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APPARATUS FOR REMOVAL OF EXCESS SPELTER FROM THE
INTERIOR OF LARGER SIZES OF CONDUIT, OR THE
LIKE, BY MEANS OF HOT PURGING FLUID
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Fig. 3

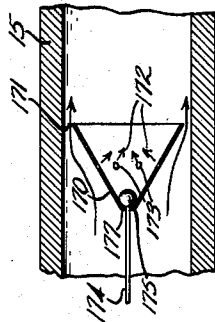


Fig. 2

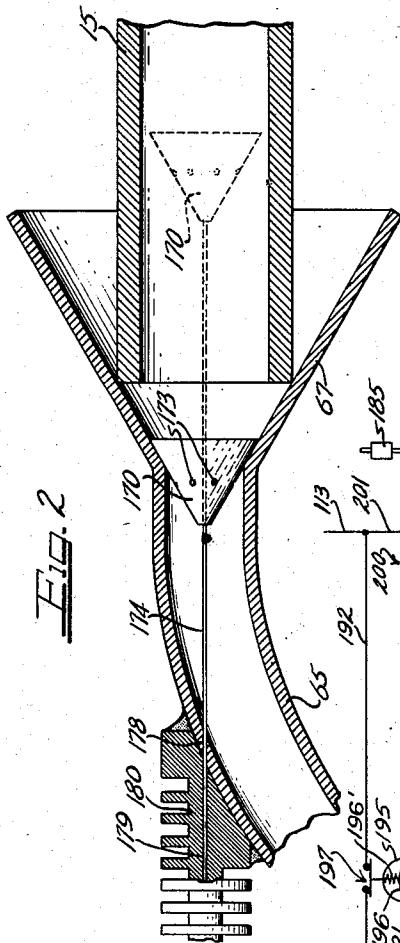
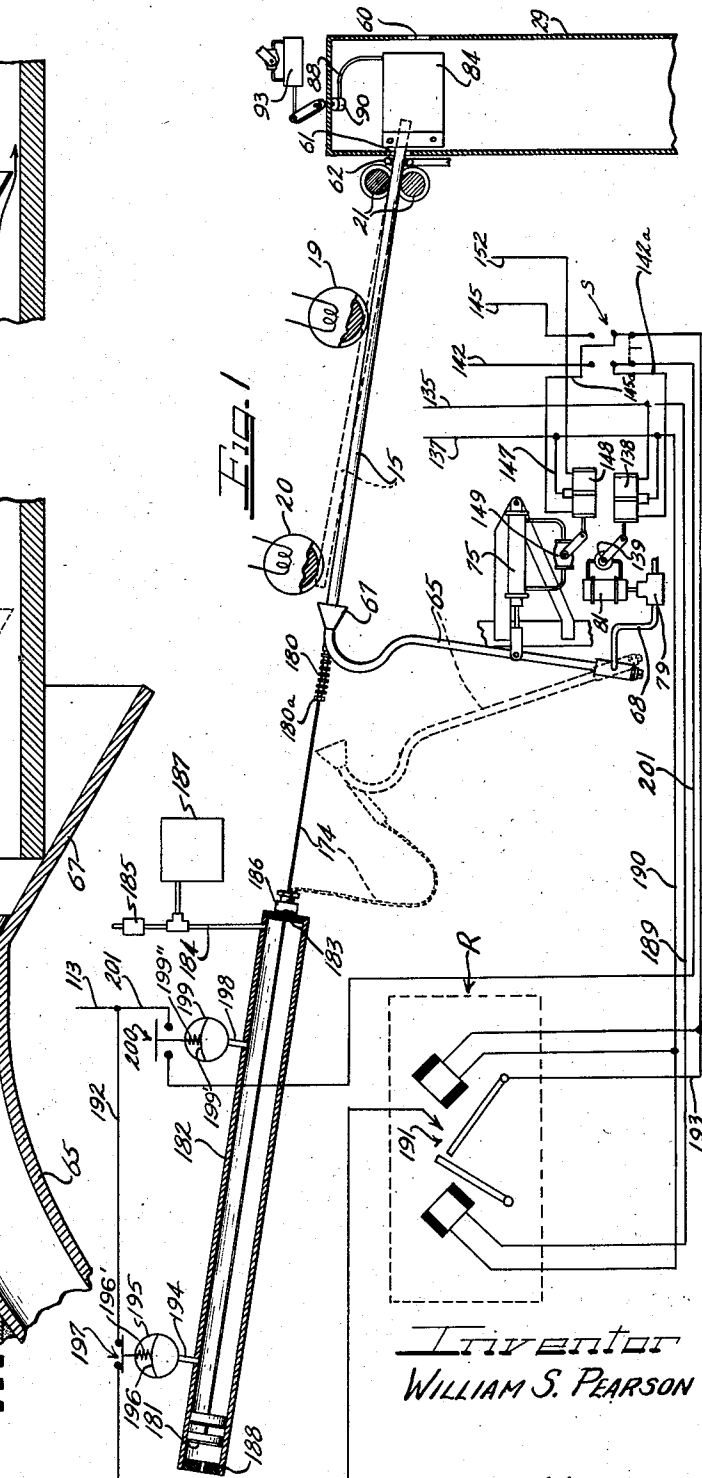


Fig. 1



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APPARATUS FOR REMOVAL OF EXCESS
SPELTER FROM THE INTERIOR OF
LARGER SIZES OF CONDUIT OR THE
LIKE BY MEANS OF HOT PURGING FLUIDWilliam S. Pearson, Baltimore, Md., assignor to
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9 Claims. (Cl. 118—63)

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The present invention relates to improvements in and relating to the removal of excess galvanizing metal in fluid state from the interior of larger sizes of freshly galvanized pipe or conduit.

The present invention is in the nature of a continuation-in-part of or an extension of the invention set forth in my copending application for patent Serial No. 28,494, filed May 21, 1948, now Patent No. 2,606,846, and wherein is described in detail a method of and apparatus for removing excess galvanizing metal from conduit or the like by swabbing the freshly galvanized conduit while the galvanizing metal is still in a heated fluid condition, with a swabbing or purging fluid such as live steam. The interior of the conduit is swabbed by means of a shot of live steam driven therethrough under such velocity that excess galvanizing metal is swabbed and carried thereby rapidly and cleanly from one end of the conduit into a splatter chamber wherein the spray of excess, fluid galvanizing metal is safely collected.

In practice it has been found that the larger sizes of conduit or pipe of from about one inch and larger require an excessive volume and velocity of live steam for internal swabbing due to the large cross sectional area of the inside diameter. Since the excess fluid galvanizing metal which it is desired to remove is all located on the wall surface of the pipe or conduit, only the surface contacting swabbing fluid does any profitable work and a large volume of the swabbing fluid inwardly from the internal surface of the conduit functions solely in its expansion pressure to maintain a swabbing force upon the peripheral layer of the swabbing fluid as it travels through the pipe.

It is accordingly an important object of the present invention to provide improvements in the removal of fluid galvanizing metal from freshly galvanized pipe or conduit whereby to increase the efficiency of the internal swabbing action of a swabbing fluid relying upon the velocity of the fluid to remove excess galvanizing metal from the internal wall surface of the pipe or conduit.

Another object of the invention is to provide an improved means for swabbing the interior of larger sizes of freshly galvanized pipe or conduit.

A further object of the invention is to provide improved means for controlling wiping action upon the wall of the passage.

Other objects, features and advantages of the present invention will be readily apparent from the following detailed description of a preferred

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embodiment thereof taken in conjunction with the accompanying drawings, in which:

Figure 1 is a fragmentary schematic sectional elevational view of apparatus for removing excess galvanizing metal in fluid state from freshly galvanized pipe or conduit, according to the present invention, and showing certain electrical operating diagrams.

Figure 2 is an enlarged fragmentary longitudinal sectional view through the mouth portion of the blow tube of the apparatus; and

Figure 3 is a fragmentary longitudinal sectional view through a section of conduit showing the swabbing fluid control cone of the apparatus in operation.

Inasmuch as except for the improvements involved in and relating to the efficient swabbing of larger sizes of pipe or conduit, the apparatus with which the present invention is concerned is substantially the same as described in detail in my aforesaid copending application, only so much of the apparatus which is common to the disclosure in the application will be described herein as will afford a thorough understanding of the improvements or extension of the idea involved in the application, and reference may be had to the disclosure of the copending application for further details.

To assist in correlating the disclosure of the present application with that in my said copending application, similar reference numerals will be used herein wherever practicable to identify corresponding elements in the disclosure of the copending application. Thus, freshly galvanized sections of ferrous pipe or conduit while still hot enough to maintain the galvanizing metal in a substantially fluid state are successively delivered to and transported at an upwardly oblique angle by means of an overhead magnetic conveyor including, among others, successively operable grooved magnetic conveyor rolls 19 and 20 which are suitably driven in unison. Operable in advance of the conveyor roll 19 is a cooperating pair of pinch feed rolls 21 which are located just outside of a spatter chamber 29 which has in the respective side walls thereof an entry opening 60 and an exit opening 61 through which the sectional conduit 15 travels under the impulsion of the magnetic conveyor and the feed rolls 21.

Between the spatter cabinet 29 and the feed rolls 21 the conduit section 15 passes through a ring-type external fluid swab 62 from which an encircling series of jets of suitable heated swabbing fluid such as superheated steam blows ex-

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cess galvanizing metal from the exterior of the conduit section as it advances therethrough, the excess galvanizing metal being directed by the force of the swabbing fluid jets into the spatter chamber 29.

Interior cleaning or swabbing of the successive sections of freshly galvanized conduit 15 is effected through the medium of a blow tube 65 which, as shown in full outline and dash outline positions is rockably mounted for receiving the leading end of the conduit section for blow out or swabbing purposes and then to release the same to clear the apparatus for the next succeeding conduit section to be cleaned. The blow tube 65 has a bell mouth structure 67 within which the leading end of the conduit section is received in substantially fluid tight engagement, being held in such engagement by the advancing action of the feed rolls 21 after dropping from the dash line position of the conduit as shown in Fig. 1 to the full line position as permitted by coordinated demagnetization of the conveyor rolls 19 and 23. Superheated steam for cleaning excess galvanizing metal from the interior of the conduit is supplied to the blow tube 65 from a suitable source through a steam pipe 68 under the control of a valve assembly 79 having associated therewith operating means such as a piston type fluid-actuated operator 81.

Ejected excess galvanizing metal leaves the trailing end of the conduit 15 which is still just inside the exit opening 62 of the spatter chamber 29, a flexibly movable baffle or shield 84 being interposed between the conduit and the entry opening 80 to prevent escape of the spatter of excess galvanizing metal. A swing rod 88 actuated by a shaft 90 operated by a piston and cylinder assembly 93 is provided for coordinated operation of the flexible shield 84.

Following clean-out of the conduit section 15, the blow tube 65 is rocked out of engagement therewith by means such as a fluid operated cylinder and piston device 75. When the cleaned conduit 15 has been cleared from the apparatus, the blow tube 65 is returned for another cycle of operation.

According to the present invention larger sizes of freshly galvanized pipe or conduit of one inch diameter and larger are efficiently internally fluid swabbed in spite of their large inside diameter and thus cross sectional flow area. To this end, the internal swabbing fluid is confined in its travel through the passage to be cleaned to an annular swabbing path hugging the surface being swabbed and traveling at high velocity. As a result, very economical use is made of the swabbing fluid and high efficiency in removal of excess galvanizing metal is attained.

Having reference to Figs. 2 and 3, means for effectuating the improved method of the present invention comprises a swabbing fluid controlling member 170 of slightly smaller diameter than the internal diameter of the conduit section 15 to be swabbed and constructed and arranged to provide a partial plug or restrictor within the conduit passage to travel down the passage under the impulsion of the swabbing fluid and in advance of the principal volume of the fluid but under sufficient restraint to permit and encourage the escape of some of the swabbing fluid thereby under increased acceleration. To this end, the swabbing control member 170 preferably comprises a cone shaped device of a cone size which may be generally similar in proportions to the apex of the internal frustum of the

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bell mouth 67 so that in the non-operating condition of the apparatus the control member 170 will seat at the neck of the blow tube mouth concentrically and amply clear of the end of the conduit 15 received concentrically within the bell mouth 67. The control cone 170 may be a hollow cone, or other suitable form.

Under the impulsion of the swabbing fluid, the swab controlling member 170 leaves its seat and moves ahead of the swabbing charge into the passage within the conduit 15, substantially as shown in dash outline in Fig. 2. By reason of its conical shape, with the apex directed toward the swabbing charge, the pressure of the swabbing fluid maintains the control member 170 substantially concentric within the conduit passage. As best seen in Fig. 3, this leaves a narrow annular clearance 171 between the base edge of the control member 170 and the inner wall surface of the conduit. By holding the control member 170 under some restraint while traveling with the swabbing fluid charge, an annular stream of the swabbing fluid will escape through the clearance or gap 171 under high velocity, accelerated by the substantially Venturi action to which it is subjected in making its escape. Since the escaping swabbing fluid must necessarily hug the inner wall surface of the conduit, any excess molten galvanizing metal on such wall surface is blown along with the escaping, substantially conduit-wall-wiping annular layer of the swabbing fluid in advance of the control plug or member 170. This efficient swabbing action continues on throughout the length of the conduit 15 until the control plug member 170 reaches the trailing end of the conduit and releases the remainder of the impelling charge of swabbing fluid therebehind after the excess internal galvanizing metal has been purged from the conduit and expelled into the spatter chamber 29.

In order to avoid backing up of excess galvanizing metal driven ahead of the deflector cone plug 170 into the area inside of the tubular, conduit-wiping swabbing stream indicated by directional arrows in Fig. 3, some of the swabbing fluid is released under high velocity through the interior of the cone 170. For example, this may be accomplished by releasing the fluid in the form of a uniform series of small high velocity crossing or converging jets 172 emitted through an annular series of small jet ports 173 provided in the wall of the control member intermediate its ends. The combined volume and high velocity of the jets 172 creates a fluid wall or barrier against backing up of the excess galvanizing metal and advances with the annular swabbing stream to drive the excess galvanizing metal ahead of the control plug 170 as it advances through the conduit passage.

Upon completion of the swabbing travel of the control deflector cone member 170, it is promptly and rapidly returned to its starting position, seated within the throat of the blow tube 65. For this purpose, the apex of the member is connected to a control cable 174 as by means of an anchoring knob or ball 175 secured to the end of the cable and seated in relatively universally adjustable relation within the internal apex of the hollow cone member, with the cable extending on through an apical clearance aperture 177 in the cone. The cable 174 may comprise a single strand of wire of appropriate flexibility. From the control cone 170, the cable 174 extends through a guide aperture 178 in the curved wall of the goose-neck upper portion of the blow tube,

the passage provided by the aperture 178 being coaxial with the bell mouth 67 and communicating with an axial passage 179 through a finned radiator cylinder 180 through which the cable 174 extends in heat transfer slidable relation for dissipating heat of the superheated steam transferred to the cable in operation. A steam-sealing packing gland 180a is provided about the cable 174 at the outer end of the radiator passage 179.

The opposite end of the cable 174 is attached to a piston structure 181 slidably operable longitudinally within a substantially elongated hollow cylinder 182 closed hermetically at its opposite ends and providing a slidable bearing passage 183 at its forward end for the cable. The piston 181 is normally urged towards the rear end of the cylinder 182 pneumatically under predetermined pressure, compressed air from a suitable source being delivered into the forward end of the cylinder through a duct 184 including a metering valve unit 185. Thus, the piston 181 normally is held and urged pneumatically to the left as seen in Fig. 1 to hold the control cone 170 to its blow tube seat. The amount of air pressure maintained in the cylinder 182 will vary, depending upon the size of the pipe to be blown for excess galvanizing metal clean out, and in practice has varied from 5 to 20 pounds per square inch, for the various sizes of pipe. A pressure sealing packing gland 186 surrounds the cable 174 at the outer end of the bearing passage 183.

During the conduit swabbing operation, the pneumatic pressure within the cylinder 182, acting on the piston 181 acts as a restraining medium or brake upon the control cone 170. Thus, as the cone 170 is driven down the tubing being swabbed, it draws the piston 181 through the medium of the cable linkage 174 forwardly in the cylinder 182 and gradually compresses the air within the cylinder, excess pressure being accommodated in an air chest 187 communicating with the air duct 184 downstream from the metering valve 185. This effects a gradual pneumatic brake upon the control cone 170, reaching the highest braking compression at the end of the swabbing stroke of the control cone. Since the rear end of the cylinder 182 is open to atmosphere through a vent 188, the moment the driving force of the swabbing fluid is dissipated at the conclusion of the swabbing stroke, the pneumatic cushion reacts within the cylinder 182 to drive the piston 181 rearwardly at relatively high speed to snap the control cone 170 in return to its starting position clear of the conduit section 15. The final interval of return travel is accomplished without undue force since the built up pressure cushion in excess of the air pressure supply is dissipated by the displacement afforded within the cylinder 182 by return of the piston. It will thus be apparent that at all times the control cone 170 and the mechanism involved therewith is substantially saved from operating shocks by the cushioning effect of the pressure fluids in the system.

By reason of its flexibility, the cable 174 can fall slack as a loop, shown in dash outline in Fig. 1 when the blow tube 65 is rocked clear of the swabbed conduit section 15.

By preference, means are provided for controlling at least certain of the coordinated functions of the various elements of the swabbing apparatus as an incident to operation of the air cylinder 182. For this purpose, certain electrical circuits are provided in addition to and integrant with the electrical control system substantially

as described in my aforesaid copending application. These integrant circuits will be described in operative order in a cycle of operation.

At the beginning of the cycle of operation, an electrical circuit including leads 135 and 137 energizes a double-acting solenoid operator 138 to actuate a fluid valve 139 to actuate the cylinder and piston actuator 81 to open the steam valve 79 and pass a charge of superheated steam to the blow tube 65.

Connected with the electrical leads 135 and 137 are electrical leads 189 and 190, respectively, functioning upon closing of the circuit through the leads 135 and 137 to energize one side of an interlocking relay assembly R and close a switch 191. This closes a break in an electrical circuit including a power lead 113 which is connected with lead 135, a lead 192, a lead 193, a lead 145a, a lead 147 and the lead 137. However as the charge of superheated steam supplied to blow tube 65 propels the control cone 170 down the tube section 15 being swabbed, the air piston 181 passes a pressure duct 194 leading from the cylinder 182 to a pressure responsive switch operator unit 195. This unit 195 may have a diaphragm 196 which operates in the presence of air pressure to maintain an electrical switch 197 in the electrical lead 192 closed, but upon drop in pressure allows the switch to open to break the electrical circuit including the lead 192 and the switch 191 so as to keep such circuit open until the swabbing operation has been completed. A spring 196' may act on the diaphragm 196 to maintain the switch 197 open when a pressure drop occurs in the unit 195.

As the piston 181 nears the end of its compression stroke, it passes a pressure take off 198 leading to a pressure responsive operator 199 which may have a diaphragm 199' in control of a switch 200 which diaphragm in the presence of air pressure maintains the switch 200 open but when the pressure drops allows the switch to complete an electrical circuit from the power lead 113 through an electrical lead 201, and an electrical lead 142a, and the electrical lead 137 to energize the double acting solenoid 138 to reverse the fluid control valve 139 to actuate the operator 81 and shut off the live steam to the blow tube 65. A spring 199'' may act on diaphragm 199' to move it to close the switch 200 when a pressure drop occurs in the operator 199. Since shutting off of the live steam supply releases the swabbing cone 170 for return under the influence of the pneumatic piston 181 the latter promptly returns past the pressure take off 198, the switch 200 remains closed only momentarily and the circuit closed thereby is promptly broken.

When the pneumatic piston 181 returns past the pressure duct 194, the pneumatic switch operator responds to the air pressure in the cylinder 182 to close the switch 197 and thus complete the circuit including the lead 192 and the switch 191 whereby the solenoid operator 138 is energized and the valve 149 operated thereby to actuate the fluid-responsive operator 75 and rock the blow tube 65 to the dash line position in Fig. 1 away from the supported and now scavenged and excess-metal-free conduit section 15 to clear the latter from the machine.

Concurrently with clearance rocking of the blow tube 65, the opposite side of the relay assembly is energized to open the switch 191 and thus deenergize the circuit which initiated rocking of the blow tube.

Automatically thereafter a circuit is closed through a lead 152 and the branch lead 147 from the power lead 137 to energize the double acting solenoid 148 in reverse and reverse the control valve 149 for reversing operation of the operator 15 to rock the blow tube 65 for return to blow-out position where it will receive the succeeding conduit section 15 to be cleaned of excess galvanizing material.

It will be understood, of course, that all of the various successive operations are properly coordinated and timed in each cycle of operation.

In order to adapt the electrical operating system for use when the pneumatic actuator and brake for the swabbing fluid control member 170 is not in use, as when smaller sizes of tubing are being swabbed and the blow tube 65 replaced by a similar blow tube not equipped with the control and deflector member 170, a double-throw, double-pole switch S is provided for selectively disconnecting the leads 142a and 145a from the leads 231 and 193 and effecting electrical connections with leads 142 and 145, respectively. The latter leads are part of control circuits which are described in my beforementioned copending application.

From the foregoing it will be apparent that an extremely efficient tube swabbing system has been provided which is especially suitable for larger sizes of tubing and that this is accomplished with fairly simple apparatus. In a practical machine utilizing the present invention quite satisfactory results have been obtained where superheated steam of about 1000° F. under only 100 lb. per square inch pressure has been utilized for the scavenging operation. The interior of tubing cleaned by this method presents a substantially mirror finish appearance.

While on first impression it might seem likely that the swabbing deflector cone 170 might contact and score the internal galvanized surface of the tube, there is actually no contact between the cone and the wall of the conduit if the machine is properly adjusted. During swabbing travel of the deflector cone the high pressure swabbing fluid metered past the cone provides a positive live centering cushion about the cone. During return travel of the cone, the residual swabbing fluid behind the cone provides a static centering cushion by compression through which the cone is rapidly retracted.

I claim as my invention:

1. In combination in apparatus for removing excess galvanizing metal from freshly galvanized conduit, a blow tube having a bell mouth receptive of the end of a conduit section, means for supporting a conduit section with an end thereof in said mouth, means for delivering superheated steam to said blow tube, a deflector cone supported at the throat of said bell mouth and having a flexible element extending therefrom, said element being connected to a piston, a pneumatic cylinder operatively housing said piston and spaced from said blow tube concentric with the axis of said cone, means normally supplying said cylinder with compressed air to urge said piston in a direction to place said flexible element under tension and draw said deflector cone into said throat, said deflector cone being adapted to be impelled by the superheated steam from its seat in said throat into and through the conduit section under pneumatic restraint to confine the superheated steam to a tubular swabbing layer along the internal wall of the conduit, means operable at the conclusion of swabbing action to

shut off the superheated steam so that the compressed air acting on the piston will cause the latter and said flexible element to return said deflector to its blow tube throat seat, means for rocking said blow tube into and out of conduit-engaging position, and means controlled by pressure and pressure drop within said cylinder in the operation of said piston to control operation of said blow tube rocking means.

2. In combination in apparatus for removing excess galvanizing metal from freshly galvanized conduit, a blow tube having a bell mouth receptive of the end of a conduit section, means for supporting a conduit section with an end thereof in said mouth, means for delivering superheated steam to said blow tube, a deflector cone supported at the throat of said bell mouth and having a flexible element extending therefrom, said element being connected to a piston, a pneumatic cylinder operatively housing said piston and spaced from said blow tube concentric with the axis of said cone, means normally supplying said cylinder with compressed air to urge said piston in a direction to place said flexible element under tension and draw said deflector cone into said throat, said deflector cone being adapted to be impelled by the superheated steam from its seat in said throat into and through the conduit section under pneumatic restraint to confine the superheated steam to a tubular swabbing layer along the internal wall of the conduit, means operable at the conclusion of swabbing action to shut off the superheated steam so that the compressed air acting on the piston will cause the latter and said flexible element to return said deflector to its blow tube throat seat, and means for rocking said blow tube into and out of conduit-engaging position.

3. In combination in apparatus for purging hot spelter from the interior of a freshly galvanized conduit, a blow member having a bell mouth receptive of the end of a conduit section, means for supporting a conduit section with an end thereof in said mouth, means for delivering heated purging fluid to said bell mouth to travel down the interior of the conduit section for purging excess hot spelter therefrom, a deflector member supported in said bell mouth and having a flexible element extending therefrom, said element being connected to a piston, a pneumatic cylinder operatively housing said piston and spaced from said blow member, means normally supplying said cylinder with compressed air to urge said piston in a direction to place said flexible element under tension and draw said deflector member into said mouth, said deflector member being adapted to be impelled by the purging fluid from said mouth into and through the conduit section but under pneumatic restraint to confine the purging fluid to a tubular swabbing layer along the internal wall of the conduit section, and means operable at the conclusion of swabbing action as determined by a position of the deflector member in said conduit remote from said mouth to shut off the purging fluid so that the compressed air acting on said piston will cause the latter and said flexible element to return said deflector member to said mouth.

4. In combination in apparatus for purging hot spelter from the interior of a freshly galvanized conduit, a blow member having a bell mouth receptive of the end of a conduit section, means for supporting a conduit section with an end thereof in said mouth, means for delivering heated purging fluid to said bell mouth to travel

down the interior of the conduit section for purging excess hot spelter therefrom, a deflector member supported in said bell mouth and having a flexible element extending therefrom, said element being connected to a piston, a pneumatic cylinder operatively housing said piston and spaced from said blow member, means normally supplying said cylinder with compressed air to urge said piston in a direction to place said flexible element under tension and draw said deflector member into said mouth, said deflector member being adapted to be impelled by the purging fluid from said mouth into and through the conduit section but under pneumatic restraint to confine the purging fluid to a tubular swabbing layer along the internal wall of the conduit section, and means operable at the conclusion of swabbing action as determined by a position of the deflector member in said conduit remote from said mouth to shut off the purging fluid so that the compressed air acting on said piston will cause the latter and said flexible element to return said deflector member to said mouth, said last mentioned means including an electrical circuit and a pneumatic pressure-sensitive switch in control of the circuit and communicating at a predetermined point with said cylinder to be subject to the pressure within the cylinder until the deflector member reaches said remote position and then subjected to pressure drop effecting actuation of the switch to energize said circuit for effecting the shutting off of the purging fluid.

5. In combination in apparatus for removing excess spelter from freshly galvanized conduit, a blow tube pivotally mounted and having a bell mouth receptive of the end of a conduit section, means for rocking said blow tube into and out of conduit section receiving position, said blow tube being pivoted out of conduit section receiving position in a direction to dispose the bell mouth upwardly, means for supporting a conduit section with an end thereof in said mouth, means for delivering heated purging fluid to said blow tube for delivery through said mouth into the conduit section to be purged, a deflector member captive at the end of a flexible element and normally seated in said bell mouth with the flexible element extending substantially beyond the back of the bell mouth, means operative on the end of the flexible element remote from the bell mouth normally applying tensioning to the flexible element when the blow tube is in the conduit-receiving position and remaining operative while the deflector member travels down the interior of the conduit for restricting the interior of the conduit progressively as the restrictor member travels through the conduit section under impulsion of the purging fluid, and means for shutting off the purging fluid when sufficient purging fluid has been delivered into the conduit to effect travel of the deflector member to the opposite end of the conduit section being purged, said tension-applying means being spaced a substantial distance from the blow tube and said flexible element falling slack between the blow tube and said tension-applying means when the blow tube is rocked away from the conduit section after purging has been completed and the deflector member has been returned by said tensioning means into the bell mouth.

6. In combination in apparatus for swabbing the interior of a tubular member, a blow tube for delivering a charge of swabbing fluid into one end of a tubular member in registration with

the blow tube, a deflector member supported by the blow tube for impulsion by the swabbing fluid through the tubular member to be swabbed, a piston connected to said deflector member, a cylinder operatively housing said piston, means normally supplying said cylinder with gas under pressure to urge said piston in a direction to draw said deflector member toward said blow tube, said piston and cylinder restraining movement of said deflector member through the tubular member by compression of gas in said cylinder by said piston to confine the swabbing fluid to a tubular swabbing layer along the internal wall of the tubular member, and means operable at the conclusion of swabbing action to shut off the swabbing fluid so that the compressed gas acting on said piston will cause the latter to return said deflector member to its initial position.

7. In combination in apparatus for swabbing the interior of a tubular member, a blow tube for delivering a charge of swabbing fluid into one end of a tubular member in registration with the blow tube, a deflector member supported by the blow tube for impulsion by the swabbing fluid through the tubular member to be swabbed, a piston connected to said deflector member, a cylinder operatively housing said piston, means normally supplying said cylinder with gas under pressure to urge said piston in a direction to draw said deflector member toward said blow tube, said piston and cylinder restraining movement of said deflector member through the tubular member by compression of gas in said cylinder by said piston to confine the swabbing fluid to a tubular swabbing layer along the internal wall of the tubular member, a chest operatively connected with said cylinder for accommodating excess pressure in said cylinder during compression of gas therein, and means operable at the conclusion of swabbing action to shut off the swabbing fluid so that the compressed gas acting on said piston will cause the latter to return said deflector member to its initial position.

8. In combination in apparatus for swabbing the interior of a tubular member, a blow tube for delivering a charge of swabbing fluid into one end of a tubular member in registration with the blow tube, a deflector member supported by the blow tube for impulsion by the swabbing fluid through the tubular member to be swabbed, a piston connected to said deflector member, a cylinder operatively housing said piston, means normally supplying said cylinder with gas under pressure to urge said piston in a direction to draw said deflector member toward said blow tube, said piston and cylinder restraining movement of said deflector member through the tubular member by compression of gas in said cylinder by said piston to confine the swabbing fluid to a tubular swabbing layer along the internal wall of the tubular member, and means operable at the conclusion of swabbing action as determined by a position of the piston in said cylinder to shut off the swabbing fluid so that the compressed gas acting on said piston will cause the latter to return said deflector member to its initial position.

9. In combination in internal freshly galvanized conduit purging apparatus of the character described, means for delivering a charge of heated purging fluid under pressure into one end of a freshly galvanized conduit section, a hollow conical restrictor and deflector member having a large end opening forwardly and a smaller end directed rearwardly, and yieldable restraining

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means connected to the smaller rear end of the member and operative to yield in response to fluid pressure against the back of the member so that the member is movable under predetermined restraint through the conduit section in advance of the charge of purging fluid to restrict the passage of the conduit section to a limited gap the other boundary of which is the inner surface of the wall of the conduit section to be swabbed, said deflector member having a plurality of small jet-creating ports extending through the conical wall thereof and disposed in a pattern spaced substantially rearwardly from the forward edge of the member to by-pass jets of the purging fluid in converging relation to the forward open end of the deflector member radially inwardly from said gap to provide a fluid barrier against back-up of spelter progressively purged from the inner surface of conduit and tending to accumu-

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late in front of the deflector member as it progresses through the conduit section during a purging operation.

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