a result of the magnetism of the conveyor rolls. Since the rolls 17 and 18 are driven to move the supported duct section onwardly and upwardly, the leading end of the duct will find its way between the pinch feed rolls 21, the spacing of the latter feed rolls being slightly less from the first conveyor roll 17 than the length of the conduit section 15. By having the first conveyor roll 19 of the final pair of conveyor rolls spaced a shorter distance from the conveyor roll 18 than the length of conduit 15, the advancing conduit section is engaged under the conveyor roll 19 before it leaves the conveyor roll 18 and thus continues undeviatingly in its path, rapidly advancing from the conveyor roll 19 to the conveyor roll 20.

After the trailing end of the conduit section 15 leaves the feed rolls 21, it is allowed to drop down onto a take-away conveyor below the conveyor rolls 19 and 20. In a preferred form the latter conveyor comprises a pair of spaced parallel conveyor chains 52 and 53 (Figs. 1, 5 and 6). The conveyor chains may be of the sprocket type

supported by sprockets 54 carried by brackets 55 attached to the frame rail 24 at the end of the chain conveyor nearest the magnetic roll conveyor, while suitably supported sprockets 57 carry the opposite end of the chain conveyor and intermediate supporting sprockets 58 afford sag preventing support. As best seen in Fig. 6 the portion of the conveyor chains 52 nearest the overhead conveyor is depressed in conformity with the oblique angle of the overhead conveyor, but the tilted angle thus existing in the chain conveyor is safely within the angle of repose of the conduits dropped onto the chain conveyors so that the conduits will not slip therefrom.

The housing 29 may be made from sheet metal in the form of an upright cabinet extending from well below the magnetic conveyor such as from the floor of the room in which the apparatus is located to well above the conveyor, substantially as shown in Fig. 1. The back of the cabinet may be secured to the frame rail 23, while the remaining frame rail 24 may be interrupted to accommodate the cabinet as best seen in Fig. 2. The housing or cabinet 29 provides a complete enclosure and may have a door 59 by which it can be opened for access to the interior as desired. For passage through the housing 29 of the successive sections of conduit, the side walls of the housing are provided with respective apertures 60 and 61 adjacent to the conveyor roll 18 and the feed rolls 21, respectively, and aligned with the diagonal path of movement of the duct sections.

The main purpose of the housing or cabinet 29 is to provide a safety chamber to receive spatter of excess galvanizing metal blown from the newly galvanized conduit sections 15.

Means for removing excess galvanizing metal from the exterior of the conduit sections 15 comprises a fluid swab device 62 in the form of a tubular ring of slightly larger diameter than the outside diameter of the conduit section 15 and disposed concentric with the passage opening 61 in the wall of the housing 29. The swab 62 receives suitable heated fluid such as superheated steam from an appropriate source by way of a duct 63 and has an annular series of jet ports 64 (Figs. 3 and 5) directed on convergent axes into the opening 61 generally opposite to the direction of movement of the conduit sections 15 through the swab ring. The fluid jets from the ports 64 impinge upon the exterior of the conduit 15 in an annular area just inside the adjacent wall of the housing 29, and thus excess molten galvanizing material swabbed from the conduit is received within the housing and all danger of spattering of the excess galvanizing metal is avoided. The swab 62 may operate continuously or it may be operated intermittently as each of the conduit sections 15 enters and remains within the effective range thereof.

For cleaning the interior of the conduit sections 15 of excess galvanizing metal, means are provided for blowing a blast of fluid through the interior of the conduit while the trailing end of the conduit is still within the housing 29. To this end, there is provided a generally gooseneck blow tube 65 (Figs 1, 5 and 7) having a bell-mouth 67 which, as shown in dash line in Fig. 1 and full line in Fig. 5 is adapted to receive the forward extremity of the freshly galvanized conduit 15 to be cleaned for blowing a blast of fluid through the conduit, such fluid preferably comprising a heated gaseous medium such as superheated steam.

Since it is necessary not only to clear the end of the cleaned conduit section 15 from the mouth of the blow tube, but also for the conduit 15 to move a further distance forward to clear the trailing end thereof from the housing 29 and the feed rolls 21, it is desirable to have the blow tube 65 movably mounted with respect to the point at which it engages the forward extremity of the conduit when introducing a cleaning fluid blast into the conduit. To this end, the blow tube 65 is mounted pivotally upon a suitable support which in the present instance comprises a steam pipe 68 carried by a bracket 69 on a frame member 70 preferably comprising an upright metal angle bar. The journal for the blow tube preferably comprises a horizontal sleeve member 71 threaded into a T-fitting 72 on the lower extremity of the blow tube. A plug 73 in the lower end of the T-fitting carries a thermal element 74 in spaced relation opposite the mouth of the steam pipe 68.

The pivotal mounting of the blow tube 65 is such that the blow tube can be rocked into and out of conduit blowing position. Means for effecting this rocking of the blow tube may comprise a steam cylinder 75 carried pivotally by a bracket 77 on the frame 22 and having a reciprocable piston rod 78 pivotally connected at its outer end to the blow tube.

Clean-out fluid need issue from the blow tube 65 only substantially while the blow tube is in operative association with one of the conduit sections 15 to be cleaned. Accordingly, means are provided for admitting blow-out fluid to the blow tube as required, such means herein comprising a gate valve assembly 79 having a relatively elongated operating stem 80 controlled by a piston type steam operator 81. The stem 80 is surrounded throughout the major portion of its length by a finned radiator sleeve 82 for dissipating heat of the superheated steam transmitted from the gate valve to the stem. An appropriate shut off valve 83 may also be interposed in the steam pipe 68 and preferably ahead of the gate valve 79.

Inasmuch as the conduit clean out blast from the blow tube 65 drives through the conduit with great force, as is desirable to effect a thorough clean out of excess molten galvanizing metal, the excess metal leaves the trailing terminal port of the conduit at high velocity, and would, if uncontrolled spatter over a considerable area and to a substantial distance. However, since the trailing end of the conduit is within the housing 29 this spattering is controlled. However, since the conduit entry opening 60 is directly in the line of fire of the ejected excess galvanizing metal, it is highly desirable to provide means for blocking the ejecta from reaching the entry opening. Herein such means comprises a valve or baffle member 84. In a desirable form the baffle member 84 comprises a flexible steel plate anchored at one margin to the back wall of the housing cabinet 29 and adjacent to the exit opening 61 as by means of a clamping bar 85 and bolts or screws 87. The remainder of the baffle plate 84 remains unfastened so that the plate can be flexed into intercepting relation in front of the entry opening 60 after a galvanized conduit 15 has passed through the housing and the trailing end clears the path of movement of the flexible baffle, and the baffle can promptly be swung back out of the path of a succeeding conduit section following the ejectment of excess galvanizing metal from the preceding section.

Means for flexing the baffle plate 84 into and out of ejecta intercepting relation comprises an

angular swing rod 88 pivotally connected to the free end margin of the plate 84 as by having such free margin curled about the rod, while the remainder of the rod projects upwardly and generally forwardly and has a coupling head 89 fixedly secured to an actuating shaft 90 journalled at its lower end in a bearing bracket 91 and projecting upwardly through the roof of the housing 29 The upper end of the shaft 90 has attached thereto a crank arm 91*a* (Figs. 1 and 2) the free end of which is pivotally connected to a piston rod 92 of a steam operated piston and cylinder assembly 93 pivotally carried upon the roof of the housing 29.

An important advantage accruing as the result of using a flexible plate for the baffle member 84 resides in the self-cleaning properties of such plate as it is flexed back and forth. That is, the molten zinc spattered thereagainst as ejected from the successive conduits 15 solidifies thereon and as it accumulates in patches is from time to time flexed off in flakes and lenticular masses and drops to the floor of the cabinet. This avoids the baffle member 84 becoming overweighted with the surplus zinc and also maintains it free for efficient flexing into and out of baffling position.

In order to operate the apparatus efficiently at high speed, means are provided for cyclic functioning of the blow tube 65 and the baffle member 84 controlled by the successive conduit sections 15 to be treated. Herein this is accomplished electrically substantially as shown schematically in Fig. 11. Each of the magnetic conveyor rolls 17, 18, 19 and 20 has associated therewith an electromagnet coil structure 95, which is also shown in Fig. 2 as carried by the respective shaft for each of the conveyor rolls. Electrical energy for the electromagnet structures is derived from a direct current source such as a power line 97, the electromagnets for the coils 17 and 18 being supplied through leads 98 controlled by a master switch 99, while the electromagnet structures for the rolls 19 and 20 are supplied through leads 100 controlled by a master switch 101.

As shown in Fig. 11, the entire system is in an inactive state. Promptly upon closing of the switch 99 magnetizing of the conveyor rolls 17 and 18 occurs and continues until the switch is again opened at the end of a period of continuous operation. At the same time the switch 101 will be closed, but magnetization of the conveyor rolls 19 and 20 will not occur until a relay type switch 102 which interrupts the circuit provided by the leads 100 is closed. The switch 102 is automatically controllable in order to render magnetization of the rolls 19 and 20 selective.

The energizing circuit for the drive motor 27 has not been shown in Fig. 11 since such circuit is independent of the electrical control circuits shown in the control diagram. Hence it will be presumed that at the same time or prior to opening of the switches 99 and 101 the control switch (not shown) for the drive motor 27 can also be closed to energize the motor and start the conveyor roll and feed roll drive into operation.

A cycle of operation involving the cleaning of excess galvanizing metal from one of the conduit sections 15 will now be described. Promptly upon feeding one of the freshly galvanized conduit sections 15 to the undersides of the conveyor rolls 17 and 18, which have now been placed in rotary as well as magnetic operation, the rolls, by their magnetic attraction hold the conduit section to them and cause it to assume a centered relation in the bight of the rolls, while at the same time initiating advance of the magnetically supported conduit section onward toward the feed rolls 21. The leading extremity of the conduit section 15 passes through the entry opening 60 in the spatter housing 29 and while still carried by both of the conveyor rolls 17 and 18 passes on through the exit opening 61 and enters between the pinch feed rolls 21.

Promptly upon engagement of the conduit section by and between the conveyor rolls 17 and 18, a low voltage electrical circuit is completed by way of a transformer 103, which may be of eight to ten volt capacity, for example, an electrical lead 104, a relay type switch 105, an electrical lead 107, the shaft of the conveyor roll 18, through the conveyor roll and the duct section to the conveyor roll 17 and its shaft to ground by way of a ground connection 108. This opens the normally closed relay switch 105 and affords a gap in an electrical circuit including a power lead 109 and a branch electrical lead 110. Since the feed rolls 21 are grounded as indicated at 111 the relay switch energizing circuit completed by the advancing conduit section will remain closed even after the trailing end portion of the conduit leaves the conveyor roll 17.

At the beginning of operation a switch 112 is also closed and this completes a circuit through a power lead 113, an electrical conductor 114, a closed flexible switch arm 115 and a power lead 117 through which the relay switch 102 is energized and closed to complete the magnetizing circuit through the leads 100 for the conveyor rolls 19 and 20. Hence, as the conduit section 15 to be cleaned advances successively to the conveyor rolls 19 and 20 it is engaged and sustained thereby.

Upon engagement of the conveyor roll 19 by the advancing conduit section 15, an energizing circuit is closed from the transformer 103 through the lead 104, a branch lead 118, the shaft of the roll 19 and the roll 19, the conduit 15 and the grounded feed roll 21 to energize a relay type switch 119 for closing a switch gap 120 in the electrical lead 110. When the trailing end portion of the conduit 15 leaves the conveyor roll 18, the energizing circuit for the relay switch 105 is broken, and this switch returns to closed condition, thus closing a circuit by way of the lead 110, and a power lead 121 to energize a solenoid 122 to release a stop bar 123 from the stop lobe of a one lobe control cam 124 carried by a cam shaft 125.

Means are provided tending normally to rotate the cam shaft 125 clockwise as viewed in Fig. 11 and comprising a continuously running motor 127 which may be connected with the alternating current power line through power leads 128 controlled by a master siwtch 129 which is closed at the start of operation of the apparatus. The motor shaft carries a worm 130 which drives a worm wheel 131 relatively rotatably carried by the shaft 125 and having operative connection with the cam shaft by way of a slip clutch 132. Thus, when the stop arm or bar 123 is in stopping relation to the cam 124, the cam shaft 125 is held against rotation while the worm wheel 131 continues to rotate. However instantaneously upon release of the stop bar 123 by energization of the solenoid 122, the cam shaft 125 is set into rotary motion by way of the slip clutch 132.

Rotation of the cam shaft 125 sets into motion a series of progressively acting switch cams which control operation of the blow tube 65. A one lobe first cam 133 which at the start of rotation of the cam shaft 125 holds a flexible contact switch arm

134 on the conductor 114 open advances until the flexible contact snaps past the lobe of the cam and closes the switch to complete an electrical circuit by way of a lead 135 and a power lead 137 to energize a double acting solenoid operator 138 to actuate and open a steam valve 139 which controls operation of the cylinder and piston actuator 81 to open the gate valve 79 and pass a charge of superheated steam to the blow tube 65. Closely following this the cam 133 opens the switch 134 and a second one lobe cam 140 releases the flexible contact arm of a switch 141 to close a circuit by way of the conductor 114 and an electrical lead 142 and the power lead 137 to operate the solenoid 138 in opposite direction to reverse the steam valve 139 and thereby reverse the steam piston actuator 81 and close the gate valve 79.

The blow tube 65 is initially in position to receive the leading end of the advancing conduit section 15 within the bell mouth 67, as shown in full outline in Fig. 11, just before the trailing end leaves the spatter chamber 29. This means that further advance of the conduit section is halted and the feed rolls 21 stalled as permitted by the slip clutch 51. However, the conveyor rolls 19 and 21 continue to operate and it is, therefore, desirable to release the conduit section therefrom to avoid chilling of the conduit or scuffing its external galvanizing coat. Accordingly, just as the leading end of the conduit enters the blow tube mouth 67, the conveyor rolls 19 and 21 are demagnetized by opening of the switch 102 to break the magnetizing circuit 100, a cam 158 on the shaft 125 acting at the proper time to open the switch 115 which controls the switch 102 through the circuit 117. This permits the conduit section to drop away slightly from the conveyor rolls 19 and 20 from the broken line position of Fig. 11 to the dot-dash position. At this point the conduit section is supported by and between the feed rolls 21 and the blow tube 65, the stalled feeding pressure of the feed rolls holding the leading end of the conduit firmly in the blow tube mouth 67.

Timing of the conduit blow-out delivery of a charge of superheated steam to the blow tube 65, as well as the length of the blow tube are so calculated and coordinated that the expanding charge of superheated steam reaches the blow tube mouth 65 an instant before full contact is made between the leading end of the conduit section 15 and the base of the inside of the bell mouth 67. This assures that all air will have been purged from the blow tube 65 prior to projection of the charge of superheated steam into the conduit section 15, and thus utmost excess metal cleaning efficiency of the superheated steam is attained within the bore of the conduit section 15, with respect to both the heat and velocity of the steam. Since the blow tube 65 engages the conduit section 15 just before the trailing end of the conduit gets to the exit port 61 in the spatter cabinet 29 and holds the conduit against further advancing movement for the relatively brief interval required for the shot of superheated steam to traverse the length of the conduit and blow the conduit clear of excess galvanizing metal, all of the excess material swabbed from the conduit is received within the cabinet.

Immediately following the blow-out action, a single lobe cam 143 releases the flexible contact arm of a switch 144 to close a circuit from the conductor 114 through a lead 145, and a branch lead 147 from the power lead 137 to actuate a double acting solenoid operator 148 to turn a steam valve 149 and actuate the piston of the blow tube swing actuator 75 to swing the blow tube 65 out of engagement with the leading end of the conduit section 15. This releases the conduit section for further advance by the feed rolls 21 to clear from the cabinet 29 and the feed rolls and then drop from the feed rolls and the blow tube mouth 67 to the take-away conveyor 52—53.

Then a succeeding one lobe cam 150 on the cam shaft 125 comes rotatively to the point where it releases a resilient contact arm of a switch 151 to close a circuit from the conductor 114 through an electrical lead 152 and through the opposite side of the solenoid operator 148 and the branch lead 147 and the power lead 137 to energize the solenoid for reversing the steam valve 149 and thus reversing the blow tube operator 75 to swing the blow tube 65 back to the blow-out position for receiving the leading end of the next succeeding conduit section 15.

While the blow tube 65 has been operated as described, the deflector plate 84 has also been actuated. To this end, when the switch 105 closed as an incident to breaking of the circuit including lead 107, a circuit is closed including the lead 109, the lead branch 110, a lead 153, and a power lead 154 to energize a two-way solenoid operator 155 which turns a steam valve 157 to effect actuation of the operator 93 for swinging the crank arm 91a. This works the shaft 90 to swing rod 88 for flexing the baffle 84 into safety closing position relative to the entrance opening 60 in the spatter chamber 29. That is, the deflector is swung from the dot-dash position shown in Fig. 3 to the full line position. In view of the relatively high speed with which the conveyor and feed rolls operate, the trailing end of the conduit 15 is rapidly cleared from the path of movement of the deflector 84 ahead of deflectional swinging thereof. Thus the deflector 84 is swung into the safety position just ahead of or coincident with the blow-out action of the blow tube 65.

The deflector 84 is swung back out of the path of the next succeeding conduit section 15 by the closing of a circuit through a branch lead 160, the power lead 109 and the power lead 154 for energizing the solenoid operator 155 in the opposite direction to reverse the steam valve 157. This occurs when the switch 119 reverses as an incident to dropping of the preceding conduit section from the conveyor roll 19 and opening of the relay energizing circuit including the lead 118.

The cam 158 travels onto the point where its lobe releases the resilient contact element of the switch 115, so that this switch closes and effects reenergization of the relay switch 102 to again close the magnetizing circuit for the rolls 19 and 20 whereby to recondition the latter for the next operation. At this same time the holding cam 124 is engaged by the stop arm 123 which in the meantime has dropped back onto the cam 124 by deenergization of the solenoid operator 122 as an incident to opening of its energizing circuit by shifting of the double acting relay switch 119. The control system is now ready for another cycle of operation as initiated and controlled by a succeeding one of the conduit sections 15 to be cleaned.

It will be understood, of course, that the several control cams 133, 140, 143 and 150, are so contoured and adjusted with respect to one another that opening and closing of the respective switches controlled thereby occurs in proper

timed sequence. It will also be understood that all of the several operations described occur in relatively rapid sequence coordinated with the fairly rapid movement imparted to the conduit sections 15 by the conveyor rolls and pinch feed rolls.

If desired, a swinging type of splatter deflector 161 may be utilized as shown in the modified form of Figs. 9 and 10. To this end, the deflector 161 comprises a metal plate which is pivotally mounted on the back wall of the housing 29' by means of a crank member 162 which has an appropriate pin and slot connection with a piston rod 163 of a steam cylinder and piston actuator 164. Thus, the deflector or baffle 161 is adapted to be swung from the clearance position as shown in full line in Fig. 9 relative to the conduit entry opening 60' to the dot dash deflecting, safety position shown to block the entry opening at the time a conduit section 15 is being blown. Actuation of the deflector or baffle 161 may be effected in the same manner as previously described in connection with the flexible deflector 84. In this modified form, furthermore, the exterior of the conduit 15 is adapted to be cleaned by a ring type fluid swab 62' disposed adjacent to the exit opening 61', the same as described in connection with the ring swab 62.

It will, of course, be understood that various details of construction may be varied through a wide range without departing from the principles of this invention and it is, therefore, not the purpose to limit the patent granted hereon otherwise than necessitated by the scope of the appended claims.

I claim as my invention:

1. In combination in apparatus for cleaning excess galvanizing metal from freshly galvanized conduit sections, an overhead conveyor comprising a series of grooved magnetic conveyor rolls, a blow tube operable when the conduit sections have respectively reached a certain position upon the conveyor to engage the leading end of the conduit section and blow a swabbing blast through the interior of the section, and means including an electrical system controlled by the successive conduit sections in association with said conveyor rolls for actuating said blow tube.

2. In combination in apparatus of the character described, a cabinet having an entry opening and an exit opening, means for moving a freshly galvanized article into the entry opening and through the cabinet out of the exit opening, means exteriorly of the exit opening for swabbing the conduit by fluid pressure directed into the exit opening so that spatter of excess galvanizing metal from the article is received within the chamber of the cabinet, means within the cabinet movable into position after the trailing end of the article has passed the entry opening for blocking escape of spattered excess galvanizing metal through said entry opening, and means automatically activated by the excessive articles for moving said spatter blocking means into and out of the spatter blocking position.

3. In combination in apparatus of the character described, a cabinet having an entry opening and an exit opening, means for moving a freshly galvanized article into the entry opening and through the cabinet out of the exit opening, means exteriorly of the exit opening for swabbing the conduit by fluid pressure directed into the exit opening so that spatter of excess galvanizing metal from the article is received within the chamber of the cabinet, and means within the cabinet movable into position after the trailing end of the article has passed the entry opening for blocking escape of spattered excess galvanizing metal through said entry opening, said spatter-blocking means comprising a flexible plate, secured fixedly along one edge thereof at the interior of the chamber, and means for flexing the plate into the splatter-blocking position.

4. In combination in apparatus of the character described, a cabinet having an entry opening and an exit opening, means for moving a freshly galvanized article into the entry opening and through the cabinet out of the exit opening, means exteriorly of the exit opening for swabbing the conduit by fluid pressure directed into the exit opening so that spatter of excess galvanizing metal from the article is received within the chamber of the cabinet, and means within the cabinet movable into position after the trailing end of the article has passed the entry opening for blocking escape of spattered excess galvanizing metal through said entry opening, said spatter-blocking means comprising a baffle plate movable in its plane into and out of spatter-blocking position.

5. In combination in apparatus for removing excess galvanizing metal from freshly galvanized conduit sections, a series of overhead magnetic conveyor rolls, a pinch feed roll set at an intermediate point in and coordinated in operation with the set of magnetic conveyor rolls, means for driving the conveyor rolls and said pinch feed rolls, a spatter cabinet structure interposed between the pinch feed rolls and the adjacent conveyor roll in the trailing direction of the conveyor system, conduit blow-out means operative at the forward end of the conveyor system, electrical means affording conveyor roll magnetizing circuits and cyclically operable circuits controlled by each successive conduit section handled by the conveyor system for operating said blow-out means and for effecting sequential deenergization of the leading conveyor rolls following said pinch feed rolls to drop the conduit sections to make way for succeeding conduit sections, said spatter cabinet structure having a spatter deflector therein movable into position between successive conduit sections to receive excess galvanizing metal blown from each section and operable through the medium of appropriate electrical circuits in said electrical means.

6. In apparatus for removing excess molten galvanizing metal from conduit sections, a movable blow tube having a generally bell-mouth, means comprising a conveyor for moving the successive conduit sections to drive the leading ends of the sections into blow-out relation within said tube mouth, means for delivering a shot of heated swabbing fluid to the blow tube as required, means for moving the tube out of the way of each blown conduit section to permit it to clear away to be replaced by a succeeding section to be blown, and means actuated by the conduit sections for controlling the operation of said fluid delivering means and said blow tube moving means.

7. In a method of removing excess molten galvanizing metal from tubular freshly internally and externally galvanized articles, the steps of blowing the excess molten galvanizing material from the external surface of the article progressively from one end to the opposite end of the article, and while uninterruptedly continuing the external blowing at said opposite end sending a high pressure internal swabbing fluid blast into

said one end for blowing the interior of the article clear of excess galvanizing metal to discharge through said opposite end of the article, whereby said external blowing at said opposite end prevents excess molten metal forcibly ejected by the internal blast from the interior of the article from whipping around onto the external surface of said opposite end of the article.

8. In apparatus for removing excess molten galvanizing metal from tubular freshly internally and externally galvanized conduit, means for advancing the freshly galvanized conduit from the galvanizing tank through a linear path, means interposed stationarily in the path of movement of the conduit and arranged to blow an annular swabbing stream of fluid against the external surface of the conduit and angularly toward the trailing end of the conduit, and means engaging the advancing end of the conduit and halting the advance of the conduit while the external swabbing means is in such relation to the trailing end of the conduit that the swabbing fluid therefrom operates uninterruptedly on the trailing end portion of the conduit, said advancing end engaging means including an internal swabbing fluid discharge opening directed into the advancing end of the conduit to discharge a high pressure swabbing fluid blast into the conduit to travel through the conduit and discharge from said trailing end while the external swabbing fluid continues swabbing action on the trailing end to prevent excess molten metal which is forcibly ejected by the internal swabbing blast from whipping around onto the external surface of the trailing end of the conduit.

9. In apparatus for removing excess molten galvanizing metal from the interior of a freshly galvanized conduit, means for advancing a freshly galvanized conduit in a linear path, a blow tube positioned at the end of said linear path and having a conduit engaging and supporting mouth directed to engage the leading end of the conduit, means operative when the leading end of the conduit is engaged in said mouth to drive a blast of internal swabbing fluid under high pressure into the leading end of the conduit to travel through the conduit and discharge from the trailing end of the conduit, means for moving the blow tube away from the leading end of the internally swabbed conduit to separate the tube from the conduit following internal swabbing of the conduit, and means operatively controlled by the conduit for controlling operations of said blast driving means and said blow tube moving means.

10. In combination in apparatus for removing excess molten galvanizing material from freshly galvanized conduit, a spatter chamber having an entry opening at one side and an exit opening at the other side generally alined with the entry opening, a plurality of overhead magnetic conveyor rolls at said one side of the chamber and arranged to carry a freshly galvanized conduit section through said entry opening and advance the same through the chamber and through said exit opening, another set of conveyor rolls at said opposite side of the spatter chamber for engaging and advancing the conduit from said spatter chamber, an external swab located just outside of said exit opening and directing a stream of external swabbing fluid against the conduit to swab excess molten galvanizing metal from the exterior of the conduit into the spatter chamber, means interposed in the path of movement of the conduit section to engage the advancing end of the conduit section when the trailing end of the conduit section has almost reached said exit opening to halt the advance of the conduit section and drive a blast of high pressure internal swabbing fluid through the conduit section to be ejected forcibly from the trailing end of the conduit section into the spatter chamber, and a flexible splatter-blocking plate attached at one edge within the chamber adjacent to said opposite side of the chamber and having operating means adjacent its opposite edge, said operating means being operable when the trailing end of the conduit section has cleared the same to flex the plate into position between the trailing end of the conduit section and said entry opening to receive splatter from the trailing end of the conduit section, said actuating means being operable thereafter to flex the plate to the initial position thereof to clear the path between said openings for movement through the splatter chamber of a succeeding conduit section.

11. In combination in apparatus for removing excess galvanizing material from freshly galvanized conduit, a blow tube having a mouth constructed to receive the end of a freshly galvanized conduit therein, means for supplying the blow tube with a charge of high pressure internal swabbing fluid to discharge from said mouth into the freshly galvanized conduit therein, and means including a pair of pinch rolls for supporting the conduit with its end in said blow tube, said pinch rolls havng driving means acting on the pinch rolls to urge the same to maintain the conduit under endwise pressure into the blow tube mouth while the pinch rolls remain stationary with the conduit being swabbed.

12. In combination in apparatus for removing excess galvanizing material from freshly galvanized conduit, a blow tube having a mouth constructed to receive the end of a freshly galvanized conduit therein, means for supplying the blow tube with a charge of high pressure internal swabbing fluid to discharge from said mouth into the freshly galvanized conduit therein, and means including a pair of pinch rolls for supporting the conduit with its end in said blow tube, said pinch rolls having driving means acting on the pinch rolls to urge the same to maintain the conduit under endwise pressure into the blow tube mouth while the pinch rolls remain stationary with the conduit being swabbed, said driving means including a slip clutch which enables the pinch rolls to remain in said stationary relationship while the drive means continues to operate.

13. In combination in apparatus for cleaning excess galvanizing metal from freshly galvanized conduit sections, a conveyor for moving each freshly galvanized conduit section in a linear path, a blow tube operable when the conduit section has reached a certain position upon the conveyor to engage the leading end of the conduit section and blow a swabbing blast of fluid through the interior of the conduit section, and means controlled by the conduit section itself for moving the blow tube into and out of conduit section engaging position.

14. In apparatus for removing excess galvanizing metal from the interior of tubular freshly galvanized conduits, a blow tube for blowing a swabbing blast of superheated steam into the respective ends of conduits brought into position relative to the blow tube, means for supplying superheated steam to the blow tube, means for controlling the delivery of superheated steam to the blow tube by shots including a gate valve

having one end of an elongated operating stem thereon and projecting to a substantial distance therefrom, an intermittently operable device on the opposite end of the stem for reciprocating the stem and thereby opening and closing the valve, a heat dissipator about said operating stem, and means operating in synchronism with movement of the conduits for effecting operation of said device.

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