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HYDRAULIC PRESS FOR MAKING TUBES OUT OF AN INGOT.

APPLICATION FILED DEC. 8, 1910.

1,049,641.

Patented Jan. 7, 1913.

8 SHEETS—SHEET 1.

Fig. 2.

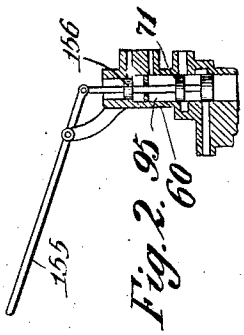

Fig. 1.

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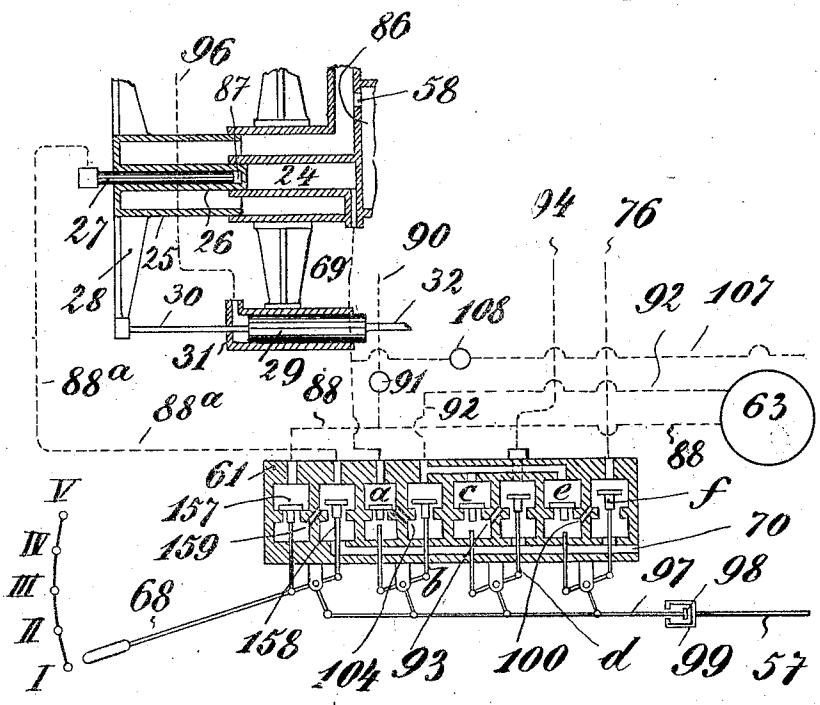
8 SHEETS—SHEET 2.

Fig. 1ᵃ



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8 SHEETS—SHEET 3.

Fig. 3.

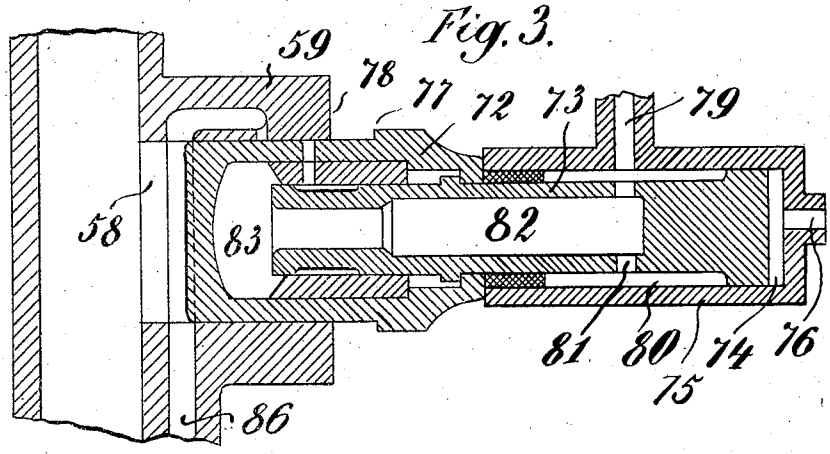


Fig. 4.

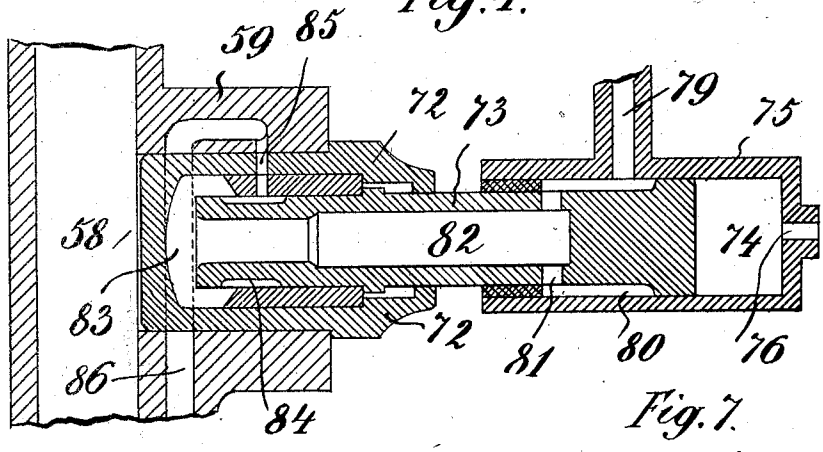


Fig. 7.

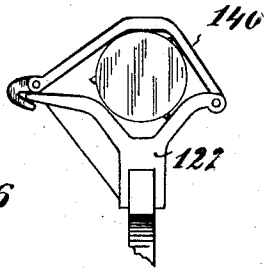


Fig. 5.

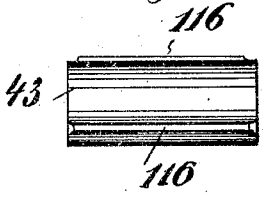
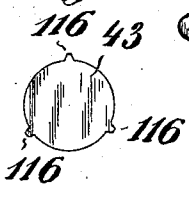


Fig. 6.



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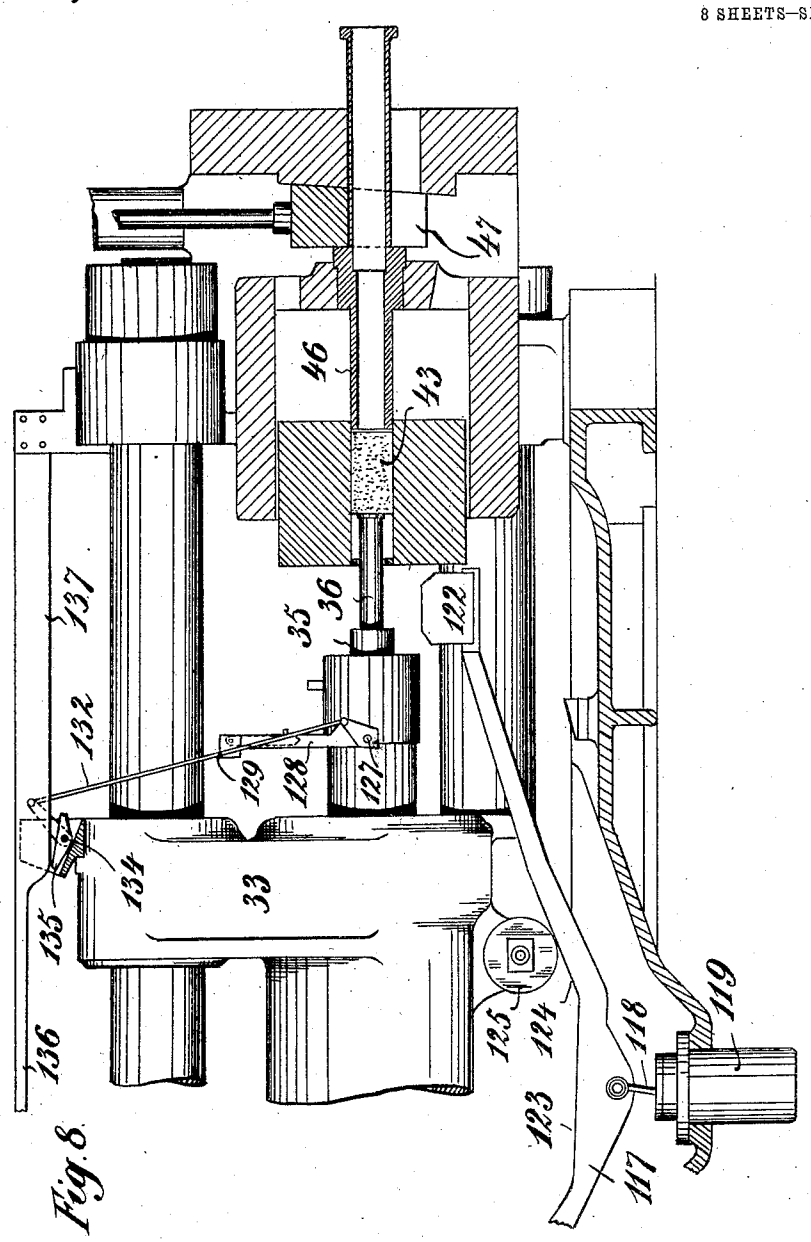

Fig. 8.

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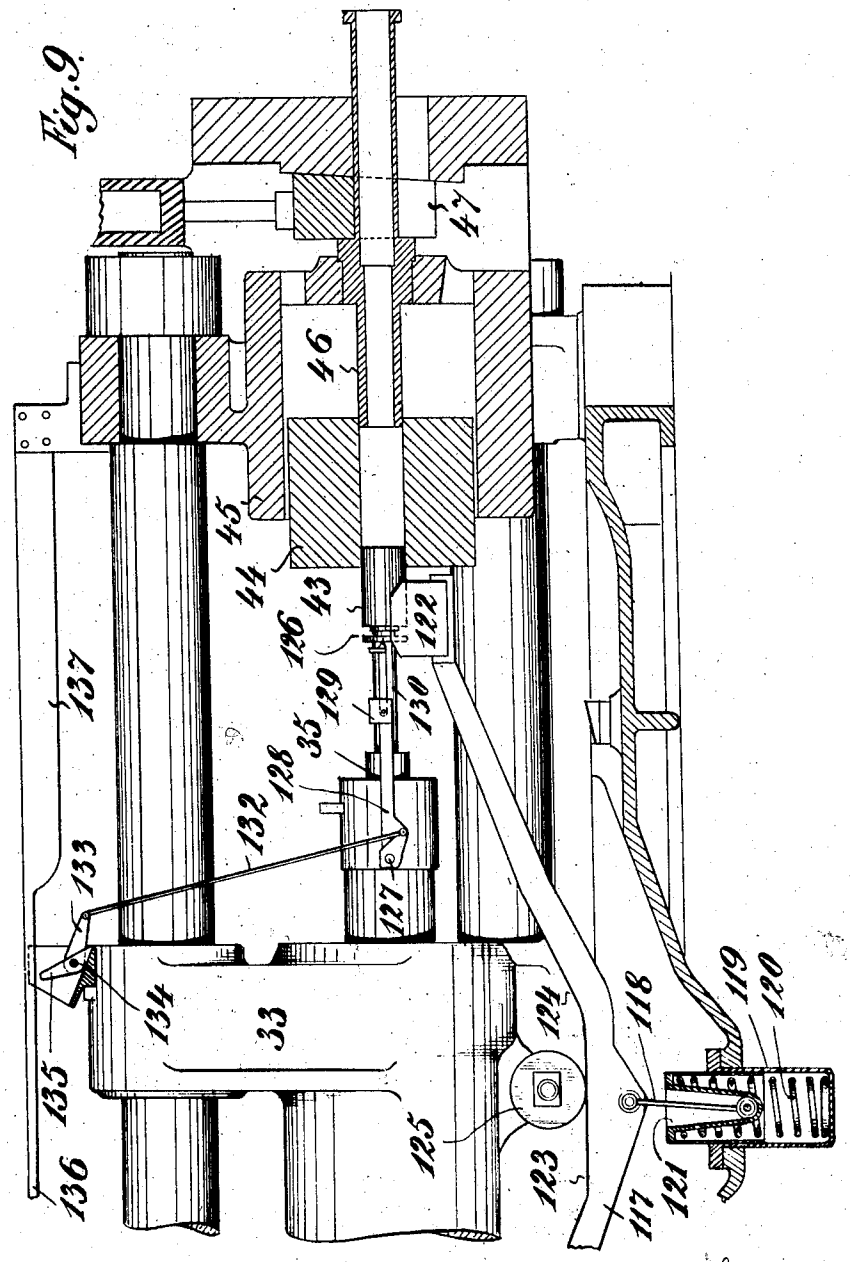
8 SHEETS—SHEET 5.

Fig. 9.



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8 SHEETS—SHEET 6.

Fig. 10.

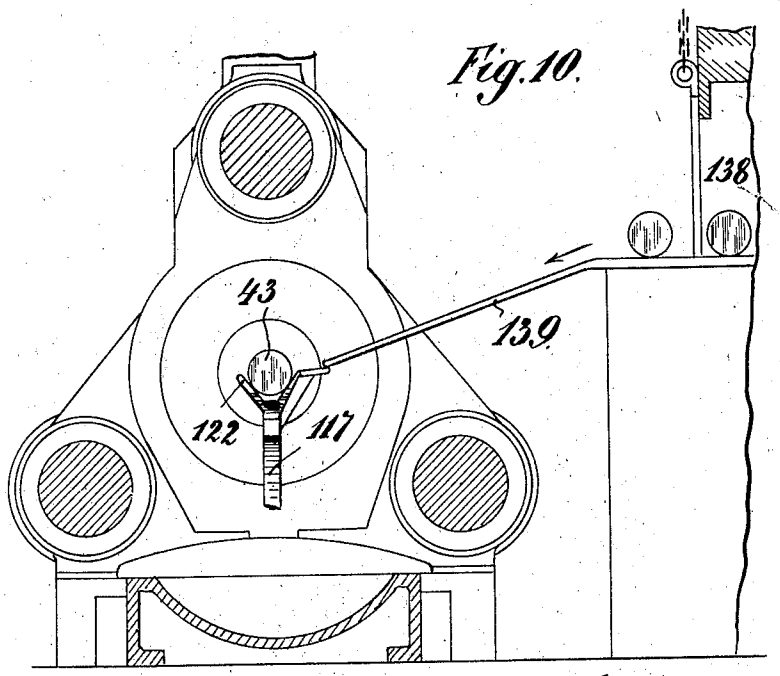

Fig. 12.

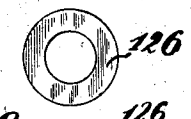

Fig. 11.

Fig. 13.

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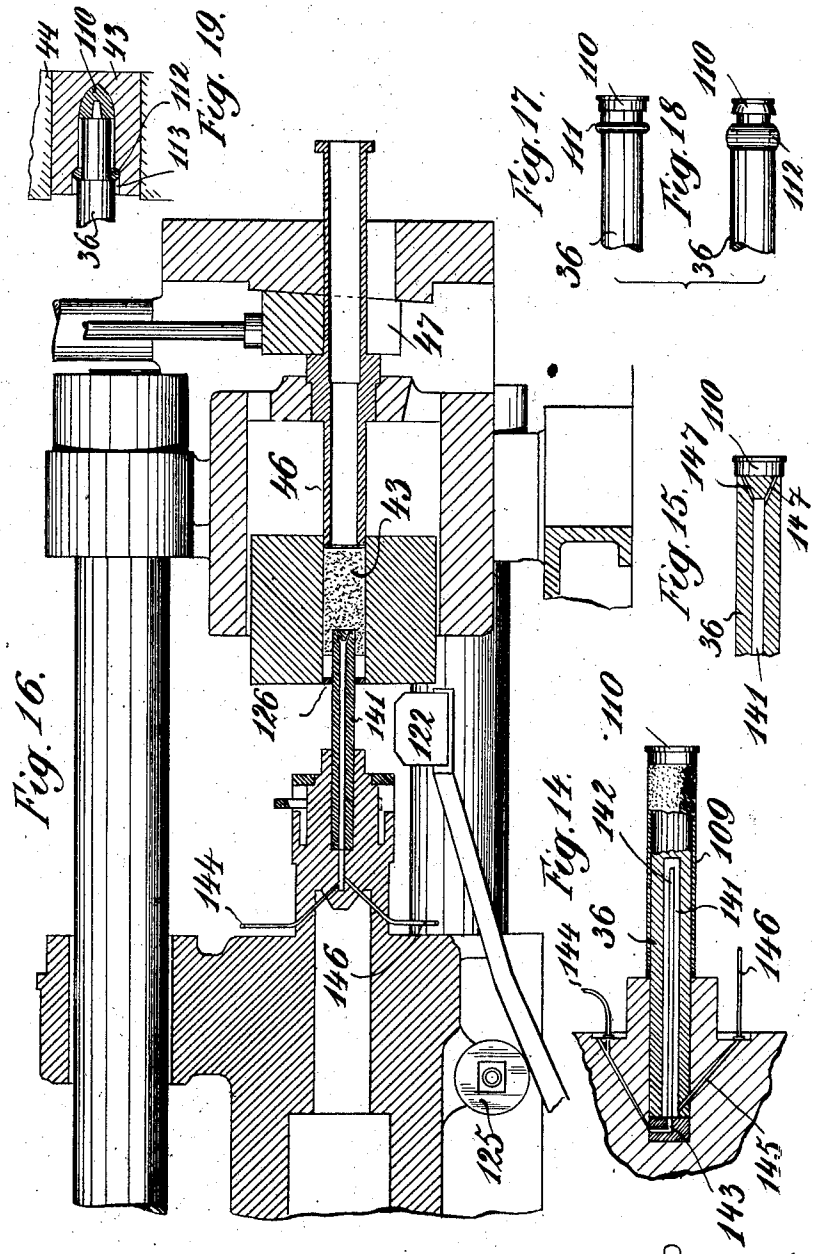
8 SHEETS—SHEET 7.



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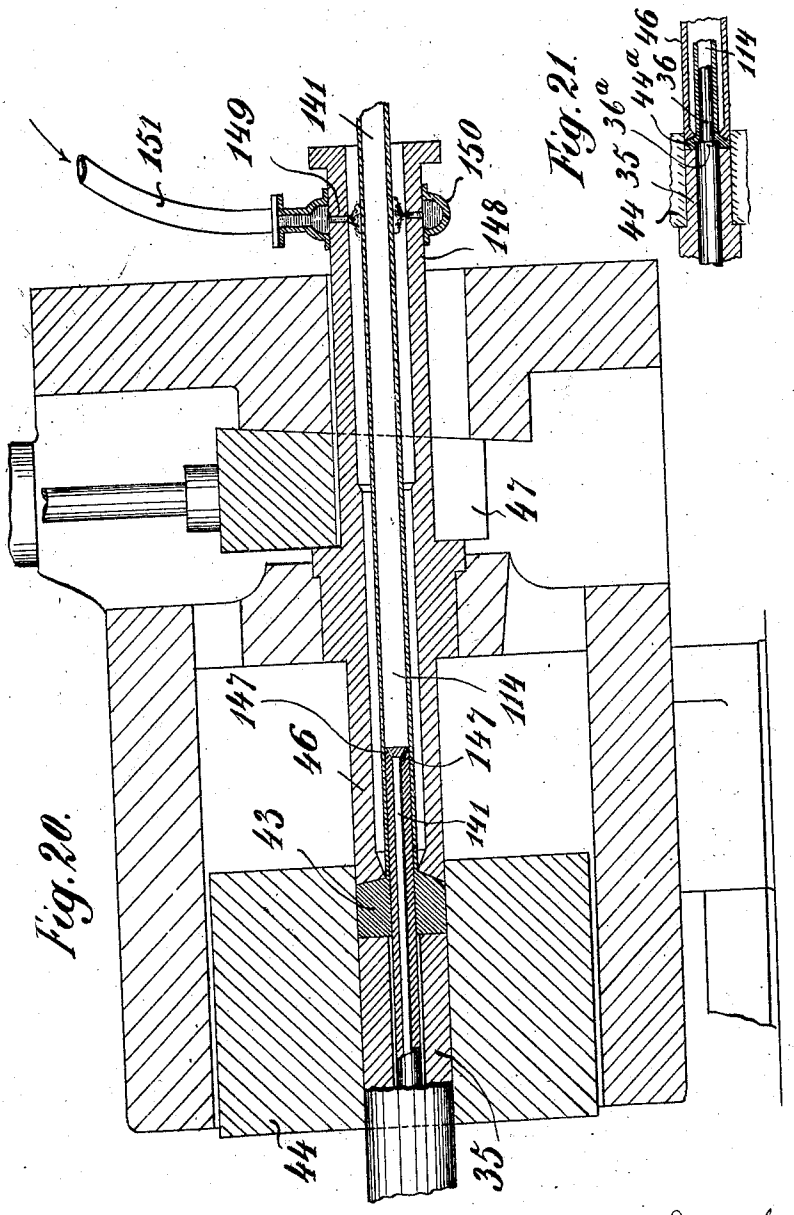

Fig. 20.

Fig. 21.

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UNITED STATES PATENT OFFICE.

WILAND ASTFALCK, OF DUSSELDORF, GERMANY.

HYDRAULIC PRESS FOR MAKING TUBES OUT OF AN INGOT.

1,049,641. Specification of Letters Patent. Patented Jan. 7, 1913.

Application filed December 8, 1910. Serial No. 596,345.

To all whom it may concern:

Be it known that I, WILAND ASTFALCK, engineer, a subject of the German Emperor, and residing at 22 Pempelforterstrasse, Dusseldorf, Kingdom of Prussia, Germany, have invented new and useful Improvements in Hydraulic Presses for Making Tubes out of an Ingot, of which the following is a specification.

The present invention relates to a hydraulic press for making tubes out of an ingot. The said press is composed of the following parts. 1. An arrangement by means of which the mandrel and the ram are advanced for introducing the ingot into the receiver, for perforating the ingot whereupon the mandrel is arrested, and the ram alone is advanced. 2. An arrangement by means of which the working chambers of the press are filled with low pressure water while the press is running idle. 3. A driving arrangement, by which the no-load resistances of the press are overcome and the parts moved forward are returned into their initial position. 4. An arrangement by means of which the receiver will during the perforating operation travel together with the displaced and receding material. 5 An arrangement for holding the receiver while the ingot is being introduced, which arrangement is adapted to be released by the main controlling lever. 6. A hydraulic or mechanical arrangement, by means of which the receiver can travel during the pressing operation with the material of the ingot in the direction of the pressure, but is returned into initial position on the ram being withdrawn. 7. Means for reducing the friction between the mandrel and the material of the ingot, and also the heating of the mandrel, consisting of collars on said mandrel or of lubricating and insulating material applied to said mandrel. 8. An arrangement for removing the scale on the surface of the ingot. 9. An arrangement for centering the ingot. 10. An arrangement for introducing the block and the pressing ring. 11. An arrangement for cooling the mandrel. 12. An arrangement for cooling the pressed tube. 13. An arrangement for severing the tube from the remaining material.

The accompanying drawings exemplify in Figure 1 the whole arrangement of the press and the distributing gear, the pipe connections in a diagrammatical manner. For the purpose of obtaining a more simple drawing the constructional details of the several parts have been omitted and all parts have been shown as if situated within the same plane. Fig. 1ª is a view of parts shown in Fig. 1 with the valve mechanism and connections modified to facilitate return movement of the operating parts of the apparatus. Fig. 2 is a detail of the controlling gear, shown in another working position. Figs. 3 and 4 illustrate a controlling member of Fig. 1 on an enlarged scale in section and in two working positions. Figs. 5 and 6 represent in two views an ingot, which is to be perforated and then pressed into the shape of a tube. Fig. 7 shows the ingot in the feed mechanism. Figs. 8 to 11 illustrate the arrangement for introducing the ingot and the pressing ring, partly in different views, partly in section and in two different working positions. Fig. 12 is a front view of the pressing ring. Fig. 13 is the arrangement for removing the scale from the surface of the ingot. In Figs. 14 to 16 the arrangement for cooling the mandrel is shown in several modifications. Fig. 14 also shows the lubricant or heat insulating medium applied to the mandrel. Figs. 17 to 19 show the mandrel with its cap attached to it and with a collar in three different modifications partly in view and partly in section. Fig. 20 illustrates the means of cooling the tube on its inside and its outside. Fig. 21 shows the arrangement on the mandrel for severing the tube from the remaining material.

The construction of the press according to Figs. 1 to 4 and its operation.—In Fig. 1, 22 is the cylinder of the press, behind which follow the feeding cylinder 23 and the return cylinder 24. Into the latter two cylinders, which may be concentrically arranged within each other, project the two plungers 25 and 26, of which the former is open toward the interior of the cylinder, the latter on the contrary being closed and serving simultaneously in its inside as a cylinder for a stationary bored plunger 27. The two plungers 25 and 26 are coupled by means of a cross-piece 28, to which the two auxiliary pistons 29 are coupled by means of rods 30. These pistons 29 work in the auxiliary cylinders 31. At their ends projecting from the cylinders the pistons 29 are coupled by

means of rods 32 with a cross-piece 33, which carries the plunger 34 moving in the cylinder 22. 35 is the ram coupled to cross-piece 33 and 36 is the mandrel displaceable in said ram, which mandrel is coupled at one end with the cross-piece 37 with rods 38 for limiting the stroke. This cross-piece is constructed to abut with a piston or plunger 39. Of course the part of the plunger 34 projecting beyond the cylinder 22 must be recessed or slotted, so as to allow sufficient room for the cross-piece 37. The piston 39 may work either in a special cylinder arranged within the hollow piston 34, or the cavity 40 of the piston 34 may serve directly as cylinder for the piston 39. This arrangement is illustrated in Fig. 1. The rods 38 for limiting the stroke are fitted with adjustable abutments 41, which abut against fixed abutments 42 which may be secured to the cylinder 22. 43 is the ingot, 44 is the receiver, 45 is the holder of the same, 46 is the die-holder, 47 is a preferably bifurcated slide, which is also shown in Figs. 8, 9, 16 and 20 and which serves to hold the die-holder. In the receiver holder pressure-chambers 48 are provided, in which work the plungers 49 bearing against the receiver. These plungers may, if desirable, also be coupled by means of the rods 50 and 52, shown by dotted lines, and a cross-piece 51 to the cross-piece 33, if a hydraulic operation of the receiver is dispensed with. In the receiver holder 45 catch-bolts 53 may be provided as shown in the drawing, which catch-bolts engage in the receiver 44 and are coupled with each other by lever 55 rocking around 54 and to the main control by means of rod gear 56, 57. The pressure cylinder 22 communicates with the feeding cylinder 23 by means of a regulable opening 58. 59 is the distributing mechanism for the pressure cylinder, and is shown in Figs. 3 and 4 on an enlarged scale. 60 is the distributing mechanism for the auxiliary cylinders 31, 61 is the centralized distributing arrangement, 62 the distributing mechanism for the pressure chambers 48, and 63 is the pressure water accumulator. 64 and 65 are telescoping tubes, of which the former communicates at the one end with the pressure cylinder 22, at the other end with the pressure water pipe, the latter communicating with the cavity 40 in the press plunger. 66 is a non-return valve, which opens toward the waste water pipe 67 and will allow of the feeding water, gradually becoming superfluous, escaping.

The operation of the press is as follows: When the main controlling lever 68 is moved into the position III, the valve *a* will be partially opened and valve *b* is partially closed. Valves *c* and *e* are, however, not yet opened and valves *d* and *f* are not yet closed, the controlling rods of said valves being graduated in length to produce the stated results, as well as other sequence of movements in the valves *a*, *b*, *c*, *d*, *e* and *f*, as hereinafter described. By way of the open valve *a* the return cylinder 24 is put into communication through pipe 69 with the waste water passage 70. The distributing piston 71 remains in the position shown in Fig. 1 while the two distributing pistons 72 and 73, which telescope in each other, assume the positions shown in Fig. 3, as the cavity 74 of the distributing cylinder 75 communicates by way of pipe 74 (Fig. 1) and the valve *f* with the waste water passage 70. For a better elucidation the distributing gear according to Figs. 3 and 4 shall be here briefly described although it is on an already known principle. The distributing piston 73 moves on the one hand in the distributing cylinder 75, on the other hand in the distributing piston 72, which at the same time closes and opens the opening 58 and thereby opens or interrupts the communication between the pressure cylinder 22 and the feeding cylinder 23. The distributing cylinder 75 communicates permanently with the pressure pipe 79 and by way of the same with the accumulator 63 and in consequence of the pressure chamber 80, the passage 81 and the bore 82 in the distributing piston 73 the pressure water will always act in the cavity 83 of the distributing piston 72 and tend to keep the two pistons apart, besides aiming to move both pistons to the right. When, however, pressure water is introduced into the pressure chamber 74, it will first move both pistons to the left and as soon as the piston 72 strikes with its abutment 77 against 78, the piston 73 will be displaced in 72 according to Fig. 4, so that the pressure water can pass from cavity 83 by way of the recess 84 and the passage 85/86 into the pressure cylinder. As, however, as hereinbefore stated, the two distributing pistons 72 and 73 are in their right hand position and the cavity 87 of the load cylinder 26 permanently communicates by way of the bored plunger 27 and pipe 88 with the accumulator, and is therefore permanently under pressure, the plunger, however, is fixed, the parts 25, 26, 28, 30, 29, 32, 33, 35 and 34 will move to the right. If the communication between the cylinder 64 and the pressure cylinder 22 is interrupted by means of a shut-off mechanism provided at 89 and the shut-off mechanism 91 provided in the pipe 90 is opened, the cavity 40 will be under pressure, as the pipe 90 will be in communication with the accumulator by way of the pipe 88 and the piston will be forced outward, so that also the parts 39, 37, 36, 38 and 41 will have to participate in the hereinbefore mentioned movement to the right. By such movement to the right the ingot 43 is pushed into the receiver 44. If then the main control lever 68 is moved into

the position IV, valve *a* is further opened, valve *b* further closed, valve *e* will remain closed, valve *f* still opened, however, valve *c* is opened, and valve *d* is closed, and now pressure water can pass from the accumulator through pipe 92, the opened valve *c*, the passage 93, through the cavity over valve *d* which communicates with pipe 94 and through the latter into the pressure chamber 95 over the distributing piston 71, which pressure water moves the distributing piston into the position shown in Fig. 2, so that now the pressure water can pass from the pipe 79 into the passage 96 leading to the auxiliary cylinders 31 and act on the pistons 29. All the hereinbefore mentioned parts will now be moved with greater force to the right whereby the perforation of the ingot 43 introduced into the receiver is simultaneously effected. During this operation the receiver can travel with the material displaced by such perforation and moving to the left. The abutment 41 must be so adjusted that they abut against 42 when the perforation is completed.

After the perforation has been completed, the control lever 68 is moved into the position V. Now the valves *a* and *c* remain open and the valves *b* and *d* remain closed. At such position of the control lever the valve *e* is furthermore opened and valve *f* is closed. At the same time the rod 97 coupling all six valves can carry along the rod 57 by means of the dog 98 provided on rod 97 and engaging with ample play with a grip 99 or the like on rod 57, so that the catch-bolts 53 are withdrawn and release the receiver 44. The pressure water can now pass from the accumulator through pipe 92 and the opened valve *e* by way of the passage 100 into the cavity above valve *f* and thence through pipe 76 into the cylinder 74, Fig. 4, so that both distributing pistons 72, 73 are moved into the position shown in this figure. The opening 58 is closed and pressure water is introduced in the hereinbefore described manner through passage 86 into the pressure cylinder 22, so that the pressing operation can be carried out. The pressure water will thus act during the pressing operation in the cylinders 22, 31 and in the cylinder cavity 87. As, however, after completion of the perforation the abutments 41 bear against the fixed abutments 42, the perforating ram or mandrel 36 cannot participate during the pressing operation in the advance of the ram 35 so that the piston 39 will be displaced in the pressure chamber 40. The pressure water can therewith be forced through the telescoping tube 65 and pipe 90 into pipe 88 and thence into the accumulator. At the same time as soon as the pressure operation is commenced the receiver will be carried to the right, either by the friction between the receiver and the ingot 43 or by the shoulder 101 of the ram or by both, so that a movement between ingot and receiver is not produced or reduced respectively, and power is saved. The plungers 49 provided in the receiver holder will therewith move to the right. The pressure chambers 48 can permanently communicate through pipes 102 and 105 with the accumulator, or they may also be separately controlled by a special controlling gear 62 by way of a shut-off mechanism 103.

When the pressing operation is completed the return motion is commenced. For this purpose the control lever 68 is moved into the position I, so that the valves *a*, *c*, *e*, assume their closed position the valves *b*, *d*, *f* their opened position exactly as shown in Fig. 1. In consequence thereof the chamber 95 of the distributing gear 60 is put into communication by way of pipe 94 and the open valve *d*, and the chamber 74 of the distributing gear 59 shown in Figs. 3 and 4 by way of pipe 76 and the open valve *f* with the waste water passage 70, so that the distributing mechanism 71 may be returned either manually or by a special mechanical device, for example, through the medium of a hand lever 155 or a driving piston 156, connected with the controlling piston 71 and standing under constant accumulator pressure through the conduit 79 into the position shown in Fig. 1 and the distributing mechanisms 72, 73 return in the hereinbefore described manner from the position according to Fig. 4 into the position according to Fig. 3. In consequence thereof the auxiliary cylinders 31 and the pressure cylinder 22 are again put into communication with the feeding cylinder 23. At the same time pressure water will enter from the accumulator 63 by way of pipe 92, the open valve *b*, the passage 104 and the pipe 69 into the cylinder 24, so that all parts except the mandrel 36 with its cross-piece and rods 38 are moved to the left. The mandrel is merely retained by the pressure prevailing in 40. Only after the cross-piece 33 abuts against cross-piece 37, the mandrel will be carried along and returned into the position according to Fig. 1. If the chambers 48 of the receiver holder 45 are permanently under pressure, the plungers 49 will simultaneously move the receiver into its left hand position. This may also be obtained by employing, as hereinbefore stated, a separate distributing mechanism 62, by connecting pipes 102 and 105, as shown by dotted lines in Fig. 1, with the distributing gear and so adjusting the shut-off mechanism, that 102 is closed after 105. On the return into chambers 48 pressure water may be conducted by a downward movement of the controlling lever 106 the consequent lifting of valve *g* and lowering of valve *h* from

pipe 105 to pipe 102 by which means the movement of the receiver to the left is obtained. But the pipe 102 may also be connected by a pipe 107 with pipe 69, and a shut-off mechanism 108 be arranged in the said pipe 107, so that, when said shut-off mechanism 108 is opened during the perforating and pressing processes the pressure chambers 48 will communicate by way of pipes 107 and 69 and the valve *a* with the waste water passage 70, but be provided during the return motion with pressure water by way of valve *b* and the same pipes, so that the receiver is returned into its initial position. The receiver may, however, be returned into its left hand position by purely mechanical means only, namely by replacing the plungers 49 say by means of rods or bolts and coupling them by means of rods 50, 52 with the cross-piece 33. For facilitating the return motion a distributing mechanism may be also provided in pipe 88, for the purpose of allowing the pressure water to escape from chamber 87 during the return stroke. For this purpose, the controller 61 must be constructed as represented in Fig. 1ª and the conduit 88 need only lead to the valve 157, while from the valve 158, a conduit 88ª branches off to the stationary perforated piston which projects into the pressure chamber 87. In the position I of the lever 68, water passes from the cylinder space 87, through the conduit 88ª and the open valve 158, into the outlet channel 70 and escapes. By the opposite movement of the lever 68, the valve 158 will be closed, and the valve 157 raised, and the water can now enter from the accumulator 63 through the valve 157, the channel 159 and through the conduit 88ª into the cylinder space 87. In other respects, the operation remains the same as described with reference to Fig. 1. If the press is to be stopped by some means, the control lever 68 is moved into the position II, so that valve *b* is closed and pressure water can no more enter into the return cylinder 24.

The tube is formed in the pressing operation by the mandrel having a smaller diameter than the hole in the die or being provided with a point and partly projecting into the latter, so that an annular space is formed through which the material pressed out must pass. In consequence thereof the end of the mandrel projecting into the hole of the die will be subject to a rapid wear. For bringing always fresh parts of the mandrel into contact with the flowing material the abutments 41 may be set so far to the left, that after the perforation the mandrel is advanced, being either carried along by the flowing material or positively moved in correspondence with the pressure in the pressure cylinder 22. For this purpose the shut-off mechanism 89 must be opened in the latter instance. In consequence thereof the pressure water acting in the pressure cylinder during the pressing operation is conducted by way of the telescoping tubes 64, 65 into the pressure chamber of the pressure piston and it will gradually displace the piston of the mandrel 39 and therewith also the mandrel.

Protecting the mandrel against too rapid wear and heating.—The mandrel may be covered according to Fig. 14 on its surface with a coating 109 which will have on the one hand a lubricating, and on the other a heat insulating effect; such coating may consist of graphite or any other suitable material. Thin tubes may also be made of such material and be pushed over the mandrel. Of course it is then necessary to fit the front end of the mandrel with a cap 110, as shown in Figs. 11 and 14, 15 and 17 to 19. In consequence of this cap the hole in the ingot will become somewhat larger, so that the mandrel can enter the same with some play and the protective coating will not be scraped off. In making so called compound tubes, the material of which the interior wall of the tubes is to be composed may be arranged in form of a tubular body around the mandrel in a manner similar to the insulating tube 109. This material will have only partly an insulating effect but gradually emerge together with the other material of the ingot through the die and thereby produce the tube. The mandrel cap 110 may also be made of a pointed shape as shown in Fig. 19, so that it will more easily enter into the material; the mandrel may furthermore be provided with a solid collar 111 according to Fig. 17, so that the material is forced to pass over this collar and will therefore not attack the end of the mandrel so much, or the mandrel may be stepped off at its front end several times as shown in Figs. 18 and 19 and be provided with collar rings 112 fitted on said steps. Both the cap and the collars will be forced out in pressing out the ingot 43. They should, however, not have a larger diameter than the hole in the die. Also the collar ring fitted on separately will leave after completion of the perforation a free space 113 between ingot and mandrel, so that the mandrel is protected against being overheated, and the material of the ingot against being too greatly cooled.

Removal of the scales on the surface of the ingot.—For this purpose the die with its holder 46 is given according to Fig. 13 a smaller diameter than the inside diameter of the receiver 44. Care must, however, be taken that the die holder moves absolutely concentrically in the receiver so that a very small annular space is left between these two parts. The die holder may also be provided with several guide webs, with which it is

guided in the receiver. For greater simplicity of the drawing these webs are, however, not shown in Fig. 13. In pressing out the ingot material 43 there will not only be formed a tube 114, but simultaneously the skin of the ingot 43 will be forced out through the annular space between the die holder and the receiver, in other words a second thin tube 115 will be formed over the die holder which tube will consist of scale only. This is a very important feature as it prevents the impurities created on the surface of the ingot during forging from entering into the flesh of the tube 114. If the die holder 46 is provided with webs and therewith concentrically guided within the receiver, these webs will simultaneously slit the skin of scale 115, so that the latter may be easily removed.

Centering the ingot.—For centering the ingot it may be provided according to Figs. 5 or 6 with several webs 116 on its surface arranged in an axial, helicoidal or other direction, which webs will be slightly flattened on the block being introduced and will not render the introduction in any way more difficult, but will insure the concentrical position of the ingot. If namely the ingot is made to exactly fit into the receiver, its introduction is difficult or requires a considerable amount of power. If on the contrary, the ingot is made of a somewhat smaller diameter, it will not fit concentrically into the receiver and in consequence thereof be eccentrically perforated. When the ingot is provided with guide webs according to Figs. 5 and 6, its introduction requires no particular amount of power and it will remain in a concentrical position during its perforation.

Arrangement for introducing the ingot and the pressing ring.—This arrangement is shown in Figs. 8 to 11. For introducing the ingot a cradle 122 is employed which may be carried on a lever-arm 117 pivoted to the frame of the press, the said lever-arm 117 being connected by means of a link-rod with a pressure device 119. In the latter a pressure medium or a spring 120 may be provided, which actuates the piston 121 secured to the rod 118, whereby lever-arm 117 is kept pressed upward. The free end of this arm carries a cradle or gutter 122 which will receive the ingot and hold it coaxially with the press in front of the receiver. The lever-arm 117 has a horizontal slide way 123 and an inclined slide way 124. The cross-piece 33 is provided with a slipper, but preferably a roller 125, which travels on said slide-ways of the lever arm. When the ram and the mandrel are advanced, the roller 125 will first travel along the horizontal slideway 123 until the mandrel has pushed the ingot 43 from the cradle into the receiver 44. When this is effected and the ram 35 approaches, the cradle, the roller 125 reaches the slide way 124 inclined in an upward direction, whereby the lever arm 117 is forced down, leaving the way clear for the ram. In such presses preferably a pressing ring 126 is employed arranged in front of the pressing ram. Such ring is shown in front view and on an enlarged scale in Fig. 12. If the mandrel is fitted with a cap according to Figs. 14, 15 and 17 to 19, the pressing ring must be previously slipped over the mandrel and then only the cap is fitted. For allowing of using this ring for supporting and centering the mandrel both while perforating the ingot and particularly in making tubes of a comparatively small inside diameter, when the mandrel will have to be very thin, it is advisable to introduce the ring into the receiver already beforehand and not only by means of the ram. For allowing of doing this automatically, the ram may be fitted as exemplified in Figs. 8 and 9 and the Fig. 11 on an enlarged scale, with two lateral arms 128 pivoted at 127, which may be coupled at their ends by a cross-piece and are fitted with two other pivoted arms 130. For obtaining a greater safety also these may be coupled by a cross-piece 131. To each arm 128 is coupled a connecting rod 132 and these are connected by means of lever arms 133 to a shaft 134 journaled in the cross-piece 33, on which shaft is fitted a double armed lever 135. On the cross-piece a set-off bar 136 may be arranged, which is situated with its part 137 projecting downward within the range of travel of lever 135. When the ram is in the position shown in Fig. 9, the whole system of levers 128 and 130 moves into the position shown and bears against the ring 126. When the ram and mandrel are advanced also the lever-arms 128 and 130 will be simultaneously moved forward and push the ring close behind the ingot 43. After the ring has been introduced into the ring in the receiver, the double armed lever 135 will strike against a projection of the bar 137 and is turned to the left, so that the whole system of levers is raised and is moved into the position shown in Fig. 8. It consequently will no more be in the way of the further advance of the mandrel and the ram. When ram and mandrel return, the gravity of the levers 132 will come into effect and return the lever-arms 128 and 130 into the position shown in Fig. 9. This arrangement may, however, also be manually operated. With the object of facilitating the transfer of the ingots into the cradle 122, the furnace 138, in which they are heated may be arranged close to the press and an inclined race-way 132 be provided leading from the furnace to the cradle. The cradle may also be fitted with a strap 140, according to Fig. 7, which

will serve to hold the ingot and prevent it from falling off in consequence of a possible carelessness of the operators or from moving out of its concentrical position.

Cooling the mandrel and the tube.—If contrary to Fig. 1 the mandrel is not displaceable in the ram, and is made in one piece with or is rigidly fitted into the ram, the cooling of the mandrel may be effected by providing it with a bore 141, according to Fig. 14, which bore does not reach quite up to the front end of the said mandrel. In this bore a pipe 142 is inserted, which is secured according to Fig. 14 at its left hand end in a passage 143, to which a flexible hose 144 is connected. The cooling water or any other suitable cooling medium enters through the latter, passes through the passage 143 and pipe 142 into the bore 141 and is discharged through passage 145 and a flexible hose or a pipe 146. The mandrel may, however, be bored according to Figs. 15, 16, 20 almost up to its end and passages and pipes 144 and 146 may be branched off from the left hand end of said bore 141, through the former of which the cooling water is supplied, which will be again discharged through the latter. The front end of the mandrel may be provided with fine squirting passages 147, which are kept closed by the cap 110 while the ingot is being perforated, so that the water cannot emerge at the front end of the mandrel. When the perforation has been completed and the pressing of the tube commences, the cap will be carried away, as already stated, by the material emerging from the die and the passages 147 are thereby opened so that the water can emerge according to Fig. 20 into the interior of the tube 114 and cool the inside of the same. In order to prevent too high pressures being produced by evaporation in the mandrel, the discharge pipe 146 may nevertheless be left open and all surplus water will flow off through it. The tube may also be cooled on its outside by the rear extension 148 of the die holder 46 being provided with squirting passages 149 and encircling these with a distributing chamber 150, which is supplied with water through a pipe 151. This water will be thereby sprayed on the outside of the emerging tube 114. By cooling the tube on its inside and its outside it is also protected against oxidization. If the mandrel cap is made as shown in Fig. 16, and if the mandrel is bored to its whole length according to Figs. 15 and 20, of course no cooling water should be sent through during the perforating operation as else the material of the ingot might be unnecessarily cooled during the perforation. If the mandrel is displaceable in the ram, as shown in Fig. 1, the supply and discharge pipes 144 and 146 must naturally be branched off at the rear end of the mandrel. They may then also be arranged in the cross-piece 37.

Arrangement for severing the tube from the remaining material.—For the purpose of utilizing the mandrel for severing the finished tube from the remaining material 44^a, the mandrel is, according to Fig. 21, made from the point which approaches the hole in the die, when the tube is almost finished, that is to say from point 36^a of such a thickness, that its diameter is equal to the outer diameter of the tube. When the tube is finished this shoulder will meet with the edge of the hole in the die, sever by a shearing action the tube from the tailing and push it fully through the die. At this moment the mandrel may be given an increased advancing movement by opening the distributing mechanism 89 and by opening the distributing mechanism 91, whereby this shearing action is quickly effected.

I claim:

1. In a hydraulic press for pressing tubes out of ingots; an ingot receiver, means for presenting an ingot into position coaxially with the receiver, means for introducing the ingot from said presenting means into the receiver, means for holding the ingot concentrically within the receiver, means for perforating the ingot while in the receiver and means for pressing the perforated ingot into the form of a tube.

2. In a hydraulic press for pressing tubes out of ingots; an ingot receiver, a cradle constructed to hold the ingot and movable to and from a position which presents the ingot coaxially with the receiver, means for introducing the ingot from said presenting means into the receiver, means for holding the ingot concentrically within the receiver, and means for perforating the ingot while in the receiver.

3. In a hydraulic press for pressing tubes out of ingots; an ingot receiver, a cradle constructed to hold the ingot and movable to and from a position which presents the ingot coaxially with the receiver, means for introducing the ingot from said presenting means into the receiver, means for holding the ingot concentrically within the receiver, and means for perforating the ingot while in the receiver, said cradle being provided with means for moving it to and from its delivering position, comprising a mounting for the cradle having means normally moving it in one direction and means carried by the press ram imparting movement to said cradle mounting in the other direction.

4. A hydraulic press for perforating ingots and pressing the same into the shape of a tube, comprising a receiver, means for presenting the ingot coaxially with the receiver, a mandrel adapted to introduce the ingot into the receiver, a detachable collar on said mandrel, said mandrel having a

shoulder against which said collar bears; the collar being constructed to guide the mandrel and to enlarge the perforation and thereby produce a corresponding clearness between the mandrel and the ingot.

5. A hydraulic press for perforating ingots and pressing the same into the shape of tubes, comprising a receiver for the ingot, a mandrel adapted to perforate the ingot in the receiver, constructed with a plurality of shoulders, and detachable collars mounted on the mandrel, bearing against the respective shoulders thereof and constructed to guide the mandrel and widen the perforation, and thereby produce a corresponding clearance between the mandrel and the ingot.

6. A hydraulic press for perforating ingots and pressing them into the shape of a tube, comprising a receiver for the ingot and a mandrel for perforating the ingot in the receiver; said receiver being displaceable relatively to the mandrel and in the direction opposite to the perforating movement of the mandrel and means being provided to cause said displacement of the receiver, with the receding material displaced by the mandrel, during the perforating operation and thereby reducing friction between the ingot and the receiver.

7. A hydraulic press for perforating ingots and pressing them into the shape of a tube, comprising a receiver for the ingot and a mandrel for perforating the ingot in the receiver; said receiver being displaceable relatively to the mandrel and in the direction opposite to the perforating movement of the mandrel and means being provided to cause said displacement of the receiver, with the receding material displaced by the mandrel, during the perforating operation and means displacing the receiver in the opposite direction with the material displaced during the pressing operation, thereby reducing friction between the ingot and the receiver.

8. A hydraulic press for perforating ingots and pressing them into the shape of a tube, comprising a receiver for the ingot and a mandrel for perforating the ingot in the receiver; said receiver being displaceable relatively to the mandrel and in the direction opposite to the perforating movement of the mandrel and means being provided to cause said displacement of the receiver, with the receding material displaced by the mandrel, during the perforating operation and means displacing the receiver in the opposite direction with the material displaced during the pressing operation, thereby reducing friction between the ingot and the receiver; said receiver displacing means comprising hydraulically operated supporting plungers.

9. A hydraulic press for perforating ingots and pressing them into the shape of a tube, comprising a receiver for the ingot and a mandrel for perforating the ingot in the receiver; said receiver being displaceable relatively to the mandrel and in the direction opposite to the perforating movement of the mandrel and means being provided to cause said displacement of the receiver, with the receding material displaced by the mandrel, during the perforating operation and means displacing the receiver in the opposite direction with the material displaced during the pressing operation, thereby reducing friction between the ingot and the receiver; said receiver displacing means comprising hydraulically operated supporting plungers adapted to return the receiver into its initial position after the material of the ingot has been pressed out.

10. A hydraulic press for perforating ingots and pressing them into the shape of a tube, comprising a receiver for the ingot and a mandrel for perforating the ingot in the receiver; said receiver being displaceable relatively to the mandrel and in the direction opposite to the perforating movement of the mandrel and means being provided to cause said displacement of the receiver, with the receding material displaced by the mandrel, during the perforating operation and means displacing the receiver in the opposite direction with the material displaced during the pressing operation, thereby reducing friction between the ingot and the receiver; said receiver displacing means comprising hydraulically operated supporting plungers and a system of levers through which said hydraulically operated plungers return the receiver into its initial position after the material of the ingot has been pressed out.

11. A hydraulic press for perforating ingots and pressing them into the shape of tubes, comprising a receiver for the ingot, a mandrel adapted to introduce the ingot into the receiver and means for displacing the receiver relatively to and in the direction opposite to the movement of the mandrel, whereby the receiver moves with the displaced material; said receiver being provided with releasable locking devices to resist displacement of the receiver during the introduction of the ingot.

12. A hydraulic press for perforating ingots and pressing them into the shape of tubes, comprising a receiver for the ingot, a mandrel adapted to introduce the ingot into the receiver and means for displacing the receiver relatively to and in the direction opposite to the movement of the mandrel, whereby the receiver moves with the displaced material; said receiver being provided with releasable locking devices to resist displacement of the receiver during the introduction of the ingot, and means au-

tomatically releasing said locking devices at the commencement of the pressing operation.

13. A hydraulic press for perforating ingots and pressing them into the shape of a tube, comprising a receiver for the ingot and a mandrel for perforating the ingot in the receiver; said receiver being displaceable relatively to the mandrel and in the direction opposite to the perforating movement of the mandrel and means being provided to cause said displacement of the receiver, with the receding material displaced by the mandrel, during the perforating operation and means displacing the receiver in the opposite direction with the material displaced during the pressing operation, thereby reducing friction between the ingot and the receiver, said mandrel having a shoulder which engages the receiver to assist its movement with the displaced material during the pressing operation.

14. A hydraulic press for shaping ingots, comprising a receiver, and a die operating in the receiver to shape the ingots; said die and receiver being constructed to leave an annular space between them for the escape of slag and impurities on the surface of the ingot, whereby the shaped ingot is left free from such impurities; there being radial guiding webs for the die in the receiver, adapted to slit the slag and skin passing through the annular space.

15. A hydraulic press for perforating ingots, comprising a receiver for the ingot and a mandrel coöperating to perforate the ingot in the receiver; said mandrel being constructed hollow and provided with means for admitting and discharging a medium for cooling the mandrel during its work, said mandrel being constructed with spray passages at its front end and provided with a cap fitting the mandrel to close said openings during the perforating operation, but removable to permit escape of the cooling medium during the movement of the mandrel in the opposite direction.

16. A hydraulic press for perforating ingots and thereafter pressing them into the shape of a tube, comprising a receiver for the ingot, a mandrel adapted to perforate the ingot in the receiver and a die operating in the receiver to impart the exterior form to the tube by a stroke in the opposite direction to the working stroke of the mandrel; said mandrel being constructed to deliver a cooling medium to the bore which it creates and means being provided to supply cooling medium to the mandrel; said supplying means being effective only after the mandrel has completed the perforation.

17. A hydraulic press for perforating ingots, comprising a receiver for the ingot, a mandrel adapted to operate upon the ingot in the receiver, constructed hollow to receive a cooling medium, and a combined lubrication and heat insulation covering on said mandrel to protect the mandrel against excessive heating and modify the cooling effect of the mandrel upon the bore in the ingot.

18. A hydraulic press for perforating ingots, comprising a receiver for the ingot, a mandrel adapted to operate upon the ingot in the receiver, constructed hollow to receive a cooling medium, and a combined lubrication and heat insulation covering on said mandrel to protect the mandrel against excessive heating and modify the cooling effect of the mandrel upon the bore in the ingot, said covering being constructed in the form of a tube passing over the mandrel.

19. A hydraulic press for perforating ingots, comprising a receiver for the ingot, a mandrel adapted to operate upon the ingot in the receiver, constructed hollow to receive a cooling medium, and a combined lubrication and heat insulation covering on said mandrel to protect the mandrel against excessive heating and modify the cooling effect of the mandrel upon the bore in the ingot, said covering being constructed in the form of a tube passing over the mandrel and being constructed to fit the bore formed by the mandrel, and form with the perforated ingot, a compound structure.

20. A hydraulic press for perforating ingots and pressing them into the form of a tube, comprising a receiver for the ingot, a mandrel for perforating the ingot, a die for shaping the exterior of the ingot, and a ram for operating said mandrel and die; said ram being provided with a hydraulic press through which it imparts thrust to the mandrel and which releases the mandrel after completion of the perforating stroke and during the working stroke of the die.

21. A hydraulic press for perforating ingots and pressing them into the form of a tube, comprising a receiver for the ingot, a mandrel for perforating the ingot, a die for shaping the exterior of the ingot, and a ram for operating said mandrel and die; said ram being provided with a hydraulic press through which it imparts thrust to the mandrel and which releases the mandrel after completion of the perforating strokes and during the working stroke of the die, adjustable abutments being provided for said mandrel to arrest the latter after completion of its perforating stroke.

22. A hydraulic press for perforating ingots and pressing them into the form of a tube, comprising a receiver for the ingot, a mandrel for perforating the ingot, a die for shaping the exterior of the ingot, and a ram for operating said mandrel and die; said ram being provided with a hydraulic press through which it imparts thrust to the mandrel and which releases the mandrel after completion of the perforating stroke and

during the working stroke of the die, the mandrel being adapted to remain in its projected position until it is again carried along by the ram.

23. A hydraulic press for perforating ingots and pressing them into the form of a tube, comprising a receiver for the ingot, a mandrel for perforating the ingot, a die for shaping the exterior of the ingot, and a ram for operating said mandrel and die; said ram being provided with a hydraulic press through which it imparts thrust to the mandrel and which releases the mandrel after completion of the perforating stroke and during the working stroke of the die, said last named hydraulic press comprising a cylinder constructed in the ram and a piston working in said cylinder, subjected to hydraulic pressure therein and adapted to bear against the mandrel.

24. A hydraulic press for perforating ingots and pressing them into the shape of a tube comprising a receiver for the ingot, a mandrel for pressing a bore through the ingot and a die for shaping the exterior of the tube; said mandrel being provided with an external enlargement corresponding in diameter to the external diameter of the tube to be produced and adapted to enter the opening of the die and sever the tube from the residue of the ingot.

25. In a hydraulic press having a ram for producing tubes from metal blocks, a feeding cylinder, a plunger coöperating with the feeding cylinder, a return cylinder located within the feeding cylinder, and a no-load cylinder located within the plunger of the feeding-cylinder, and at the same time serving as plunger for the return cylinder.

26. In a hydraulic press having a ram for producing tubes from metal blocks, a feeding-cylinder, a plunger coöperating with the feeding-cylinder, a return cylinder located within the feeding cylinder, a no-load cylinder located within the plunger of the feeding-cylinder, and at the same time serving as plunger for the return cylinder, a mandrel-driving piston, a hydraulic press cylinder, and a cylindrical piston coöperating with the hydraulic press-cylinder and serving as cylinder for the mandrel piston.

27. In a hydraulic press having a ram for producing tubes from metal blocks, a feeding cylinder, a plunger coöperating with the feeding cylinder, a return cylinder located within the feeding cylinder, and a no-load cylinder located within the plunger of the feeding-cylinder, and at the same time serving as plunger for the return cylinder; there being a cradle arranged to hold an ingot coaxially to the press, a lifting-arm for said cradle, a suitable source of power adapted to constantly raise said lifting-arm, and a member carried by the ram, adapted to depress the lifting-arm as the ram advances.

28. In a hydraulic press having a ram for producing tubes from metal blocks, a feeding cylinder, a plunger coöperating with the feeding cylinder, a return cylinder located within the feeding cylinder, and a no-load cylinder located within the plunger of the feeding-cylinder, and at the same time serving as plunger for the return cylinder; there being an advancing device comprising lever-arms swingingly mounted upon the plunger, a centering ring against which said advancing device bears to introduce the centering ring, and means automatically removing the advancing device after introduction of the centering ring, comprising an abutment-lever, and a fixed abutment bar.

The foregoing specification signed at Berlin this 15th day of November, 1910.

WILAND ASTFALCK.

In presence of—
WOLDEMAR HAUPT,
HENRY HASPER.