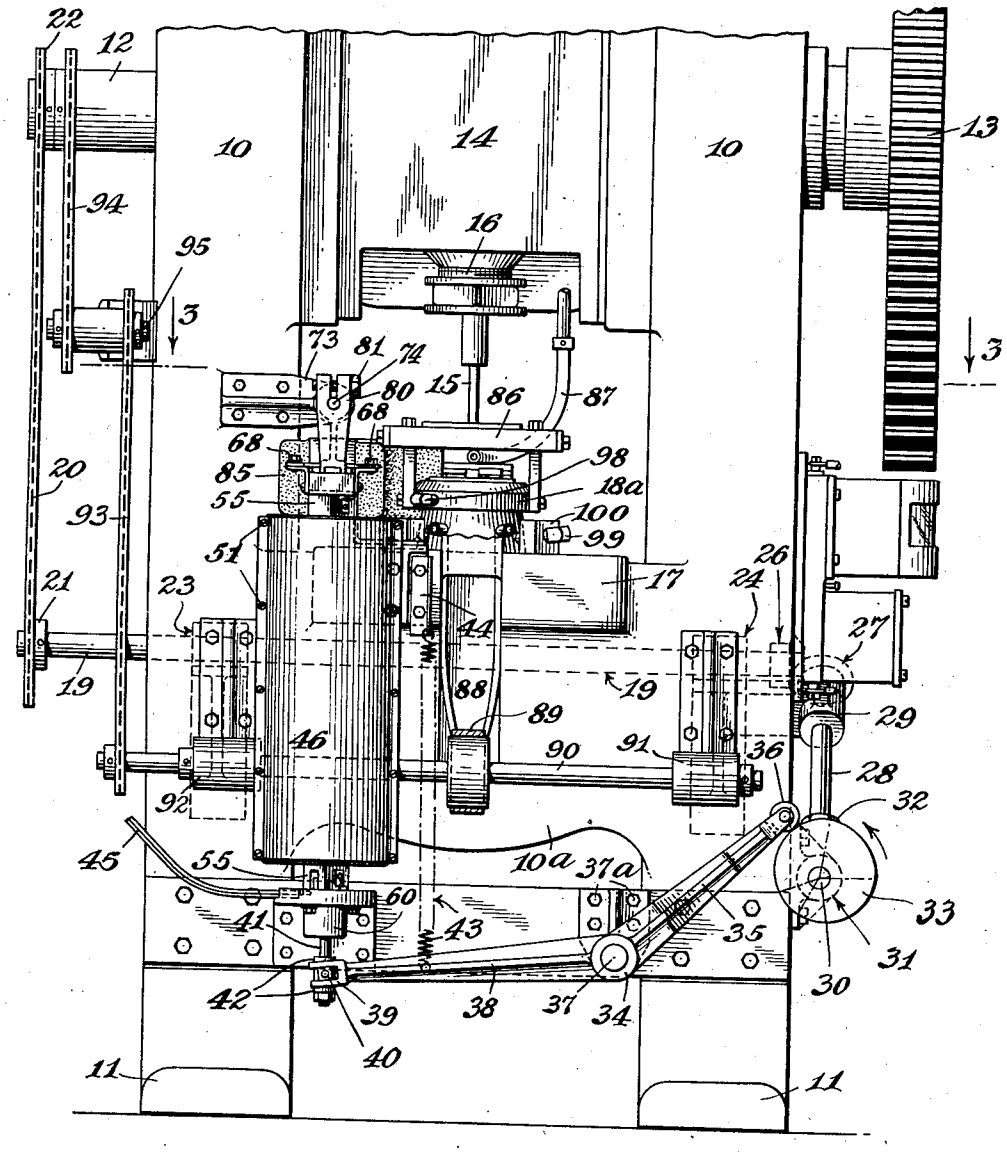
April 18, 1939. J. H. FRIDEN 2,154,611

EXTRUSION PRESS

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Fig. 1.



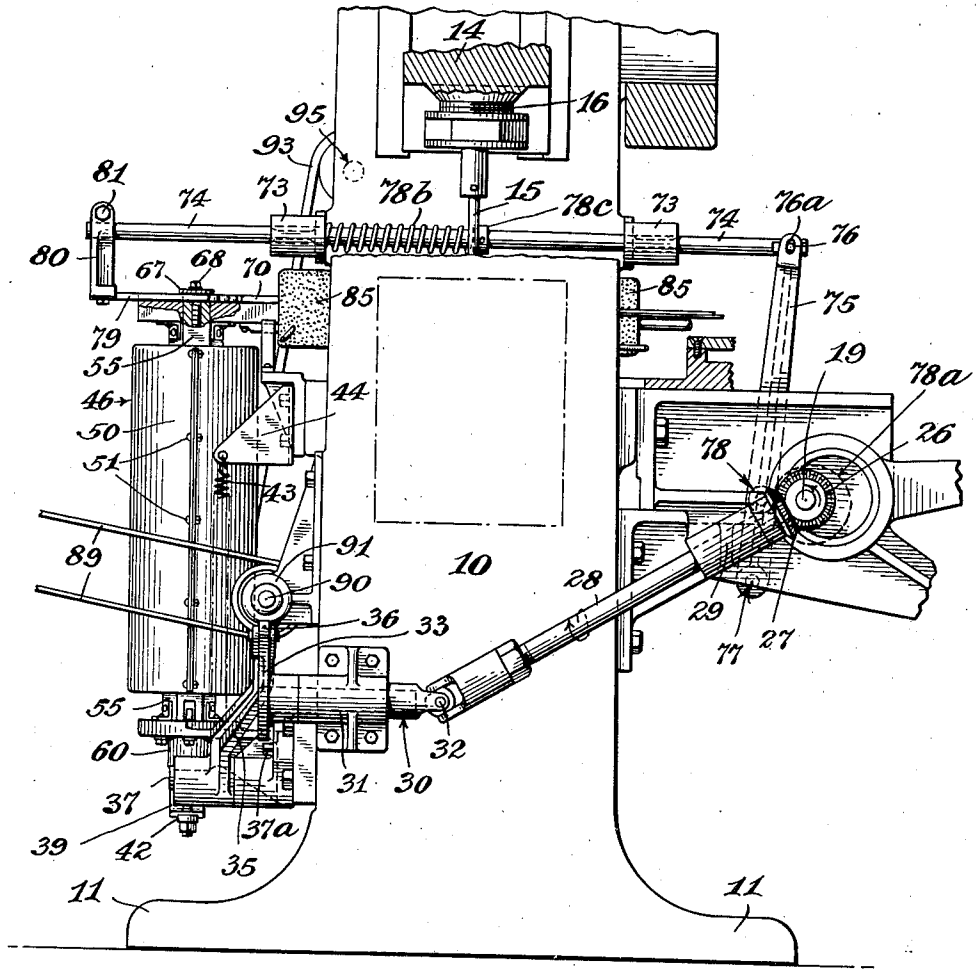
INVENTOR:
John H. Friden
BY
H. C. Klessing
his ATTORNEY

April 18, 1939. J. H. FRIDEN 2,154,611

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Fig. 2.



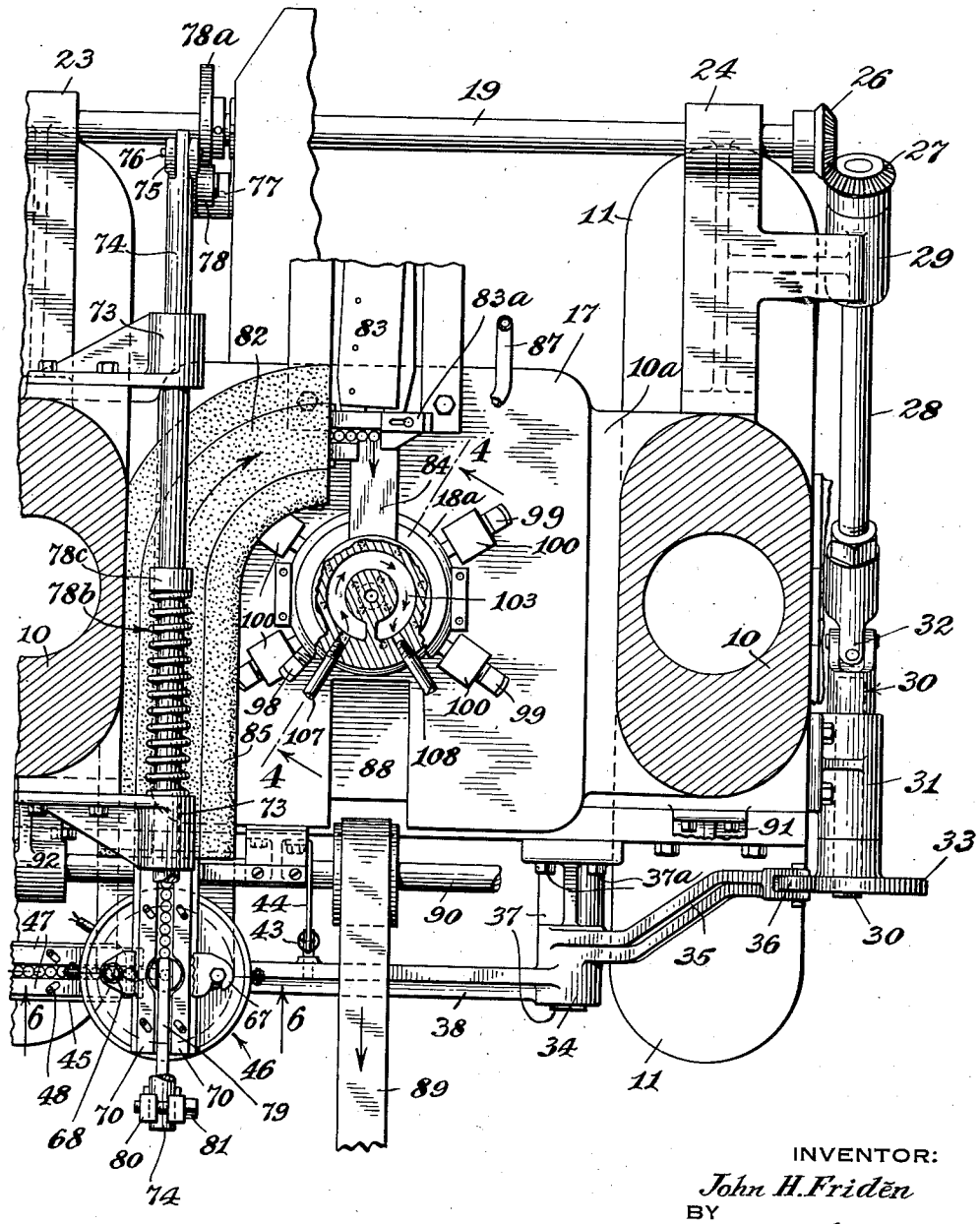
INVENTOR:
John H. Friden
BY
H. C. Rheem
his ATTORNEY

April 18, 1939. J. H. FRIDEN 2,154,611

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Fig. 3.



INVENTOR:
John H. Friden
BY
H. C. Kliesrud
his ATTORNEY

April 18, 1939. J. H. FRIDEN 2,154,611

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Fig. 4.

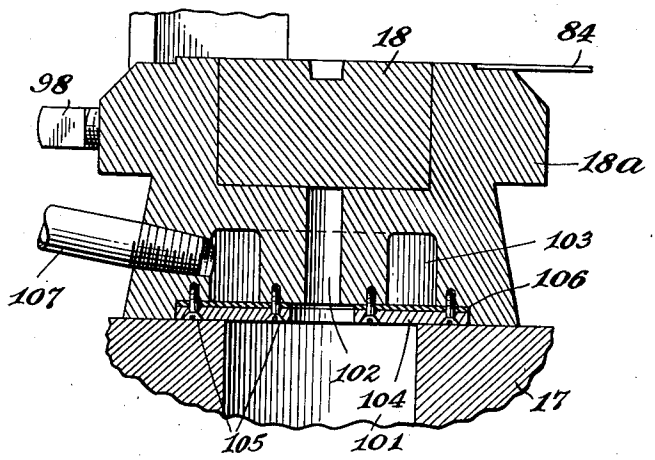
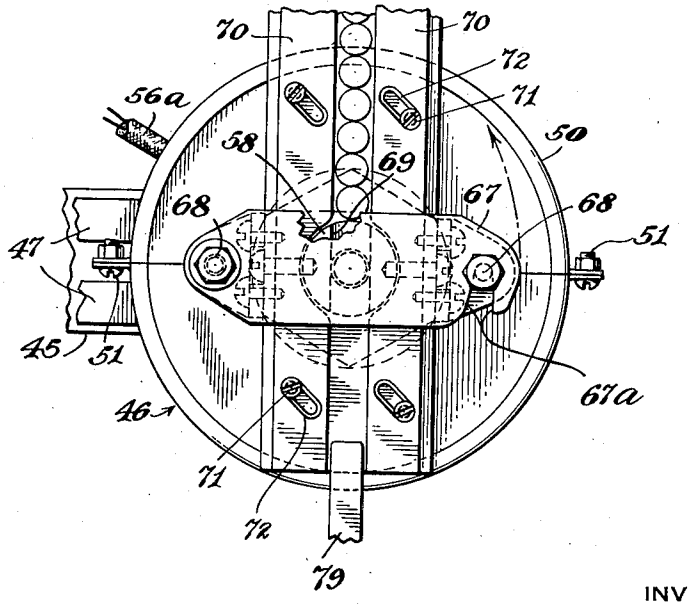


Fig. 5.



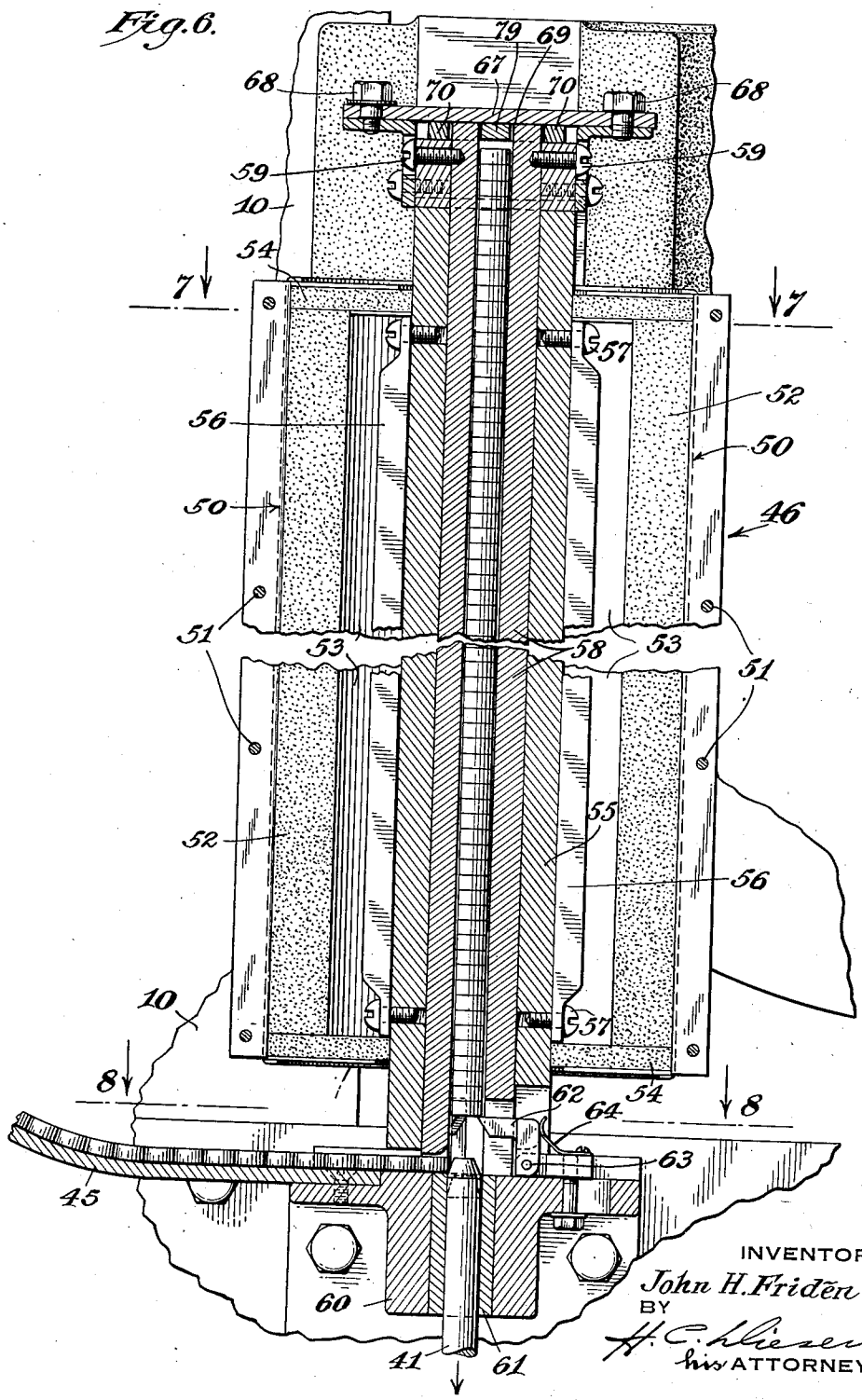
INVENTOR:
John H. Friden
BY
H. C. Schlesemann
his ATTORNEY

April 18, 1939. J. H. FRIDEN 2,154,611

EXTRUSION PRESS

Filed Sept. 13, 1935 6 Sheets-Sheet 5

Fig. 6.



INVENTOR:
John H. Friden
BY
H. C. Kliesrud
his ATTORNEY

April 18, 1939. J. H. FRIDEN 2,154,611

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Fig. 7.

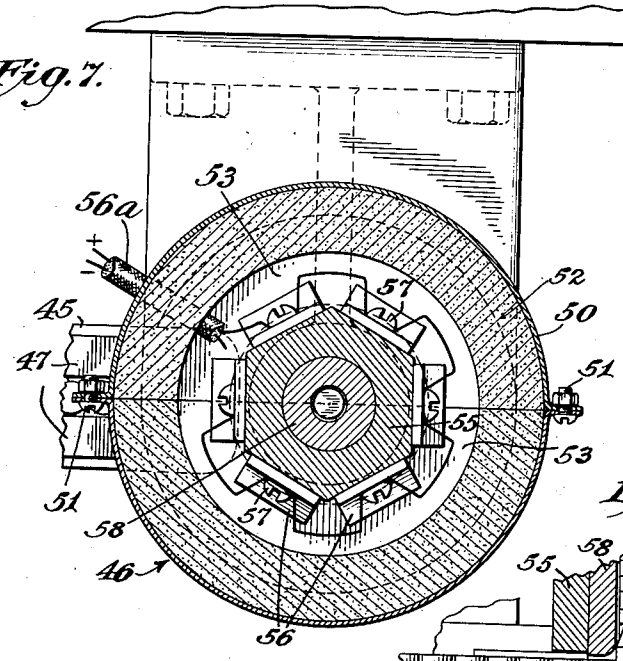


Fig. 10.

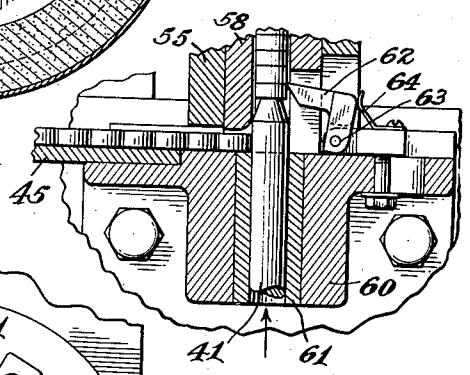


Fig. 8.

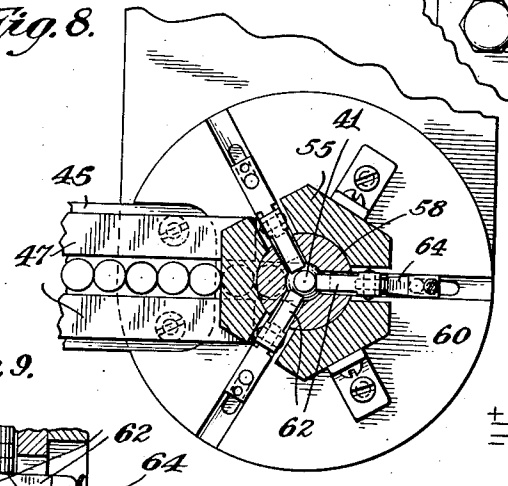


Fig. 11.

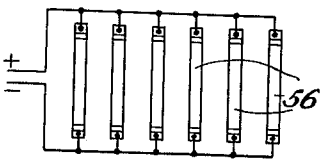
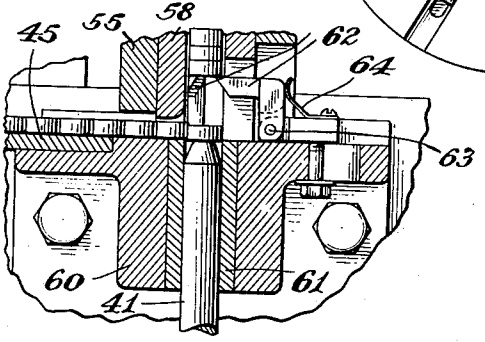


Fig. 9.



INVENTOR:
John H. Friden
BY
H. C. Fliesenund
his ATTORNEY

Patented Apr. 18, 1939 2,154,611

UNITED STATES PATENT OFFICE

2,154,611

EXTRUSION PRESS

John H. Friden, Maplewood, N. J., assignor to The Sun Tube Corporation, Hillside, N. J., a corporation of New Jersey

Application September 13, 1935, Serial No. 40,385

10 Claims. (Cl. 207—16)

This invention relates to improvements in methods of and apparatus for extruding metal and more particularly to apparatus for extruding metals, such as zinc, which will not flow at ordinary temperatures under the permissible working pressures into the form of hollow tubes or similar articles.

One object of this invention is to provide an improved device for accurately and quickly heating slugs to be extruded in an efficient manner such that the output of acceptable articles from the extrusion press may be materially increased and the product made substantially uniform. It is generally recognized that accuracy in the shape and size of die members is very important in obtaining uniform results. Uniform temperature of the slugs supplied to the machine is also an important governing factor.

A related feature of the invention is the accurate control and maintenance of the temperature of the die members within predetermined limits, and also the adjustment of the temperature of the slugs supplied thereto.

Other objects and advantages of my invention will be more apparent from the detailed description of the embodiment shown in the drawings, in which:

Figure 1 is a front elevation of the lower portion of an extrusion press illustrating my invention.

Figure 2 is a side elevation of the same portion of such extrusion press with a portion of the slug feeding means shown in section.

Figure 3 is a horizontal cross section through the machine taken on the line 3—3 of Figure 1 and showing the construction of the female die in cross section.

Figure 4 is a vertical sectional view through this die member taken on the line 4—4 of Figure 3.

Figure 5 is a plan view of a pre-heater attached to the extrusion press and shows the slug feeding means in conjunction therewith.

Figure 6 is a vertical cross section through the pre-heating device showing the slug loading chute and is taken on the line 6—6 of Figure 3.

Figure 7 is a horizontal sectional view through the pre-heater taken on the line 7—7 of Figure 6.

Figure 8 is a horizontal sectional view on the line 8—8 of Figure 6 illustrating the locking means for retaining slugs in the pre-heater.

Figure 9 is a view similar to Figure 6 but showing only the slug loading means for the pre-heater with the lifting rod at its lowest position.

Figure 10 is a similar view but showing the lifting rod in a partly raised position, and

Figure 11 is a diagrammatic view showing the electrical connections for the pre-heater.

The extrusion press illustrated, is made up of side frame members 10, supported on suitable legs and feet 11, and joined by the integral horizontal section 10a forming a support for one die member. This frame carries a main shaft 12 rotatably mounted therein in suitable bearings and driven by a gear 13 through a pinion or other driving means not shown. The shaft 12 is connected to a slide 14, arranged for vertical oscillation in the frame by any suitable means such as a toggle arrangement (not shown). Slide 14 carries a reciprocating punch 15 adapted to perform the extruding operation on the downward stroke. The punch and its holder are preferably removably attached to the slide by means of the screw threads 16, so that articles of different sizes and shapes may be extruded on the same machine. Horizontally disposed between the side frame members as an integral part of the frame section 10a is a shelf 17 arranged to support the female die member 18 in the die block 18a immediately below the punch. Parallel with the shaft 12 is arranged a second shaft 19 which may be driven by said shaft 12 through the chain 20 and sprockets 21 and 22. These sprockets are preferably of the same size so that both shafts make one rotation in the same period of time. Shaft 19 is mounted in suitable bearings 23, 24 and carries at one end thereof a suitable bevel pinion or gear 26 which meshes with a similar bevel gear 27 connected to a downwardly extending shaft 28. Said shaft 28 is rotatably mounted in bearing 29 and is connected to a horizontal section 30, rotatably mounted in bearing 31, by the universal joint 32. The lower section 30 rotates at the same speed as shafts 19 and 12. At its forward end this shaft 30 has fixed thereto a cam 33 for reciprocating a member within the heater, as will presently appear. A suitable rotatably mounted collar or hub 34 is provided with an integral upwardly extending arm 35 carrying a roller 36 at its free end. This roller is held against the cam 33 and acts as a follower therefor. The collar 34 may be pivotally mounted on a pin 37, which is fixed to the main frame in any desirable manner, as by bolts 37a. A second arm 38 having a forked end 39 adapted to slidingly engage a block 40, pivotally attached to a rod 41, is fixed to collar 34 opposite said arm 35. The vertically reciprocating feed rod 41 is provided with a pair of collars 42, adapted to confine or limit the vertical movement of block 40 and hence arm 38 with respect to said feed rod. This con-

struction translates the arcuate movement of the end of arm 38 into a straight line vertical movement for the feed rod 41. Arm 38 is normally maintained in a raised position and the roller 36 is held in engagement with the heater cam by a spring 43, extending therefrom and connected at its upper end to a bracket 44 attached to the frame. The feed rod 41 serves to supply slugs from the chute 45 to the pre-heater 46. This chute 45 (Figure 3) may be made up of a base member and guides 47 adjustably mounted thereon by means of the slots and set screws 48, to accommodate slugs of different sizes.

Referring more particularly to Figures 5–7 the pre-heater 46 is made up of an outer casing 50, formed in semi-circular sections provided with radial flanges at their edges which are joined by bolts 51. This casing may conveniently be formed from sheet metal or the like and is preferably lined wtih some heat insulating material 52, defining a central vertical chamber 53. Suitable annular cover members 54 close the ends of the chamber except for centrally disposed circular openings through which a tube of metal or some other heat conducting and resisting material 55 is fitted. This tube is preferably longer than the heating chamber, per se, and is hexagonal in cross-section so that the resistance elements 56 may be conveniently clamped thereto by means of bolts 57. These resistance elements are preferably connected in parallel (Fig. 11) and supplied with current by means of the cable 56*a*. Disposed within this tube, and preferably fitting rather snugly to obtain good heat conduction, is a second tube 58 which may be held in place by bolts or set screws 59. This inner tube, also formed of metal or other good heat conducting materials, acts as a muffle chamber and is adapted to receive a vertical column of slugs to be heated. Gas, oil, or other fuel may, of course, be employed as the heating medium instead of electricity, if desired.

When dealing with slugs of different sizes it is desirable to have this inner tube interchangeable so that one of the correct inside diameter may be provided at all times. When slugs of only a definite size are dealt with, however, the tubes 55 and 58 may be combined into a single integral tube.

At the bottom of the chamber, the feed rod 41 reciprocates in a suitable bearing 60, which may be lined with babbitt or a bronze bushing 61 or the like, if desired. The upper end of this feed rod is preferably somewhat tapered or pointed. At the lower end of the stroke, as shown in Figure 9, this feed rod is below the plane of the under surface of the slugs in the chute 45 so that one slug is pushed out over the top of the rod into a position to be loaded into the pre-heating chamber. The slugs in the chute may be supplied automatically from a suitable hopper (not shown) and fed by gravity or in any other suitable way. As the feed rod raises the slug to be loaded or added to the column in the chamber, the tapered end of the feed rod cams the other slugs in the chute slightly back out of the way and the main part of the rod then retains them in this position. The slug to be loaded is carried upwardly into engagement with a series of three detents 62 pivoted on pins 63 at the lower end of tube 55 and urged inwardly by the action of springs 64. As the slug continues its upward movement it exerts a camming action on the cut away lower surfaces of the detents and rocks them against the action of the spring 64. The feed rod 41 carries the slug still further upwardly until it has completely passed the tips of the detents which then are allowed to snap back into place below this slug. Now when the rod 41 is lowered again the column of slugs will drop a slight distance until the newly added slug rests upon the tops of the detents whereupon the rod is permitted to continue its downward movement independently to the point where it will receive another slug.

The top portion of the tube 58 holding the column of slugs extends some distance above the pre-heating chamber and may be heat insulated in any suitable way to maintain a substantially uniform temperature. The top of this tube is preferably closed by a plate 67, held in place by bolts 68 entering a flange extending from a collar that surrounds and is attached to the upper end of the tube 55. One end of the plate 67 is formed with an open jaw 67*a* receiving one of the bolts 68 so that when these bolts are loosened, the plate may be swung around in the direction indicated by the arrow in Figure 5. If the slugs should become jammed in the tube 58 the plate 67 may be thus quickly swung back out of the way and the difficulty corrected. This arrangement also greatly facilitates changing the tube 58 for one of a different internal diameter. The top of the tube 58 immediately below the plate 67 is provided with a horizontal groove 69 alined with a passageway formed by a pair of guides 70. These guides 70 may be adjusted to accommodate different sized slugs by means of the set screws 71 cooperating with slots 72.

Mounted in suitable bearings 73 above the pre-heater, is a reciprocable rod 74 attached at one end thereof to an arm 75 pivotally mounted on a stud 77 carried by the machine frame. The connection between rod 74 and arm 75 is through a pin 76 on the rod engaging an elongated slot 76*a* in the arm. The arm 75 carries intermediate its ends a roller 78 adapted to bear against a cam 78*a* secured to the shaft 19. Cam 78*a* serves to reciprocate the rod 74 by its action on the roller 78 which is held against the cam by the action of a spring 78*b* surrounding the rod between one of the bearings 73 and a collar 78*c* on the rod. The other end of said rod 74 is connected to a slide bar 79 by means of the bracket 80 which may be frictionally clamped in the desired position by the bolt 81. Push rod 79 slides in the passageway formed by the guides 70 and the groove 69. Its movement is so timed that as the column of slugs in the pre-heating chamber is raised to the point that the top slug comes into the path of this slide bar, it is shoved edgewise into the passageway formed by said guides 70. These guides form a passageway having a curved section 82, to a point immediately in front of the female die member. At this point suitable gripper arms 83 pick up the slugs, which are prevented from sliding too far by the adjustable stop member 83*a*, and push them over the plate into the recess of the die in position to be extruded by a downward stroke of the punch 15.

During the passage of the slugs between the guides 70 they are further heated in an oven 85 formed of suitable heat insulating material. The temperature of the slugs in the pre-heating chamber need not be accurately controlled, but for the sake of economy and best results suitable thermostatic means or the like may be provided. The temperature of the slugs is accurately adjusted however within certain pre-determined limits. For this purpose thermostatically con-

trolled electrical heating units may conveniently be employed, as more fully explained in my pending application S. N. 667,372 filed April 22, 1933.

As the slugs are extruded into a finished article and the punch 15 is withdrawn the articles are carried upwardly thereby and are stripped therefrom by means of a stripper 86 and finally are removed from the machine by a jet of air, or gas, or the like discharged from a tube 87. These hollow articles, when blown out of the region of the dies, fall into a chute 88 and are delivered onto and carried away on a suitable conveyor 89 driven by a shaft 90. This shaft 90 may be mounted in suitable bearings 91, 92 and driven from the shaft 12 by suitable chains and sprockets 93, 94 through the stub shaft 95.

The die 18 is preferably removably mounted in the die block 18a and may be held in place by means of a set screw 98. The assembly thus provided may be clamped to the shelf 17 in the press by bolts 99 threaded through the blocks 100 which are integral with said shelf. Said shelf is preferably provided with an opening 101 below the center of the die block which is also provided with a central opening 102, whereby the die member may be pushed out from below the shelf without removing the die block. The bottom part of the die block is provided with an arcuate passageway 103, which is closed at the bottom by the annular plate 104, held in place by suitable screws 105. A gasket 106 may be employed, if desired, thus forming a substantially annular chamber in the die block which is liquid tight. Hot water, steam, or other heating or cooling means, may be supplied to the die block by means of the pipe 107 from any suitable source (not shown) and drawn off from the die block by the pipe 108. Either manual or automatic, thermostatically controlled means may be employed to regulate the flow of the heating or cooling fluid. It is thus possible to accurately maintain the temperature of the die block and the die carried thereby constant throughout the use of the press by means of a continuous and regulated circulation of a heating or cooling fluid.

All of the moving parts of my improved apparatus are outside of the pre-heater 46 and the oven 85, thus insuring smooth operation with low repair and replacement costs.

The operation of some portions of my device and the constructional features of the toggle for the punch, the gripper arms, the stripping mechanism, and other parts, are described in more detail in my pending application Serial Number 667,372 filed April 23, 1933.

Slugs of a suitable size are fed to my improved machine through the chute 45 where they are picked up by the feeder rod 41 and pushed upwardly through the pre-heating chamber as already described. Each slug is retained in this chamber substantially the same length of time during the continuous operation of the machine. As the slugs reach the top of tube 58, they are picked up singly by the push rod 79, and advanced in a series edgewise through the passageway formed by guides 70. During travel through this passageway the temperature of the pre-heated slugs may be easily and accurately adjusted, either raised, lowered, or maintained. The uniformly heated slugs finally emerge from this passageway and are picked up by the gripper arms and deposited in the cavity of the die member. The punch descends, extruding the article and carries it upwardly until it strikes the stripper which slides the article off and into the path of the ejecting fluid from pipe 87. The timing of the feed cam 78a and the cam 33 should be adjusted to synchronize with the stroke of the punch and the feeding action of the gripper arms.

When a press of this type is started, the die block is usually cold and after the press has been in use for some time, particularly if the operation is rapid, the die block will become overheated. The passage 103 and associated pipe connections provide means for bringing the die block up to the proper temperature before use thereof, through the introduction of steam or the like, and for subsequently preventing the die from becoming too hot during use, through the introduction of a cooling agent.

In the construction which I have described the temperature of both die members and metal in the form of slugs to be extruded may be accurately maintained constant throughout the operation of the machine. This is a very important factor in extruding thin walled collapsible metal tubes and other hollow, tubular members, since variations in the size of the die members, such as is occasioned by thermal expansion, is thereby prevented and the user is assured of a uniform product.

The terms used in describing the invention are used as terms of description and not as terms of limitation and it is intended that all equivalents of these terms be included within the scope of the invention claimed.

I claim:

1. An extrusion press comprising a frame, a die member mounted in said frame, guides forming a passageway for feeding individual flat disc-like slugs to said die member, means to pre-heat said slugs before entering said passageway, means associated with said guides to control the temperature of said pre-heated slugs within predetermined limits, and means to control the temperature of said die member in accordance with the temperature of said slugs.

2. An extrusion press comprising a frame, a die member mounted in said frame, means for feeding individual flat disc-like slugs edgewise to said die member, means associated with said feeding means to control the temperature of the slugs within predetermined limits, means for preheating slugs, means for supplying pre-heated slugs to said feeding means, and means to control the temperature of said die member in accordance with the temperature of said slugs.

3. In a press for extruding metal articles, a heating chamber, means for intermittently supplying disc-like slugs to the bottom of a pile in said chamber, and means for intermittently removing the top slug from said pile for feeding to said press.

4. In a press for extruding metal articles, a heating chamber having a substantially vertical opening therein, means for supplying disc-like slugs to the bottom of said opening, means for raising a series of slugs axially in said opening, and means for removing the slugs from said chamber at the top of said opening.

5. In a press for extruding metal articles, a heating chamber having a substantially vertical opening therein, means for supplying disc-like slugs to the bottom of said opening, means for raising a series of slugs in said opening, and means for feeding slugs as they emerge from the top of said chamber to a die member.

6. In a press for extruding metal articles, a heating chamber, a muffle chamber removably

mounted therein having a substantially vertical opening, means for supplying slugs to the bottom of said opening, means for raising a series of slugs in said opening, and means for removing the slugs from said chamber at the top of said opening.

7. A method of producing hollow articles of zinc and the like which comprises pre-heating slugs of the metal to be extruded while advancing the same upwardly through a pre-heating zone, subsequently advancing the slugs through a final heating zone maintained at a predetermined regulated temperature, depositing the slugs separately in a die at a predetermined temperature, and extruding the slugs while at a regulated, elevated temperature.

8. A method of producing hollow articles of zinc and the like which comprises pre-heating disc-like slugs of the metal to be extruded while advancing the same axially through a pre-heating zone, subsequently advancing the slugs edgewise through a substantially horizontal final heating zone maintained at a predetermined, regulated temperature, depositing the slugs separately in a die at a predetermined temperature and extruding the slugs while at a regulated, elevated temperature.

9. In a press for extruding metal articles, means for heating slugs prior to extrusion thereof comprising a heating chamber having a substantially vertical passage therethrough, means for supplying slugs to the lower portion of said chamber, means for intermittently raising a supplied slug into said passage, means for retaining a series of slugs in said passage, and means for feeding heated slugs to said press as they emerge from the upper portion of said chamber.

10. In a press for extruding substantially flat disc-shaped slugs into hollow articles, a heating chamber disposed at a substantial angle to the horizontal, a removable muffle chamber mounted therein, said muffle chamber having an opening corresponding approximately to the size and shape of said slugs, means for feeding a column of said slugs upwardly through said opening, and means for feeding heated slugs to said press as they emerge from the top of said opening.

JOHN H. FRIDEN.