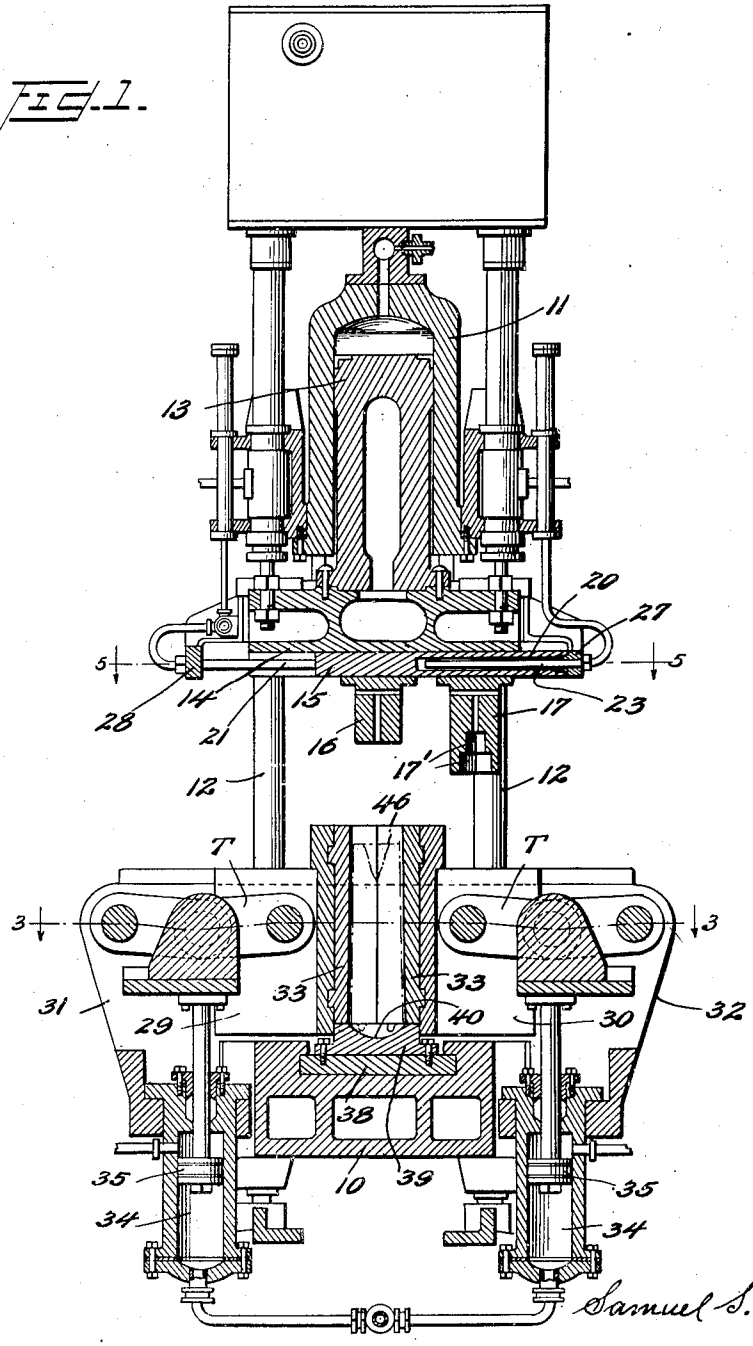
June 28, 1927. 1,633,970

S. S. BALL

APPARATUS FOR COMPRESSING INGOTS

Filed April 24, 1922 3 Sheets-Sheet 1

FIG. 1.



Inventor
Samuel S. Ball,

By Watson, Cole, Moore & Grindle,
Attorneys.

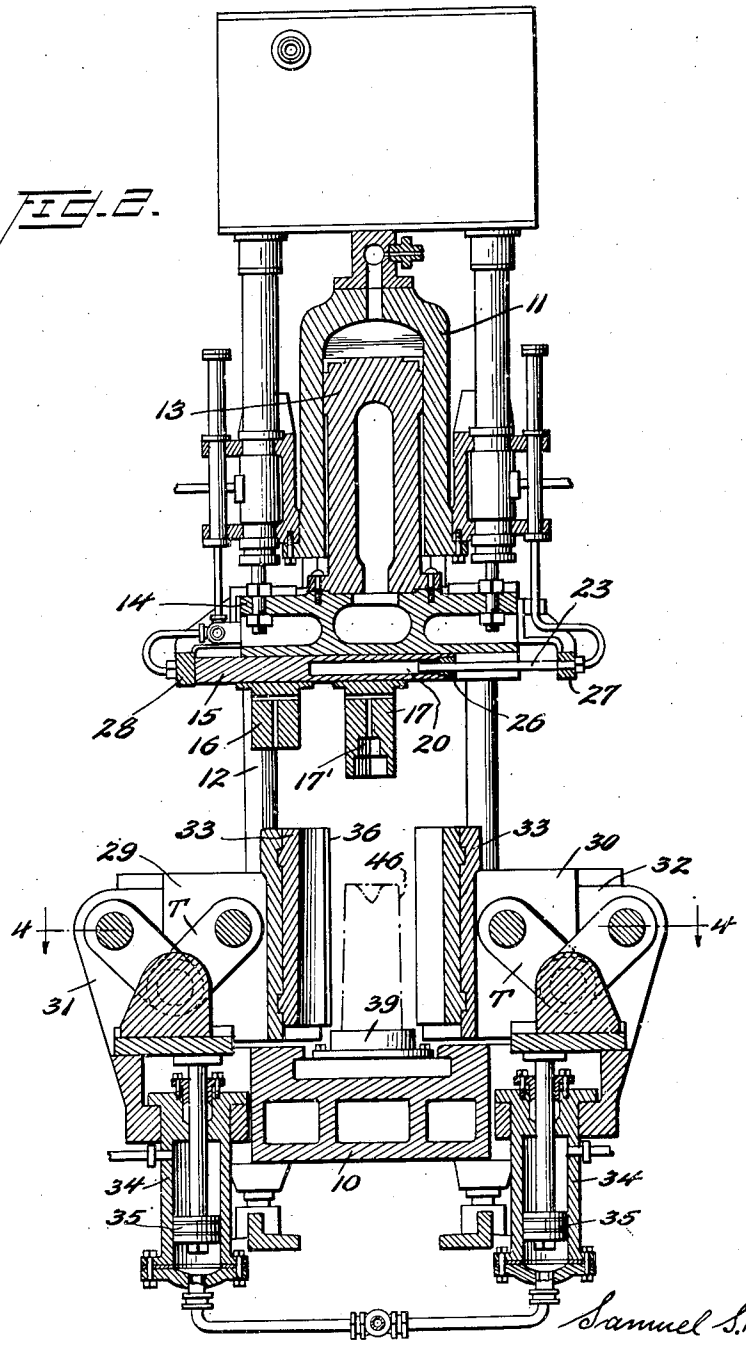
June 28, 1927. 1,633,970

S. S. BALL

APPARATUS FOR COMPRESSING INGOTS

Filed April 24, 1922. 3 Sheets-Sheet 2

FIG. 2.



Inventor

Samuel S. Ball,

By Watson, Cole, Morse & Grindle,

Attorneys.

June 28, 1927. 1,633,970

S. S. BALL

APPARATUS FOR COMPRESSING INGOTS

Filed April 24, 1922 3 Sheets-Sheet 3

FIG. 3.

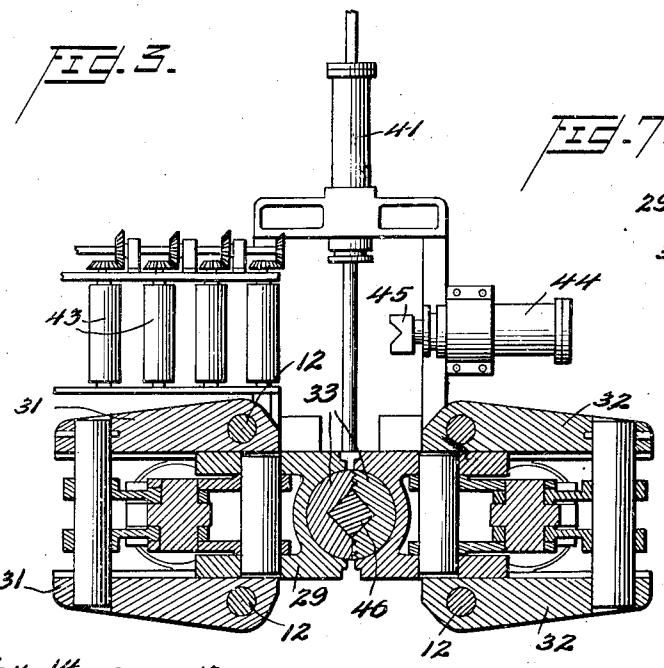


FIG. 7.

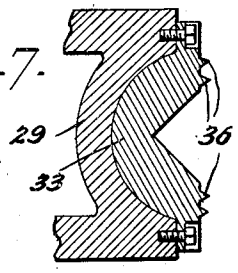


FIG. 5.

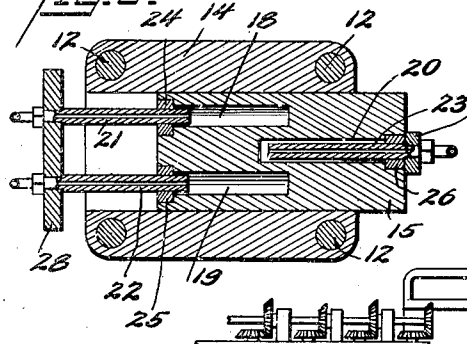


FIG. 6.

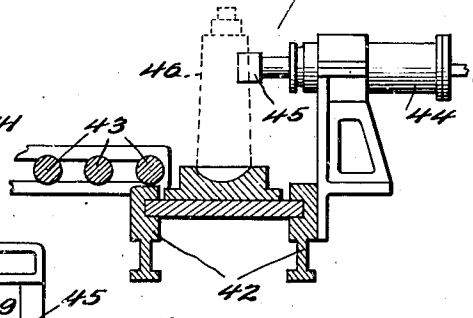
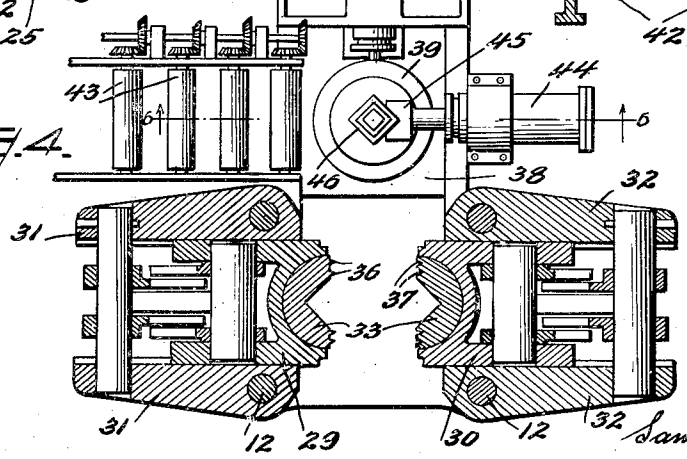


FIG. 4.



Inventor

Samuel S. Ball,

By Watson, Cole, Moore & Grindle,

Attorneys.

Patented June 28, 1927. 1,633,970

UNITED STATES PATENT OFFICE.

SAMUEL S. BALL, OF BETHLEHEM, PENNSYLVANIA.

APPARATUS FOR COMPRESSING INGOTS.

Application filed April 24, 1922. Serial No. 556,242.

The present invention relates to apparatus for compressing ingots while in a plastic or semi-fluid state and relates particularly to apparatus for carrying out the method for displacing and isolating the impurities and piping in ingots which is disclosed in application, Serial No. 556,241 filed by the present applicant.

The method described in the application above referred to consists essentially in exerting a pressure on the surface of the ingot, which is in a plastic state, and in a direction normal thereto, on all sides of a defective spot, or gathering of unsound metal, the sound metal surrounding the spot being pressed toward and into the body of the ingot and the unsound metal being displaced by this inward flow of sound metal and caused to flow outwardly to form a knob or protrusion extending outwardly from the body of the ingot. This may then be severed from the ingot so that the remainder is entirely of sound metal, the separation of the sound from the unsound metal having been effected with a minimum loss of sound metal. Various mechanisms may be provided for carrying out the method and in the present application a press is described and illustrated which is particularly suited for effecting the isolation of the unsound metal in the top of an ingot where it usually occurs. It will be understood that this embodiment of the invention is given by way of example only and that numerous modifications come within the spirit and scope of the invention.

In the drawings;

Fig. 1 is a vertical axial section through the press,

Fig. 2 is a similar view but showing certain of the parts in different positions from those in which they are illustrated in Fig. 1.

Fig. 3 is a section on line 3—3 of Fig. 1.

Fig. 4 is a section on line 4—4 of Fig. 2.

Fig. 5 is a section on line 5—5 of Fig. 1.

Fig. 6 is a section on line 6—6 of Fig. 4.

Fig. 7 is an enlarged section through a detail.

The base or table of the press is indicated at 10, the main cylinder at 11, and four corner columns which serve to support the cylinder above the base at 12. Slidably contained within the cylinder 11 is the cylindrical portion 13 of a piston, this piston having also an enlarged plate or cross head portion 14 bolted or otherwise suitably secured to the cylindrical member 13. A transversely movable slide 15 is secured within a groove in the bottom of plate 14 and has projecting downwardly therefrom an upsetting die 16 and a displacement die 17. By moving the slide 15 either die may be brought directly above the center of the table 10.

Hydraulic means is provided for effecting the movement of this slide in either direction, this means comprising cylindrical openings 18, 19, and 20 formed in the slide and pistons 21, 22, and 23 for these cylinders respectively. The pistons are stationary, piston 23 being rigidly supported on a bracket 27 at one end of plate 14 and pistons 21 and 22 on a bracket 28 at the other end of plate 14. Packing rings 24, 25 and 26 prevent leakage from the respective cylinders and each of the pistons shown is longitudinally perforated so that fluid under pressure may be introduced into the interior of the cylinders. Water under constant pressure is introduced into cylinder 20 through the aperture in piston 23 and as piston 23 is rigidly supported upon a non-moving bracket there is a constant tendency for the slide to move toward the left, Fig. 1, which movement will take place unless opposed. Pistons 21 and 22 are also rigidly supported and the flow of fluid through these pistons is controlled by the operator of the press. When fluid under the same pressure as that existing in cylinder 20 is admitted to the cylinders 18 and 19, the slide will move toward the right to the position shown in Figures 1 and 5, combined fluid pressures in the two cylinders overcoming the resistance of the fluid within cylinder 20.

The carriages 29 and 30 move between and are supported on guides 31—31 and 32—32, these guides being in turn supported upon the columns 12 of the press, and each of these carriages carries one portion 33 of the split confining die. The carriages are moved simultaneously toward or from each other by means of toggles T of well known construction, the operations of which are effected by hydraulic pressures in cylinders 34 acting alternately on the upper and lower faces of pistons 35. If desired, a constant

pressure may be supplied to the upper ends of these cylinders so that when the pressure in the lower ends of the cylinders is relieved, the toggles become operative to separate the halves of the confining die. Pistons 35, it will be seen, are in reality differential pistons, the effective areas of their upper surfaces being considerably less than the effective areas of their lower surfaces so that the movements of the toggles to bring the halves of the separable die together may be effected by admitting fluid to these cylinders 34 beneath pistons 35, which has the same unit pressure as the fluid above these pistons. One portion of the die 33 has longitudinal ribs 36 which enter corresponding recesses 37 in the opposite half, to prevent relative displacement of these portions in the operation of the press.

As shown in Figures 1 and 4, the table 10 of the press is provided with a trackway in its top to slidably receive a carrier 38 having the bottom portion 39 of the confining die bolted or otherwise suitably secured thereon. Portion 39 of the confining die comprises a bottom plate and has formed therein a cup shaped depression 40, the edges of which coincide with the lower inner edges of portions 33 of the die when the three parts are assembled, as in Fig. 1.

The carrier 38 may be moved transversely of the press by means of hydraulic pressure, it being connected to a piston reciprocally contained in hydraulic cylinder 41. As shown in Fig. 6, carrier 38 is supported and guided by members 42 after it leaves the table 10 of the press. A series of live rollers are indicated at 43 which are so operated that they will convey from the press an ingot which is placed thereon. A cylinder 44 arranged at right angles to the path of travel of the carrier is provided for operating a pusher head 45, which is adapted to engage an ingot 46 above its center of gravity, when the ingot is resting upon the bottom plate 39 and to overthrow the ingot so that it falls downwardly toward and on to the live roller line which immediately acts to convey it to a shear, or other point in the shop where the next operation is to be performed.

In the operation of the mechanism just described the operator will start with the die portions 33 separated as shown in Fig. 4 and the carrier 38 to one side, as shown in this figure. With the parts in these positions, an ingot 46 is placed upon the base plate 39, supported on the carrier, the lower end of the ingot resting in the depression 40 of the base plate. The carrier 38 is then moved until the ingot lies between the separable sides of the confining die, as shown in Fig. 3, after which these parts may be brought together so that the sides and bottom of the ingot are confined. There will be, however, a considerable clearance between the outer walls of the ingot and the inner walls of the die and the bottom of the ingot will not conform, of course, to the cup shaped depression 40 of the carrier. While the die illustrated is to receive ingots of rectangular cross section, it will be understood that it may be designed to reecive ingots of any cross section used in practice.

With the ingot in position in the die, and the toggles T fluid locked so that the sides of the separable die can not be moved apart by pressure from within, the slide 15 is moved until the upsetting die 16 is directly above the mouth of the confining die. The main piston is then brought downwardly by introducing fluid under pressure into cylinder 11, so that upsetting die 16 enters the confining die and abuts against the top of the ingot contained therein. Downward movement of the piston 13 is continued to exert a great pressure on the upper end of the ingot, which is in a plastic state, to shorten and thicken the same and cause its outer walls and bottom to conform to the outer walls and bottom of the confining die. The piston 13 is then raised and slide 15 moved to bring the displacement die 17 directly above the mouth of the confining die.

The piston is again brought down so that the displacement die enters the confining die and bears upon the ingot. It will be seen that the displacement die has a central stepped recess 17′ and that initially the bearing of the die on the ingot is limited to the horizontal surface of its lower face which constitutes a margin for this central recess. This marginal bearing of the die on the ingot is upon the sound metal around the edges of the ingot at its top, and further downward movement of the die results in the forcing of this sound metal toward and into the body of the ingot. Downward flow of the sound metal around the edges will, of course, result in the upward flow of the central portion of the ingot top into the recess 17′ of the displacement die and the extent of this flow will depend upon the pressure exerted, the time during which the pressure is exerted and the condition of the metal. It is generally desired to continue the movement until the entire unsound portion of the top of the ingot has been displaced and extends upwardly from the body of the ingot as shown on Fig. 6. After this displacement of the unsound metal has been effected, the sides 33 of the die may be separated and the carrier 38 moved to its outer position, as shown in Fig. 4. The pusher head 45 is then operated to overturn the ingot, which falls upon the roller line and is carried away from the press.

The press illustrated and described is a preferred one for handling ingots of the usual type, relatively long and square in cross section, but it will be understood that it may

be modified to handle different types of ingots, and in other ways, without departing from the spirit and scope of the invention.

What I claim as my invention and desire to secure by Letters Patent is:

1. In mechanism of the class described, in combination, a base for supporting an ingot, a plunger movable relatively to the base for axially compressing the ingot, a die for engaging and supporting the side walls of the ingot during its axial compression, said die comprising a plurality of separable portions which constitute, together with the base, a confining chamber, a horizontally movable carriage supporting each of said separable portions of the die, and means including toggle mechanism for simultaneously operating said carriages.

2. In mechanism of the class described, in combination, a base for supporting an ingot, a plunger movable relatively to the base for axially compressing the ingot, a die for engaging and supporting the side walls of the ingot during its axial compression, said die comprising a plurality of separable portions which constitute, together with the base, a confining chamber, a horizontally movable carriage supporting the base and horizontally movable carriages supporting respectively the separable portions of the die.

3. In mechanism of the class described, in combination, a press for acting on an ingot, a roller train adjacent the press, a horizontally movable carriage for conveying ingots from the press to a position adjacent the roller train and means for overturning an ingot carried by said base on to the roller train.

4. In mechanism of the class described, in combination, a press for compressing an ingot which includes a confining die having a separable base portion upon which an ingot may rest, a roller train adjacent the press, means for moving the base portion of the confining die from the press to a position adjacent the roller train and means for overturning an ingot carried by the base on to the roller train.

5. In mechanism of the class described, in combination, a press for acting on an ingot, a roller train adjacent this press, a horizontally movable carriage for conveying ingots from the press to a position adjacent the roller train, and means for forcing the ingots from the carriage on to the roller train.

6. In mechanism of the class described, in combination, a press for axially compressing a vertically disposed ingot, a roller train adjacent the press, a horizontally movable member for conveying vertically disposed ingots from the press to a position adjacent the roller train, and means for successively overturning the ingots on to the roller train.

7. In mechanism of the class described, in combination, a press for axially compressing a vertically disposed ingot, a roller train adjacent the press, a horizontally movable member for conveying vertically disposed ingots from the press to a position adjacent the roller train, and horizontally movable means for exerting a pressure on said ingots above their centers of gravity to successively overturn them on to the roller train.

8. In mechanism of the class described, in combination, a press for axially compressing a vertically disposed ingot, a roller train adjacent the press, a horizontally movable member for conveying vertically disposed ingots from the press to a position adjacent the roller train, and a hydraulically operated pusher head horizontally operable to contact successively with the ingots to overturn them on to the roller train.

9. In a machine of the class described, in combination, a confining die for holding an ingot, a power-operated member movable longitudinally of the confining die an upsetting plunger die for upsetting and compressing an ingot to shorten the latter and to cause it to fill the confining die, a plunger die having a central recess adapted to bear upon the margin of the top of a compressed ingot in order to force sound metal inward and to secure extrusion of unsound metal into the recess, and means for connecting the plunger dies to said member, whereby the plunger dies may be successively aligned with the confining die.

10. In a machine of the class described, in combination, a confining die for holding an ingot, a power-operated member movable longitudinally of the confining die, an upsetting plunger die for upsetting and compressing an ingot to shorten the latter and to cause it to fill the confining die, a plunger die having a central recess adapted to bear upon the margin of the top of a compressed ingot in order to force sound metal inward and to secure extrusion of unsound metal into the recess, a supporting member for the plunger dies carried by and movable transversely of the power-operated member, and means for securing transverse movement of the supporting member in order to bring the plunger dies successively into alignment with the confining die.

In testimony whereof I hereunto affix my signature.

SAMUEL S. BALL.