United States Patent

[11] 3,577,759

[72] Inventors **Paul Tandler**
Clayton, Mo.;
Ellis R. Blackwell, East St. Louis, Ill.

[21] Appl. No. **712,857**
[22] Filed **Mar. 13, 1968**
[45] Patented **May 4, 1971**

[73] Assignee **Cerro Corporation**
New York, N.Y.

[54] **METHOD OF AND APPARATUS FOR PREPARING COPPER AND BRASS BILLETS FOR EXTRUSION INTO HOLLOW SHELLS**
13 Claims, 30 Drawing Figs.

[52] **U.S. Cl.** **72/254,** 90/24
[51] **Int. Cl.** **B21c 23/01**
[50] **Field of Search** 207/10.21; 72/253, 254, 40, 41; 90/24.01

[56] **References Cited**

UNITED STATES PATENTS

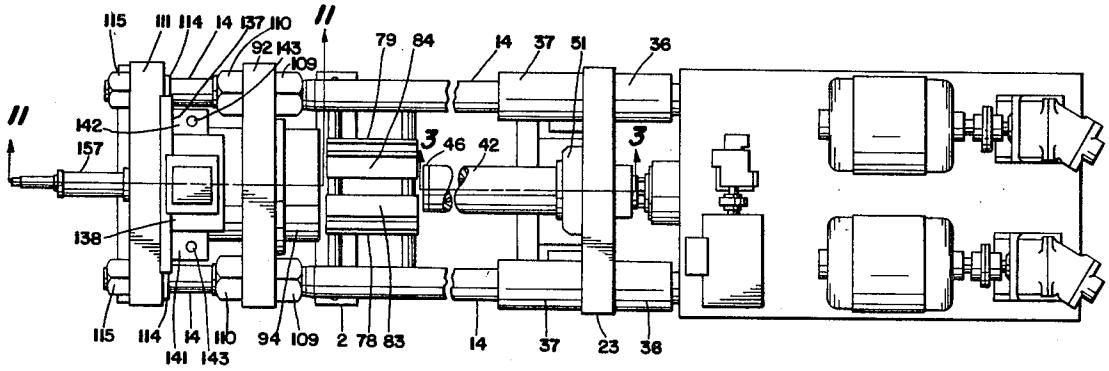
2,688,400	9/1954	Ansel	72/154
3,187,531	6/1965	Cairns	72/254X
2,045,786	6/1936	Lorant	72/254
3,243,984	4/1966	Hoffmann	72/255
1,912,966	6/1933	Brownstein	72/255
2,858,017	10/1958	Kent	72/255
Re19,474	2/1935	Singer	72/254X

FOREIGN PATENTS

130,059	5/1919	Great Britain	72/254X

Primary Examiner—Richard J. Herbst
Attorney—Isler and Ornstein

ABSTRACT: This invention is concerned with a prepiercing and scalping method, in which the billet is precompressed, pierced and scalped, in a substantially continuous closely controlled operation, in a single press, for the purpose of preparing the billet for subsequent extrusion in an extrusion press. The method is designed to prevent distortion or deflection of the piercing mandrel, prevent the wear and tear encountered in the conventional extrusion cycle, and to save time. Provision is made for removal of the slug or breakout resulting from the prepiercing operation, as well as to sever the scalped material into easily removable segments or parts. The invention is further concerned with a press of novel construction for performing the method.



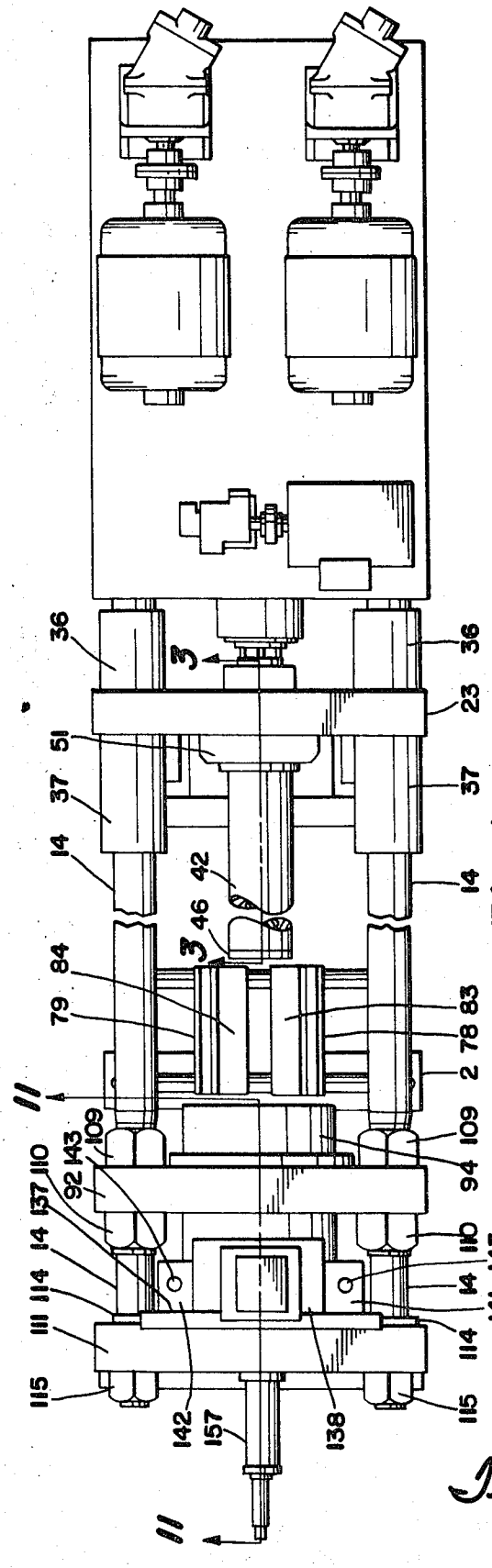


Fig. 1

INVENTORS
PAUL TANDLER
ELLIS R. BLACKWELL
BY
Isler & Dunstein
ATTORNEYS

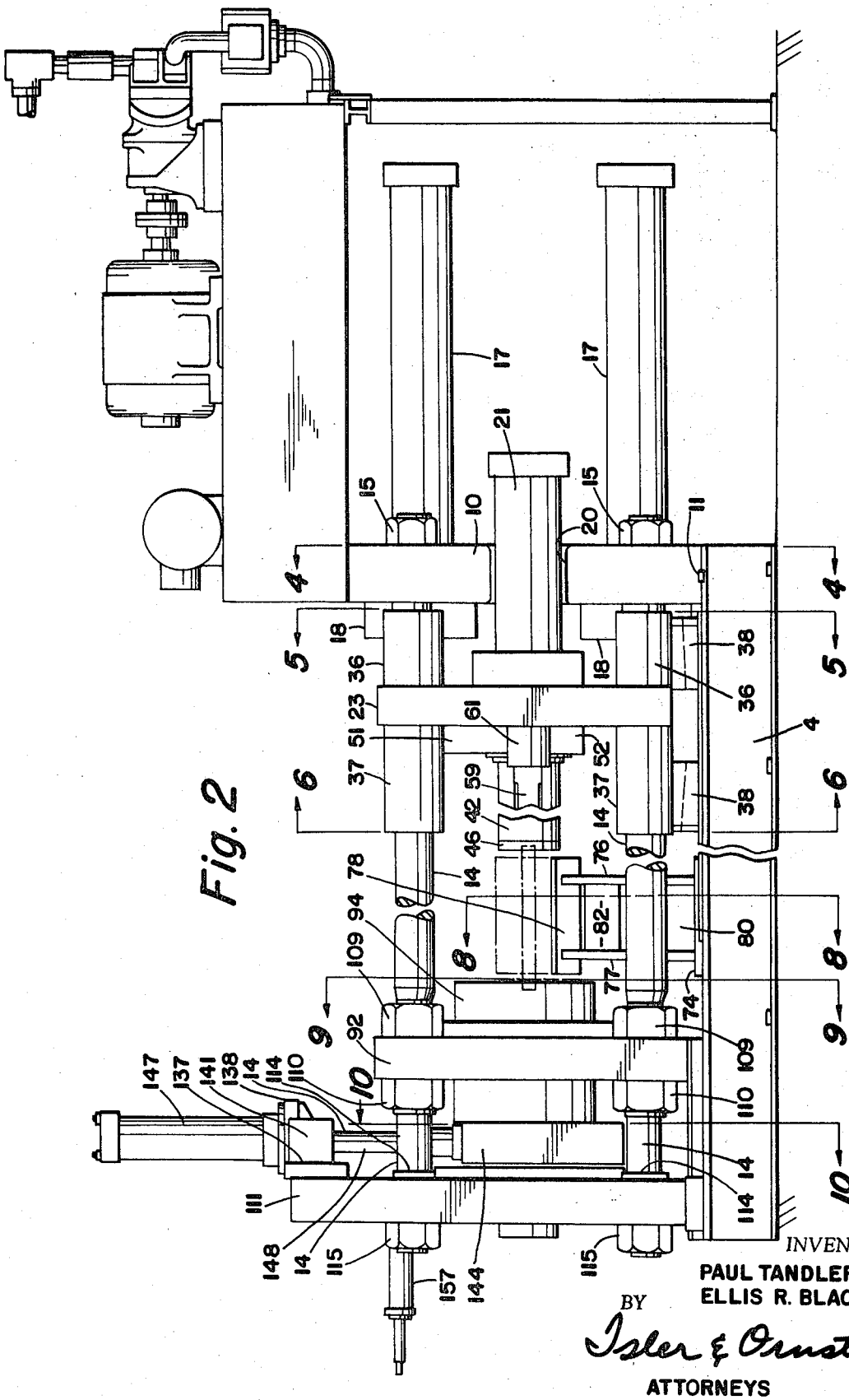


Fig. 2

INVENTORS
PAUL TANDLER
ELLIS R. BLACKWELL

BY
Isler & Ornstein
ATTORNEYS

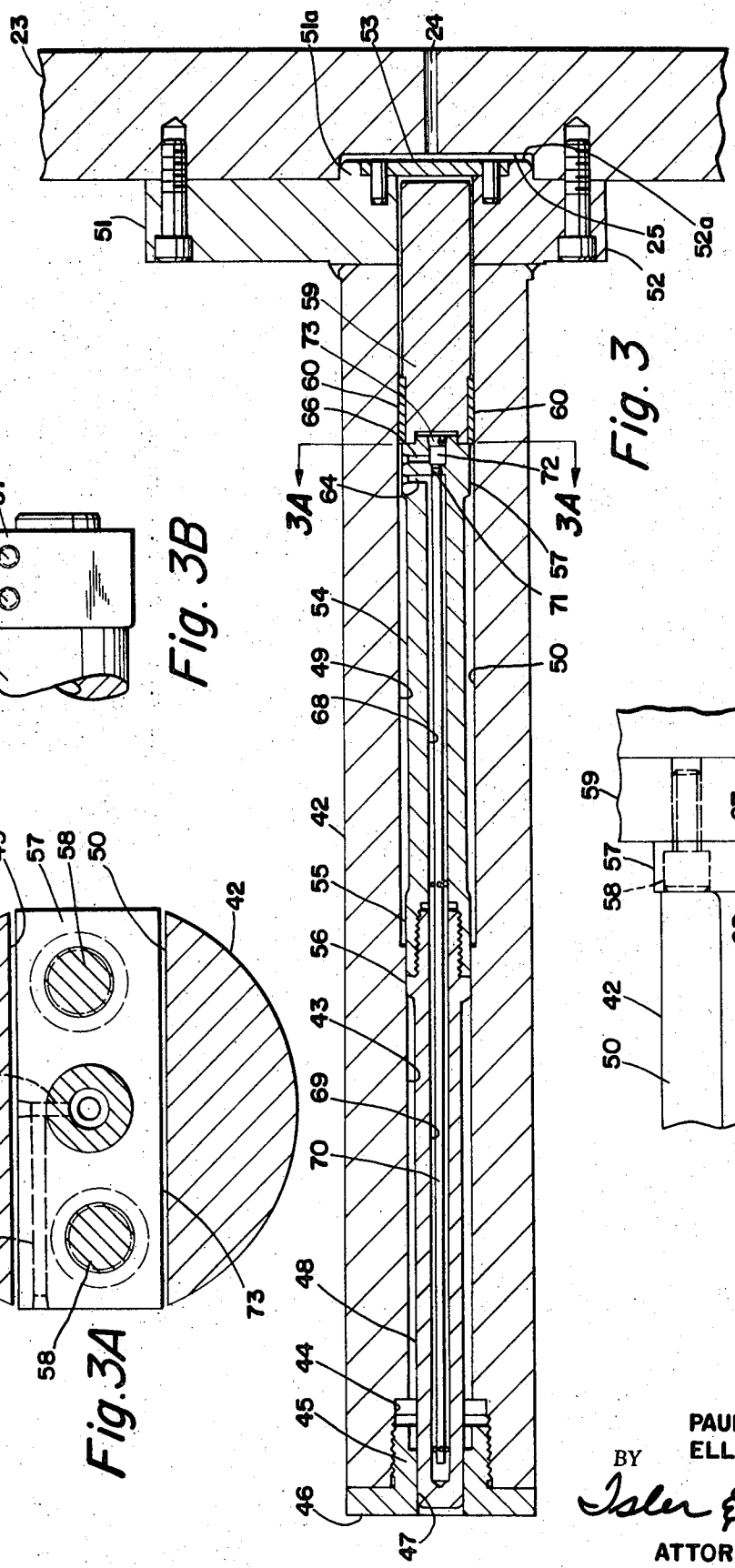


Fig. 3

Fig. 3B

Fig. 3A

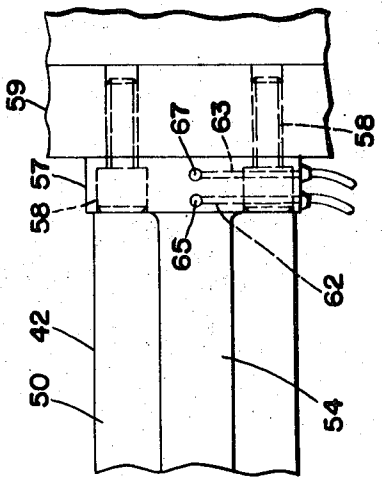


Fig. 3C

INVENTORS
PAUL TANDLER
ELLIS R. BLACKWELL

BY Isler & Dunstein

ATTORNEYS

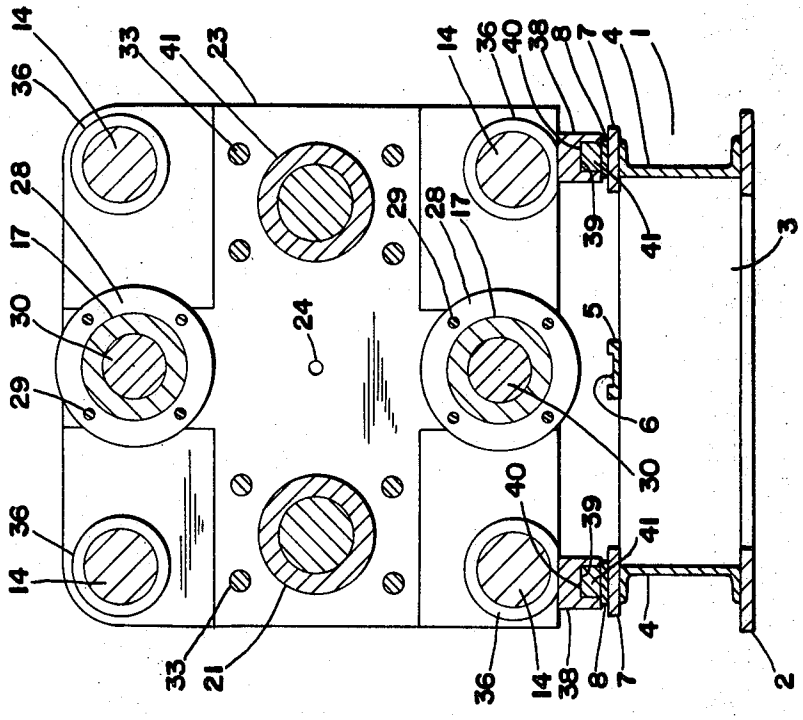


Fig. 5

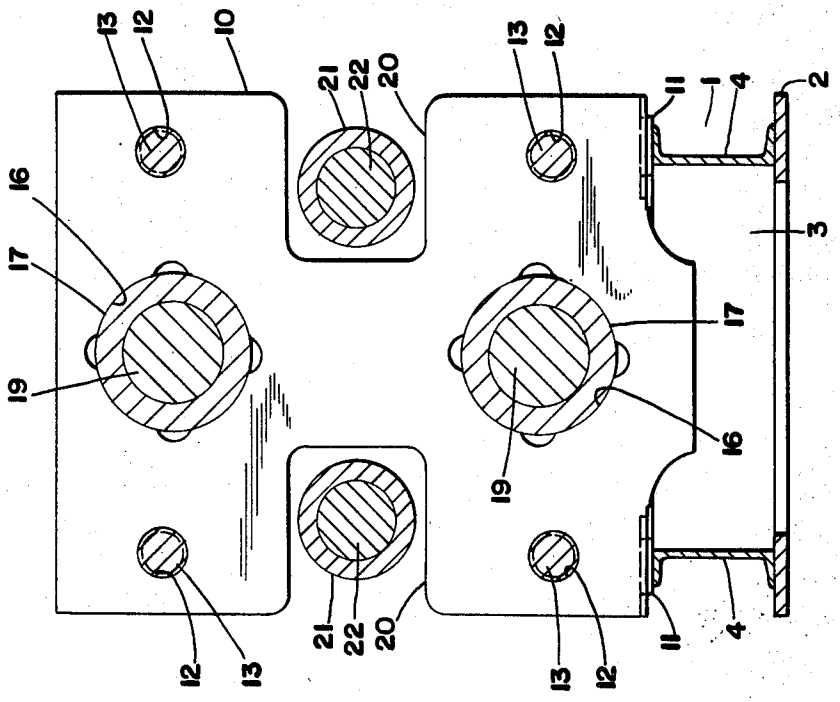


Fig. 4

INVENTORS
BY PAUL TANDLER
ELLIS R. BLACKWELL
Isler & Ornstein
ATTORNEYS

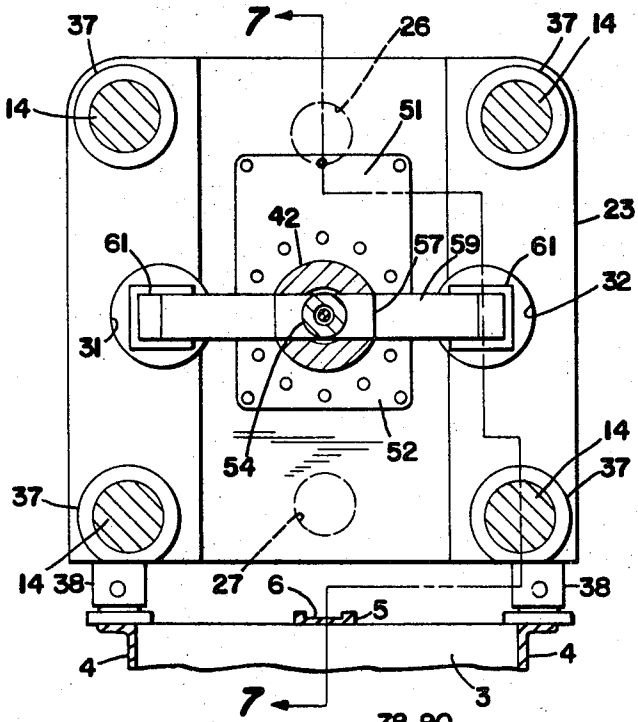


Fig. 6

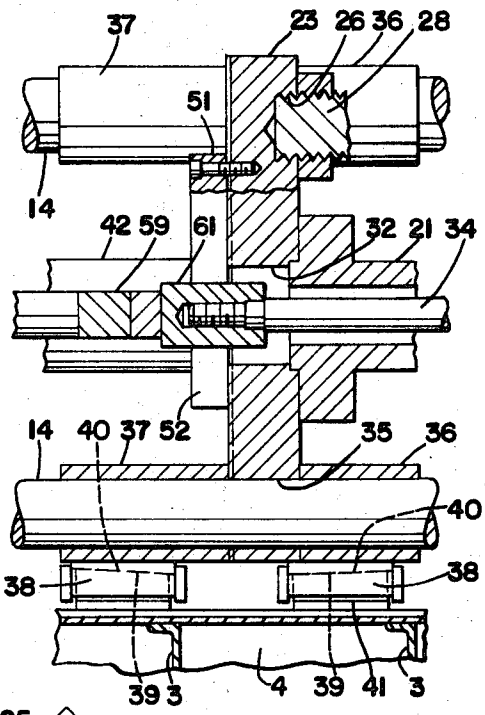


Fig. 7

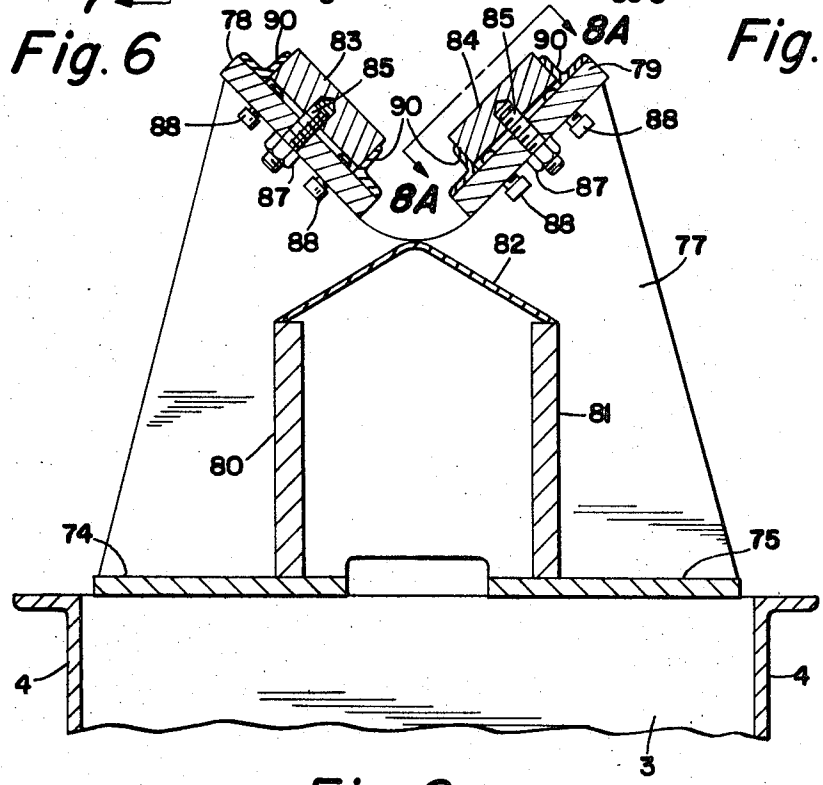


Fig. 8

INVENTORS
PAUL TANDLER
BY ELLIS R. BLACKWELL
John & Ornstein
ATTORNEYS

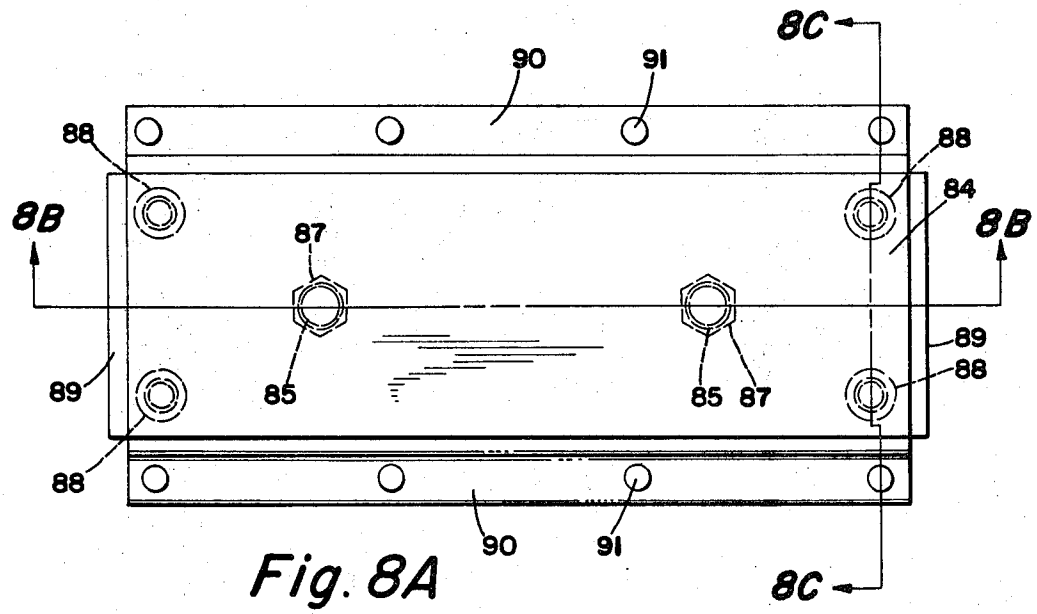


Fig. 8A

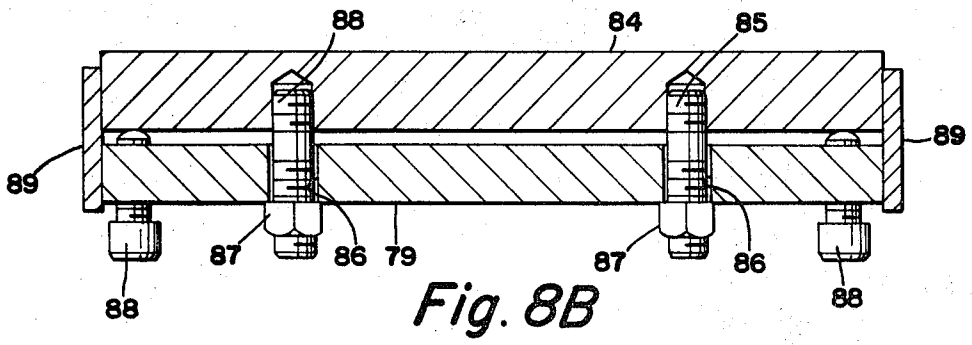


Fig. 8B

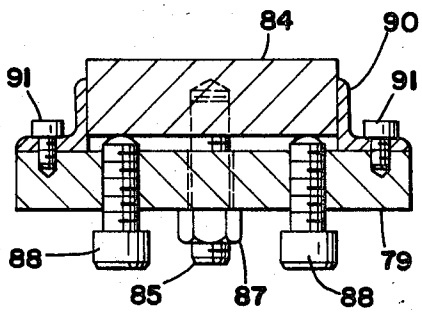
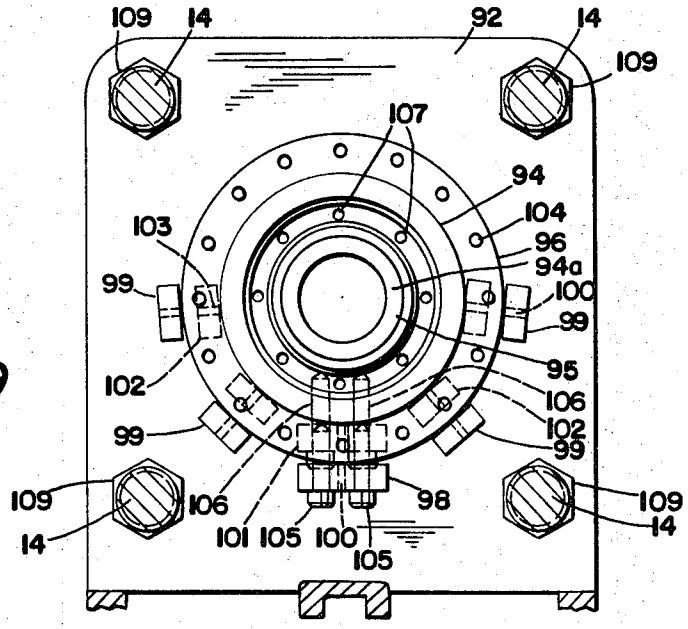


Fig. 8C

INVENTORS
PAUL TANDLER
BY ELLIS R. BLACKWELL
Isler & Ornstein
ATTORNEYS

Fig. 9



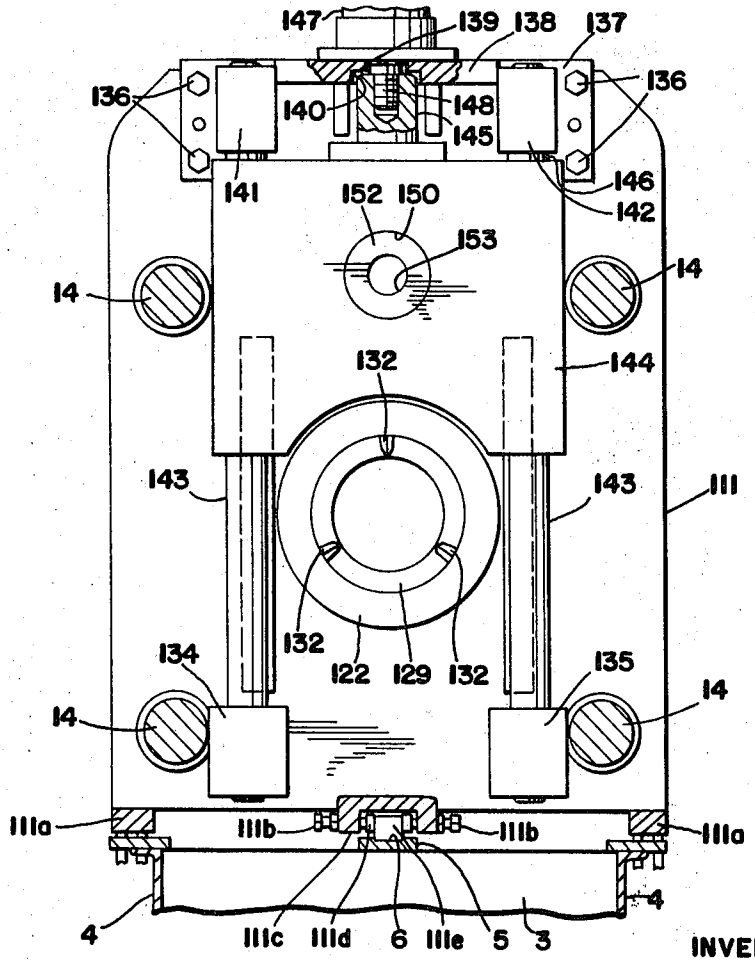


Fig. 10

INVENTORS
PAUL TANDLER
BY ELLIS R. BLACKWELL
Dalen & Ornstein
ATTORNEYS

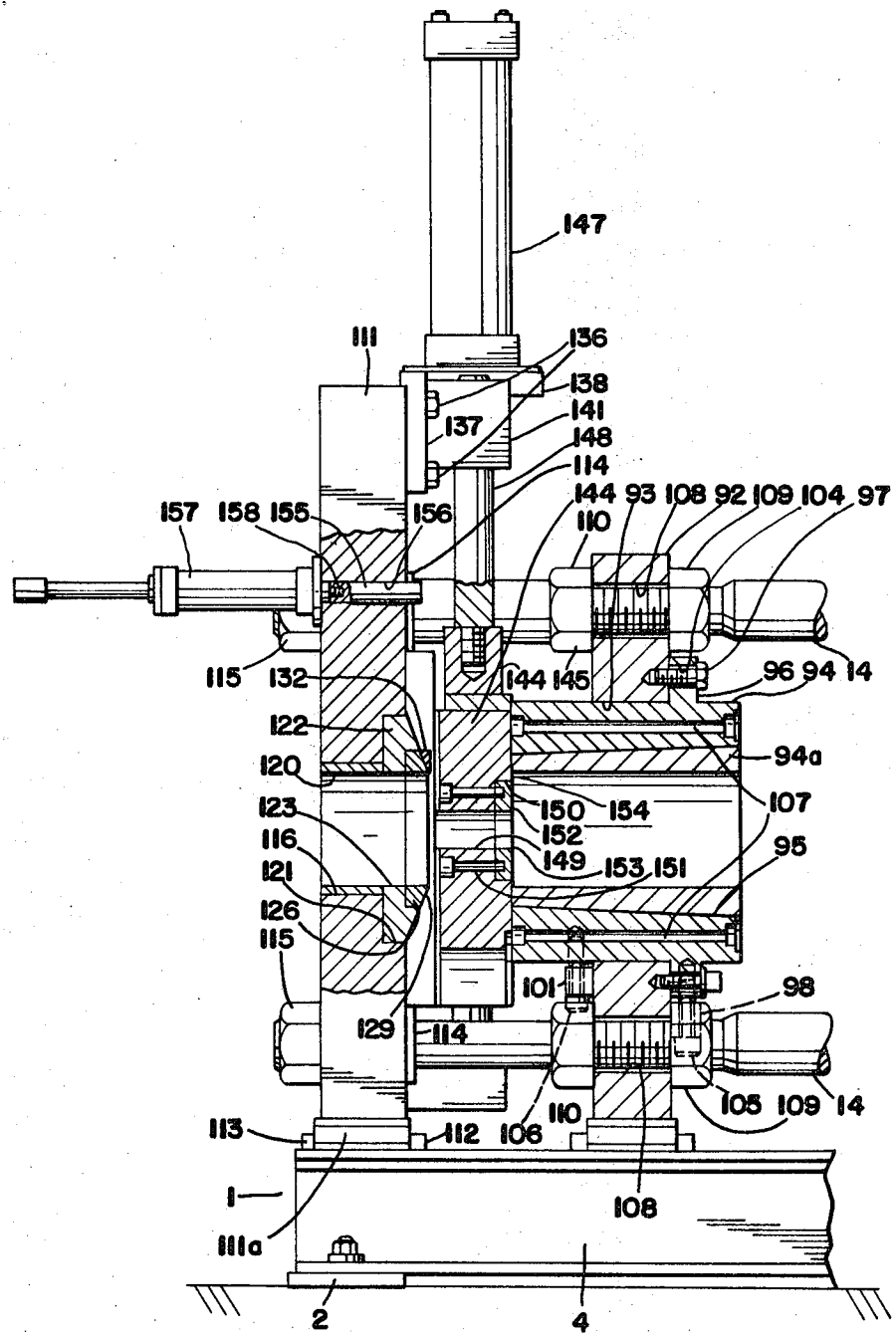


Fig. 11

INVENTORS
PAUL TANDLER
BY ELLIS R. BLACKWELL
Isler & Arnstein
ATTORNEYS

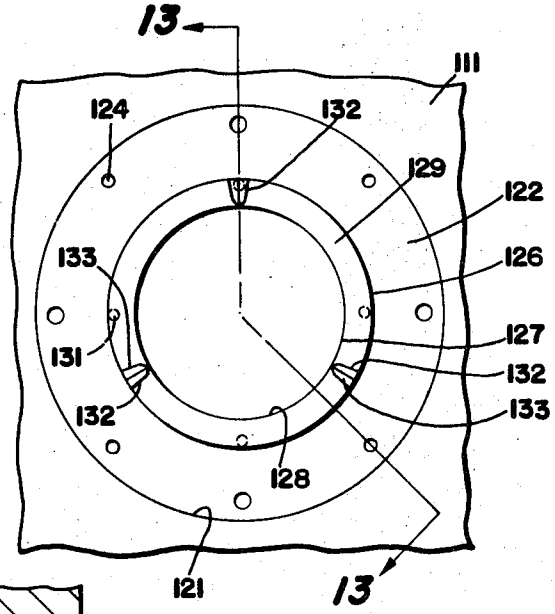


Fig. 12

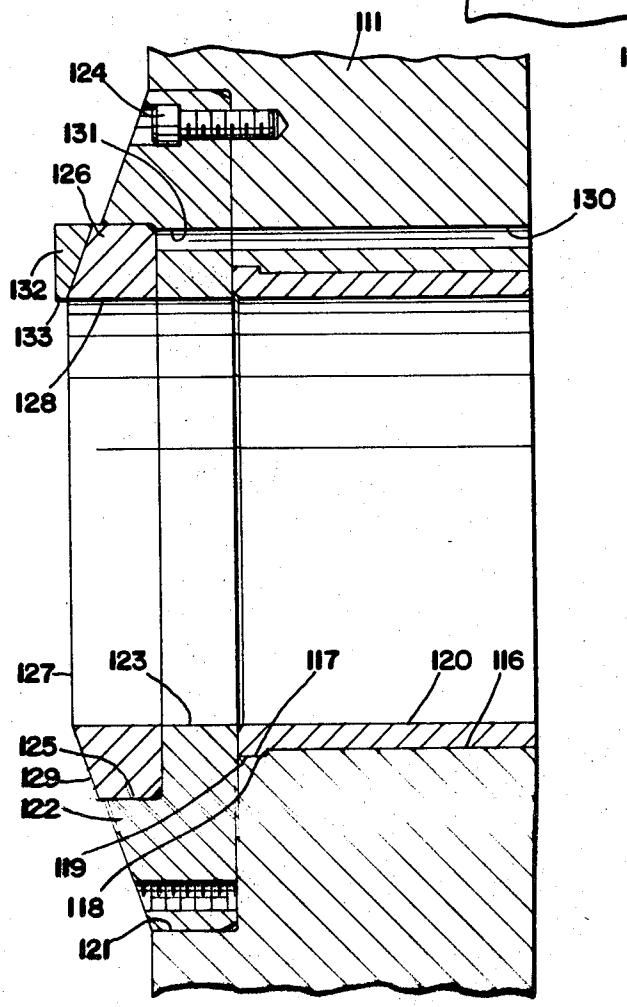


Fig. 13

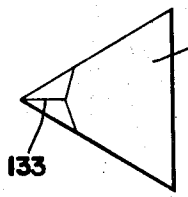


Fig. 14

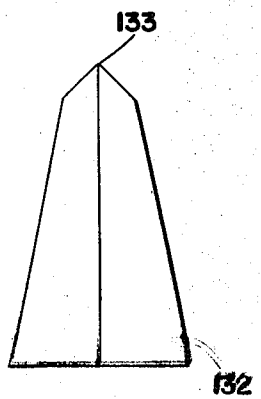


Fig. 15

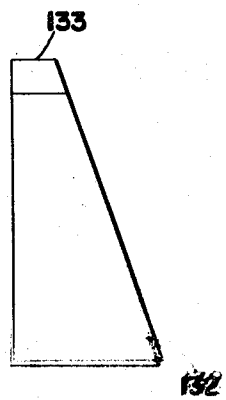


Fig. 16

INVENTORS
PAUL TANDLER
BY ELLIS R. BLACKWELL
Isler & Ornstein
ATTORNEYS

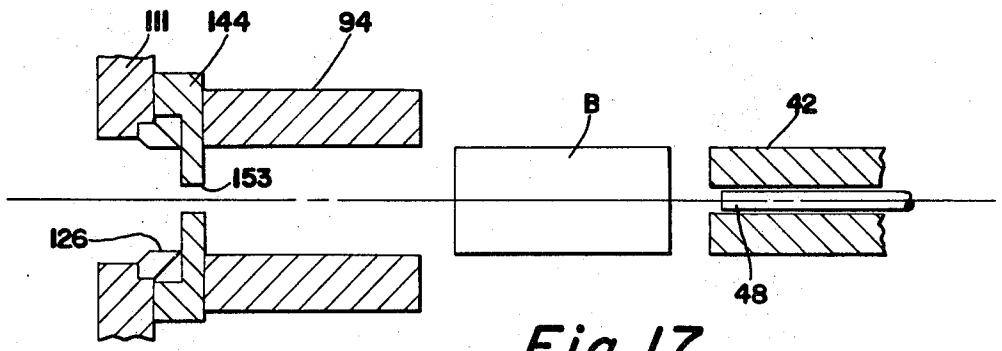


Fig. 17

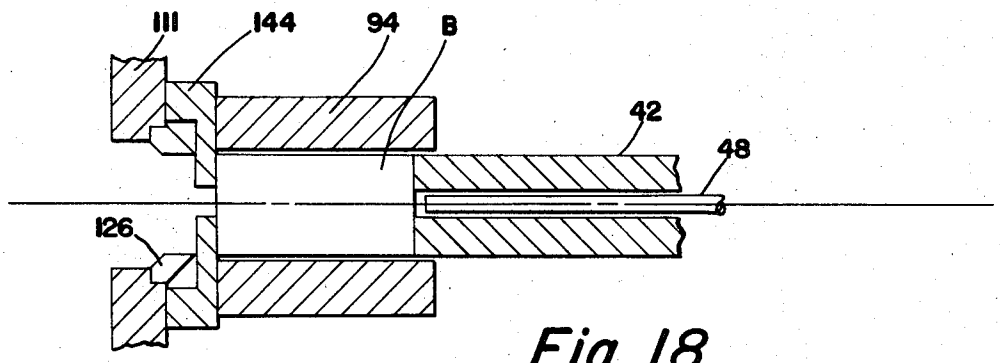


Fig. 18

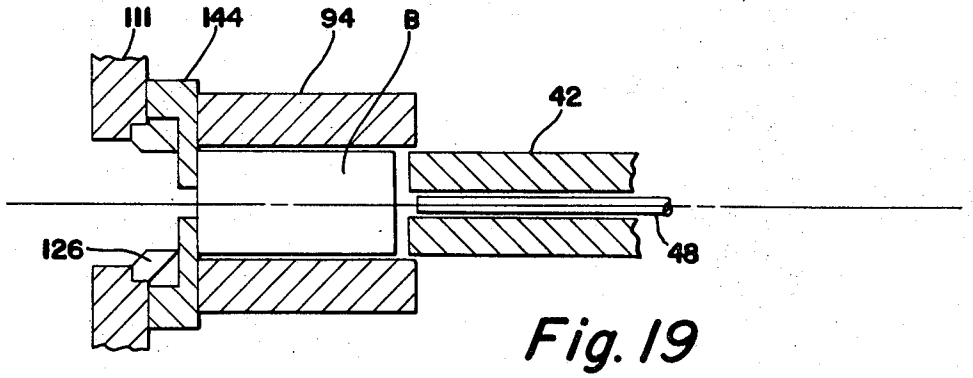


Fig. 19

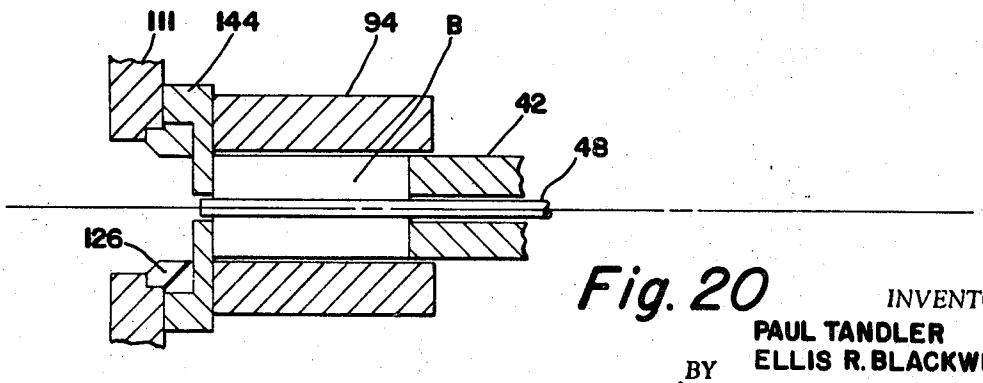


Fig. 20

INVENTORS
PAUL TANDLER
ELLIS R. BLACKWELL
BY
Isler & Ornstein
ATTORNEYS

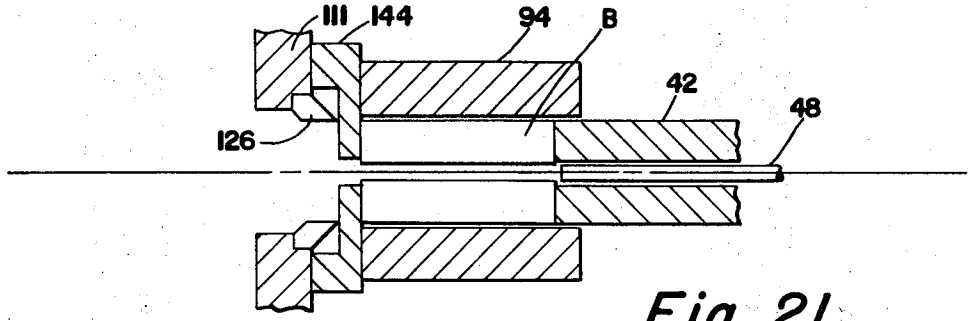


Fig. 21

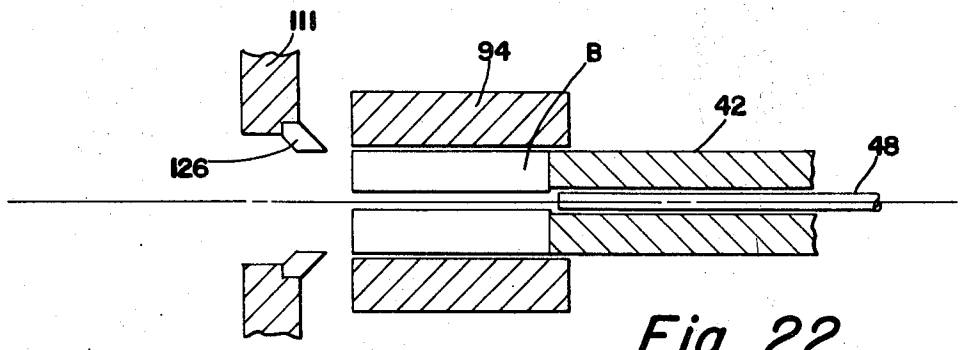


Fig. 22

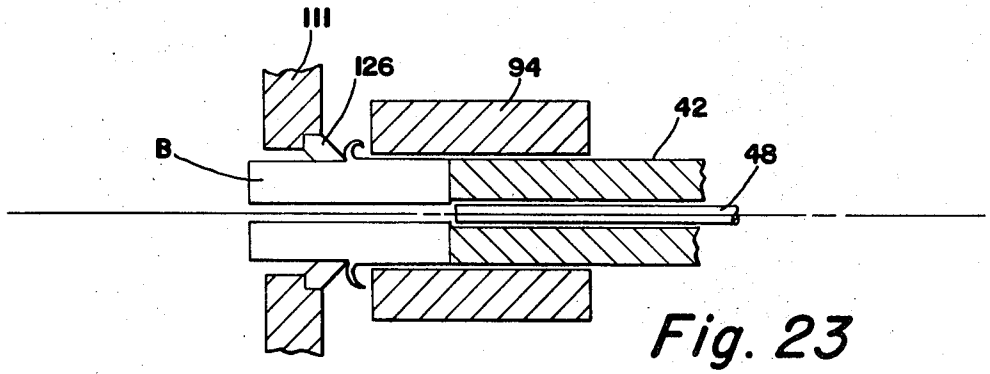


Fig. 23

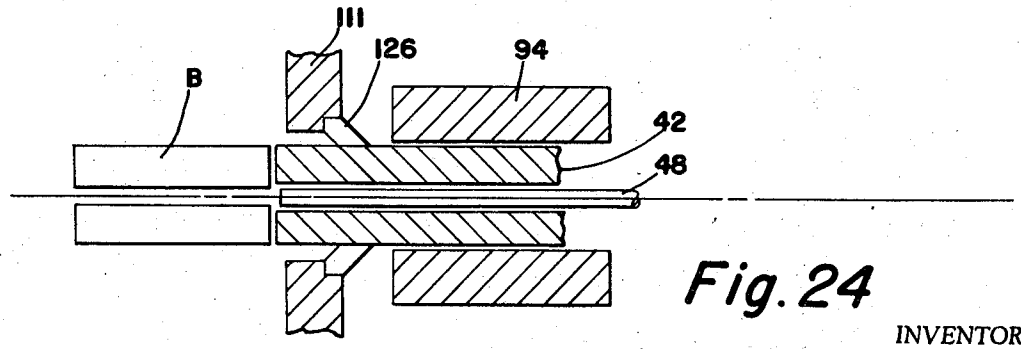


Fig. 24

INVENTORS
PAUL TANDLER
ELLIS R. BLACKWELL
BY
Isler & Ornstein
ATTORNEYS

METHOD OF AND APPARATUS FOR PREPARING COPPER AND BRASS BILLETS FOR EXTRUSION INTO HOLLOW SHELLS

This invention relates generally to a method of and apparatus for preparing copper or brass billets for extrusion into hollow shells.

In the conventional extrusion process, as shown, for example, in Cairns, U.S. Pat. No. 3,172,536, the billet is placed in the extrusion press container and is precompressed or upset by the main ram of the press, after which the billet is pierced by a piercing mandrel which is so positioned in the extrusion die as to form an annular space through which metal of the pierced billet flows or is extruded, thereby forming a hollow shell or tube.

In some cases, the billet is scalped in a separate operation, prior to piercing and extrusion, for the purpose of removing surface impurities or defects and/or sizing the billet to a desired external diameter.

In such conventional extrusion methods, the method of piercing causes deflection of the piercing mandrel, resulting in an eccentric positioning of the mandrel with respect to the extrusion die, producing an extruded shell or tube in which the inner and outer surfaces are in eccentric relation to each other.

Moreover, in all cases where the billets are scalped prior to extrusion, the scalping does not correct or ameliorate the eccentric relationship to which reference has been made, and this is particularly so because the scalping is not carried out in conjunction with or in a controlled correlation with the piercing operation, that is to say, no control over or correlation is assured between the scalping and piercing operations.

Finally, in such conventional extrusion methods, the piercing mandrel of the extrusion press is subjected to the considerable wear and tear of normal operations, requiring frequent repair or replacement, the overall extrusion cycle is time consuming, and a heavy expenditure or hydraulic power in the operation of the extrusion press is required.

The present invention has, as its primary object, the provision of a method of preparing billets for extrusion, in which a much closer control over the piercing operation is exercised than in a conventional extrusion cycle, whereby deflection of the piercing mandrel is eliminated, and production of a shell or tube of accurate conformation is assured.

Another object of the invention is to provide a method of the character described, in which the billet is prepierced in a press substantially smaller than a conventional extrusion press, and having easily adjustable alignment of its parts, and wherein no extrusion is accomplished, thereby sparing the mandrel of the extrusion press from the wear and tear of normal extrusion operations.

A further object of the invention is to provide a method of the character described, in which the billet is scalped in the same press in which the prepiercing is accomplished, that is to say, the scalping is carried out in conjunction with or in a controlled correlation with the piercing operation, thereby insuring that the scalped billet is in proper condition for the extrusion operation.

Other objects and advantages of our invention will be apparent during the course of the following description.

In the accompanying drawings forming a part of this specification, and in which like numerals are employed to designate like parts throughout the same,

FIG. 1 is a fragmentary top plan view of a prepiercing and scalping press embodying the invention;

FIG. 2 is a fragmentary side elevational view of the press of FIG. 1;

FIG. 3 is a fragmentary cross-sectional view, on an enlarged scale, taken on the line 3–3 of FIG. 1;

FIG. 3A is a fragmentary cross-sectional view, taken on the line 3A–3A of FIG. 3;

FIG. 3B is a fragmentary elevational view of the mandrel head showing the water cooling ports as viewed from the left end of FIG. 3A;

FIG. 3C is a fragmentary top plan view of the rear portion of the mandrel holder, and showing the manner in which it is connected to the mandrel crosshead;

FIG. 4 is a vertical cross-sectional view, taken on the line 4–4 of FIG. 2;

FIG. 5 is a vertical cross-sectional view, taken on the line 5–5 of FIG. 2;

FIG. 6 is a vertical cross-sectional view, taken on the line 6–6 of FIG. 2;

FIG. 7 is a fragmentary cross-sectional view, taken on the line 7–7 of FIG. 6;

FIG. 8 is a vertical cross-sectional view, taken on the line 8–8 of FIG. 2;

FIG. 8A is a view taken in the direction indicated by the arrows 8A–8A of FIG. 8;

FIG. 8B is a cross-sectional view, taken on the line 8B–8B of FIG. 8A;

FIG. 8C is a cross-sectional view, taken on the line 8C–8C of FIG. 8A;

FIG. 9 is a vertical cross-sectional view, taken on the line 9–9 of FIG. 2;

FIG. 10 is a vertical cross-sectional view, taken on the line 10–10 of FIG. 2, but with the gate lock in elevated position;

FIG. 11 is a fragmentary cross-sectional view, taken on the line 11–11 of FIG. 1;

FIG. 12 is a fragmentary front elevational view, on an enlarged scale, of the scalping die platen, scalping die holder and scalping die;

FIG. 13 is a fragmentary cross-sectional view, taken on the line 13–13 of FIG. 12;

FIG. 14 is an end view of one of the slitting knives for the scalped material;

FIG. 15 is a front elevational view of the slitting knife of FIG. 14;

FIG. 16 is a side elevational view of the slitting knife of FIG. 14;

FIG. 17 is a view illustrating in a more or less diagrammatic manner, the first step in the sequence of operations of the press, and FIGS. 18, 19, 20, 21, 22, 23 and 24 illustrate, also, in a more or less diagrammatic manner, successive subsequent steps in the sequence of operations of the press, constituting a complete cycle of operations.

Referring more particularly to FIGS. 1 to 16 inclusive of the drawings, the press which will presently be described in detail is mounted on a support base of welded steel construction generally designated by reference numeral 1, and which consists of longitudinally spaced transversely extending pads 2 having transversely extending channel members 3 mounted thereon, longitudinally extending support channel members 4 secured to the ends of the members 3, and a longitudinally extending member 5 (see FIGS. 5, 6 and 10) mounted on the members 3 centrally thereof and having a keyway 6 therein. Support plates 7 (FIG. 5 are mounted on the channel members 4, and wear plates 8 (FIG. 5), preferably of a wear-resisting alloy, are secured to the support plates 7.

For the purpose of facilitating the description of the press, the various units or elements thereof will be described with reference to those views in which they are best illustrated.

FIXED PLATEN

The fixed platen is shown most clearly in FIGS. 2 and 4, and comprises a plate 10 which is located at one end of the base 1, as by keys 11.

The plate 10 is provided with openings 12, through which the reduced ends 13 of tie rods 14 extend, and to which nuts 15 are secured.

The plate 10 is also provided with vertically spaced openings 16 through which cylinders 17 extend, these cylinders having heads 18 which are bolted to the forward face of the plate 10. The pistons of these cylinders are indicated by reference numeral 19 in FIG. 4.

The cylinders 17, which are utilized for movement of the movable platen to be presently described, are preferably "Sheffer" hydraulic cylinders Style FF–UH Series, having a 10-inch bore, a 7-inch rod and a 74-inch stroke.

The plate 10 is further provided in its sides with recesses 20, which accommodate the passage therethrough of cylinders 21 having pistons 22. The cylinders 21 are preferably "Sheffer" hydraulic cylinders Style FF–UH Series, having a 10-inch bore, a 7-inch rod, and a 28-inch stroke. The function of these cylinders will be presently described.

MOVABLE PLATEN

The movable platen of the press is shown most clearly in FIGS. 1, 2, 3, 5, 6 and 7 of the drawings, and is mounted forwardly of the fixed platen, for slidable movement along the base.

This platen comprises a substantially rectangular plate 23, of substantial thickness, having a central bore or passageway 24, which terminates at its forward end in a counterbore 25, for a purpose to be presently described.

The plate 23 is provided centrally thereof adjacent its upper and lower edges with circular recesses 26 and 27 extending into the rear of the plate, which receive the forward ends of anchor pads 28 (FIG. 5) which are secured to the plate 23 by means of bolts 29. The forward ends of the piston rods 30 of the cylinders 17 are secured to the anchor pads 28.

The plate 23 is also provided with bores 31 and 32 (FIGS. 6 and 7) which extend through the plate at points spaced equidistantly laterally from the bore 24 and have their axes coplanar with the axis of the bore 24.

The cylinders 21 are secured, as by bolts 33, to the rear face of the plate 23 in alignment with the bores 31 and 32, and the piston rods 34 of these cylinders extend into the bores 31 and 32.

The plate 23 is further provided adjacent its corners with bores or passageways 35 (FIG. 7).

Welded to the plate 23 in axial alignment with the bores 35, at the rear face of the plate, are cylindrical bushings 36, and welded to the plate 23 in alignment with the bores 35, at the other face of the plate, are cylindrical bushings 37. The tie rods 14 extend through the bushings 36 and 37 and bores 35, as best seen in FIG. 7.

For the purpose of leveling or adjusting the position of the movable platen, the bushings 36 and 37 are mounted on support pad housings 38 (FIGS. 2, 5, 6 and 7) having inclined lower surfaces 39 (FIGS. 5 and 7) which rest on similarly inclined surfaces 40 of slide locks 41. By moving the blocks 41 longitudinally relatively to the housings 38, the positions of the housings 38 may be adjusted vertically. Any desired means may be employed for moving the blocks 41 and for then locking the parts in adjusted position.

STEM, MANDREL HOLDER, AND MANDREL ASSEMBLY

The stem, mandrel holder and mandrel assembly, as well as the manner in which this assembly is mounted on the movable platen, is best seen in FIGS. 1, 2, 3, 3A, 3B, 3C, 6 and 7.

The stem or ram designated by reference numeral 42, comprises an elongated cylindrical member having an axial bore 43 in its forward portion, which is counterbored, as at 44, to provide a recess which is threaded to receive the stem 45 of a nosepiece 46 for the stem 42, this nosepiece having an axial bore 47, in which is slidably mounted the forward end of a piercing mandrel 48.

Rearwardly of the bore 43, the stem 42 is formed to provide a diametrically extending horizontal slot, defined by upper and lower walls 49 and 50 respectively.

The stem 42 has secured at its rear end, above the wall 49, a mounting plate 51, and has secured thereto at its rear end, below the wall 50, a second mounting plate 52, the plates being bolted to the front face of the plate 23 of the movable platen, whereby to secure the stem to the platen in axial alignment with the counterbore 25. The counterbore 25, to which reference has previously been made, provides a circular recess to receive extensions 51*a* and 52*a* of the mounting plates 51 and 52 respectively, as well as a tie plate 53 which interconnects the plates 51 and 52.

A mandrel holder 54 is provided having its forward end slidably mounted in the bore 43 of the stem 42 and has an internally threaded socket 55 at its forward end, in which the rear end of the mandrel 48 is secured, the mandrel having an annular flange 56 which abuts the front end of the socket 55, and which is slidable in the bore 43 of the stem 42.

The mandrel holder 54 is provided at its rear end with a transversely extending head 57, which is movable along the slot defined by the walls 49 and 50. The head 57 is secured, as by bolts 58, to a cross head 59, which extends transversely through the aforesaid slot, and is provided on its upper and lower surfaces with wear plates 60 which are slidable along the walls 49 and 50. The crosshead 59 is provided at its ends with internally threaded sockets 61, which are spaced apart for axial alignment with the bores 31 and 32 of the plate 23, and extend into the latter, as best seen in FIG. 7. The sockets 61 are threadedly secured to the forward ends of the piston rods 34.

For the purpose of cooling the piercing mandrel 48 and its holder 54, the head 57 of the mandrel holder is provided with parallel horizontal passageways 62 and 63, the passageway 62 communicating with a vertical passageway 64, which is closed at its upper end by a plug 65, and the passageway 63 communicating with a vertical passageway 66, which is closed at its upper end by a plug 67.

The passageway 64 communicates with a passageway 68 in the holder 54, which, in turn, communicates with a passageway 69 in the piercing mandrel 48. The passageway 69 is closed at its forward end, so that a cooling fluid, such as water, enters the passageways 64, 68 and 69 and flows through a pipe 70 which extends through the passageways 64, 68 and 69 and has its rear end threadedly secured to the mandrel holder 54, as at 71. Fluid from the pipe 70 enters a chamber 72 in the mandrel holder which is closed at its rear by a plug 73, and passes from this chamber to the passageways 66 and 63.

MEANS FOR ACTUATING THE STEM

The plate 23 is mounted for movement longitudinally of the base 1 on the tie rods 14, which extend through the bushings 37 and 36, and are connected at their rear ends, as by the nuts 15, to the fixed platen 10.

Since the movable platen 23 is connected to the stem 42 in the manner described above, it will be apparent that actuation of the movable platen by means of the piston rods 30 of the cylinders 17 will result in actuation of the stem 42.

MEANS FOR ACTUATING THE MANDREL ASSEMBLY

The actuation of the mandrel assembly is effected by the cylinders 21, through their piston rods 34, which, as previously described, are connected to the sockets 61 of the crosshead 59 of the mandrel assembly.

BILLET CRADLE

The billet cradle is best seen in FIGS. 1, 2, 8, 8A, 8B, and 8C of the drawings, and consists of laterally spaced baseplates 74 and 75 which are mounted on the channel members 3, longitudinally spaced uprights 76 and 77, which are welded to the plates 74 and 75, and base pads 78 and 79, which are welded to the upper edges of the plates 74 and 75, and are disposed at an angle of 90° to each other.

The cradle further includes spaced uprights 80 and 81, which interconnect the uprights 76 and 77, and an inverted V-shaped plate 82, which covers the space between the uprights 80 and 81.

For the purpose of adjusting the position of the billet, to insure axial alignment of the billet with the mandrel assembly,

the billet is not supported directly on the base pads 78 and 79, but, instead, is supported on adjustable pads 83 and 84, having threaded studs 85 welded thereto, which extend through openings 86 in the base pads 78 and 79, and are secured against displacement from these pads by means of nuts 87 secured to the lower ends of the studs 85.

The pads 83 and 84 are adjustable relatively to the pads 78 and 79 by means of push bolts 88 which are threadedly secured in the pads 78 and 79 and which bear against the lower surfaces of the pads 83 and 84. It will be understood that after this adjustment has been made, the nuts 87 are drawn up against the pads 78 and 79 to lock the pads 83 and 84 in adjusted position.

The pads 83 and 84 are provided at their ends with guide plates 89 which abut the pads 78 and 79 and thus act to guide the pads 83 and 84 during the adjustment.

Angle members 90 are secured to the pads 78 and 79 in abutment with the pads 83 and 84, as by means of bolts 91, and serve as dirt deflectors to prevent dirt and scale from accumulating under the pads 83 and 84.

FORMING PLATEN AND BILLET CONTAINER

The press further includes a forming platen and billet container, which is best seen in FIGS. 1, 2, 9 and 11, and comprises a plate 92 of generally rectangular configuration and substantial thickness.

The plate 92 has a circular opening 93 therein through which a billet container 94 extends, which container has a cylindrical outer surface and a conical inner wall 95, that is to say, this wall 95 decreases slightly in diameter from its right end, as viewed in FIG. 11, to its left end. This taper of the wall 95 is to facilitate insertion, as by a press fit, into the container of a removable alloy steel liner (94*a*), having an outer wall of a taper corresponding to that of the wall 95, and an inner wall of a diameter corresponding to the diameter of the billet, e.g., about 11¾ inches to 12 inches, to be received in the liner.

The container 94 is provided with an annular collar or flange 96, which may be formed integrally with the container or welded thereto, this flange being in abutment with the plate 92, and secured to the plate by means of bolts 97.

The billet container 94 does not have a slide fit in the opening 93, but, instead, has an outside diameter slightly smaller than the diameter of the opening 93, so that the billet container can be adjusted, by means to be now described, for the purpose of aligning the alloy steel liner therein axially with the mandrel assembly.

For this purpose, the front wall of the plate 92 is provided at points spaced circumferentially thereabout with a center adjusting pad 98 and angular adjusting pads 99, which pads are welded to the plate. Adjusting screws or bolts (not shown) are mounted in threaded openings 100 in these pads, with their stems bearing against the periphery of the flange 96, whereby adjustment of these screws or bolts in the pads enables the position of the billet container to be adjusted.

Similarly, the rear wall of the plate 92 is provided at points spaced circumferentially thereabout with a center adjusting pad 101 and angular adjusting pads 102 which pads are welded to the plate. Adjusting screws or bolts (not shown) are mounted in threaded openings 103 in these pads, with their stems bearing against the cylindrical outer surface of the container 94, whereby adjustment of these screws or bolts in the pads 98 and 99, enables the position of the billet container to be adjusted.

It may be noted that the openings 104 in the flange 96 through which the bolts 97 pass are of slightly larger diameter than the diameter of the bolts 97, so that the adjustment which has been described may be made without removal of the bolts from the plate 92. After the adjustment has been made, the bolts 97 may be tightened.

After the adjustment has been made, the container is fixed in position or stabilized by means of bolts 105 which pass through unthreaded openings in the pad 98 and are threaded into flange 96, and by means of bolts 106 which pass through unthreaded openings in the pad 101 and are threaded into the wall of the container 94.

The circumferentially spaced passageways or bores 107 (FIGS. 9 and 11) in the container 94 are adapted to receive heating elements (not shown) which may be installed for preheating the container, if such preheating is desired.

As shown in FIGS. 9 and 11, the plate 92 is provided adjacent its corners with openings 108 through which pass threaded portions of the tie rods 14, the tie rods being secured to the plate 92 by means of nuts 109 and 110 which are mounted on these threaded portions of the tie rods.

SCALPING DIE PLATEN AND DIE

The scalping die platen is described at this point in the specification, because it functions to support certain parts of the gate lock to be presently described, but which is positioned between the forming platen 92 and the scalping die platen.

The scalping die platen and die is best seen in FIGS. 1, 2, 10, 11, 12, 13, 14, 15 and 16.

It comprises a plate 111 of substantially rectangular configuration, and is mounted on the base between pads 112 and 113, constituting stops, and which are welded to the base. Adjustable leveling blocks 111*a* (FIGS. 10 and 11) are used to level or adjust the position of the plate 111 vertically. Adjustment of the plate 111 transversely is accomplished by screws 111*b* (FIG. 10) mounted in an adjustment bracket 111*c* secured to the plate 111. These screws are provided with buttons 111*d* which bear against a key 111*e* mounted in the keyway 6.

The plate 111 is provided adjacent its corners with openings through which pass threaded portions of the tie rods 14, the tie rods being secured to the plate between washers 114 and nuts 115 secured to the ends of the tie rods.

The plate 111 is provided with a bore 116, which is axially aligned with the mandrel assembly, and is counterbored as at 117 (FIG. 13) to provide an abutment shoulder 118 for the flange 119 of a guide bushing 120.

The counterbore 117 is further counterbored as at 121 to provide a recess and abutment for a scalping dieholder 122 having an opening 123 therein of the same diameter as the inner diameter of the bushing 120. The dieholder 122 is secured in the counterbore 121 by means of bolts 124.

The holder 122 is provided with a recess 125, in which is disposed a scalping die 126 having an annular scalping or cutting edge 127, formed by the intersection of the internal surface 128 of the die and a conical surface 129 of the die. The surface 128 is of the same diameter as the inner diameter of the bushing 120 and the opening 123 of the dieholder 122. The die 126 is secured to the holder 122 by means of bolts (not shown) which extend through circumferentially spaced holes 130 which extend through the plate 111 and holes 131 in the die holder 122, and are threaded into the rear of the die.

The die 126 is provided at three circumferentially spaced points, 120° apart, with knives 132, of a construction clearly depicted in FIGS. 14, 15 and 16, and having cutting edges 133 which are perpendicular to the cutting edge 127 of the scalping die 126. The cutting edges 133 are preferably tipped with a cutting alloy, such, for example, as Stellite.

GATE LOCK

The gate lock and means for mounting it are shown most clearly in FIGS. 1, 2, 10 and 11.

The plate 111 has secured thereto adjacent its lower edge a pair of transversely spaced guide blocks 134 and 135, having vertical bores therein.

Secured to the plate 111 adjacent its upper edge, as by bolts 136, is a gate lock cylinder bracket 137 having a horizontal plate 138 provided with an opening 139 which is counterbored to provide a recess 140.

The bracket 137 is also provided with spaced guide blocks 141 and 142 having vertical bores therein which are in axial alignment with the ores of the guide blocks 134 and 135 respectively.

Mounted in the bores of the blocks 134, 135, 141 and 142 are the reduced end portions of gate lock guide rods 143 which serve to guide a gate lock 144 in its vertical movements.

The gate lock 144 has secured to its upper edge a cylinder mount adapter 145, which, when the gate lock is in its uppermost position, extends into the recess 140 of the plate 138.

Stop plates 146 are secured to the upper edge of the gate lock 144 and come into abutment with the lower ends of the guide blocks 141 and 142 to stop upward movement of the gate lock.

Mounted on the plate 138 of the bracket 137 is a hydraulic cylinder 147 for actuating the gate lock. The cylinder 147 is preferably a "Sheffer" Style FFX–Series HH cylinder, having an 8-inch bore and a 3½-inch rod 148 having a stroke of 24 inches, this rod being threadedly secured to the adapter 145.

The gate lock 144 is provided with a bore 149, which is counterbored as at 150 to provide a recess in which is secured, as by bolts 151, a trimmer 152 having a circular cutting or trimming edge 153, which is substantially flush with the face 154 of the gate lock. The trimmer 152 is designed, during upward movement of the gate lock 144, to shear off the slug or breakout which is formed during the prepiercing operation of the press, which operation will be presently described.

For the purpose of removing such slug or breakout, when the gate lock is in its elevated or raised position, a knockout or rod 155 is provided, which is slidably mounted in a bore 156 or the plate 111. This knockout or rod is adapted to be moved into the bore 149 and through the trimmer 152 when the gate lock is in raised position, for the aforesaid purpose.

The rod 155 is actuated by a pneumatic cylinder 157 which is mounted on the plate 111. The cylinder 157 is preferably a "Sheffer" cylinder Style FFX–HH Series, having a 3¼-inch bore and a 1¾-inch rod having a 10-inch stroke, the rod of the cylinder being threadedly secured, as at 158, to the rod 155.

METHOD OF OPERATION

A hydraulic system for actuating the various cylinders, and an electrical system for actuating these in a predetermined sequence, so that operation of the press is virtually automatic, is provided, but a description of these systems, and the circuitry involved, is not deemed to be necessary or essential for the purposes of this invention.

The method of operation and the sequence of operations will be understood, through reference to the constructional features which have been described, taken in conjunction with FIGS. 17 to 24 inclusive, which illustrate, in a somewhat diagrammatic manner, the sequence of operations.

A heated billet, designated B in FIG. 17, is rolled onto the pads 83 and 84 of the billet cradle, which has been described, with the stem 42, piercing mandrel 48, billet container 94, lowered gate lock 144, plate 111 and scalping die 126 in the relative positions shown in this FIG.

The stem 42, sometimes referred to as the ram, is, through movement of the movable platen, effected by the cylinders 17, moved forwardly to the position shown in FIG. 18, pushing the billet B into the container 94, or rather, into the liner 94*a* of the container, and just before the billet bottoms against the gate lock 144, the ram or stem slows to a pressing speed and upsets or compresses the billet, at a pressure of 200 tons.

The pressure on the stem is then relieved, and the stem is backed away from the billet approximately 2 inches, as indicated in FIG. 19, where the stem is stopped and locked in position hydraulically, preparatory to the piercing operation.

The stem is then moved to the position shown in FIG. 20, to lock the billet against rearward movement, and the piercing mandrel 48 is then moved to the position shown in this FIG., causing the billet to be pierced. This piercing operation involves movement of the mandrel at piercing speed by the cylinders 21, and the mandrel is moved through its full stroke, so that its forward end extends into the opening 149 of the gate lock 144. As a result of this piercer breakthrough of the billet, a slug or breakout of copper or brass from the billet is forced into this opening. This slug or breakout of copper or brass is sheared off the billet and subsequently disposed of in a manner to be presently described.

At the end of its stroke, the piercing mandrel 48 is returned or withdrawn to the position shown in FIG. 21, while the ram or stem 42 maintains some pressure against the billet, thus stripping the billet off the mandrel.

With the billet and parts in the position shown in FIG. 21, the gate lock 144 is elevated by the cylinder 147 to the position shown in FIG. 10, and denoted, in FIG. 22, by the absence of a showing of the gate lock. This movement of the gate lock causes the trimmer 152 to shear off the slug or breakout on the end of the billet, and which, as stated above, has been forced into the opening 149. This slug or breakout is then knocked out or removed from the gate lock by movement of the rod 155 through the opening 149, which movement is effected by the cylinder 157, after which the rod 155 is retracted to the position shown in FIG. 11.

With the gate lock 144 in its fully elevated position, the ram or stem 42 moves forwardly, as indicated by FIG. 23, and at pressing speed, to push the billet out of the container 94 and through the scalping die 126, the cutting edge 127 of which "scalps" or removes a thin outer layer or skin of a depth of from 0.050 inch to 0.060 inch from the billet, in the manner indicated in FIG. 23, to thereby remove surface impurities or defects and/or size the billet to a desired external diameter for subsequent extrusion of the billet.

In order to facilitate removal of this outer skin or scalped layer, as the scalping operation proceeds, the knives 132 cut the scalped layer into segments, which fall off the billet, and thus cause no interference with the scalping operation.

The ram or stem 42 then pushes the billet through the platen 111 and to the discharge position indicated in FIG. 24, from which position the billet rolls into an extrusion press loader (not shown). The ram is then retracted to its fully retracted position, as shown in FIG. 17.

With the ram in fully retracted position, the gate lock is lowered to the position shown in FIGS. 2 and 11, pushing off any scalped material which has clung to the scalping die, and the gate lock is then in position for the next cycle of operations.

It is thus seen that we have provided a method of preparing billets for extrusion in which a close control over the piercing operation is exercised, and wherein deflection of the piercing mandrel is virtually eliminated, and production of a shell or tube of accurate conformation is assured.

It is also seen that we have provided a method of the character described, in which the billet is prepierced in a press which is substantially smaller than a conventional extrusion press, which press has easily adjustable alignment of its parts, and wherein no extrusion is accomplished, thereby sparing the mandrel of the extrusion press from the wear and tear of normal extrusion operations. In this connection, it should be noted that the prepiercing operation enables the extrusion of an open tube in the extrusion press in which such tube is subsequently extruded, and without the usual formation of a "piercing slug" during the conventional piercing stroke of such extrusion press, with the attendant problem of removing the piercing slug. In other words, the piercing slug is removed in the press of the present invention, and the extrusion operation on the prepierced billet in the extrusion press is greatly facilitated.

It is also seen that we have provided a method of the character described, in which a time savings in the overall extrusion cycle is effected, as well as a substantial saving in the hydraulic power required for operation of the extrusion press.

It is further seen that we have provided a method and press in which the billet is scalped in the same press in which the prepiercing is accomplished, that is to say, the scalping is car-

ried out in conjunction with or in a controlled correlation with the piercing operation, thereby insuring that the scalped billet is in proper condition for the extrusion operation.

It is to be understood that the form of our invention, herewith shown and described, is to be taken as a preferred example of the same, and that various changes may be made in the shape, size and arrangement of parts thereof, without departing from the spirit of the invention or the scope of the subjoined claims.

We claim:

1. In a method of prepiercing and scalping billets for subsequent extrusion into hollow shells, the steps which comprise compressing a billet to a predetermined size by releasably confining said billet against movement of a ram thereagainst, piercing the confined billet by means of a piercing mandrel moving in the same direction as said ram, retracting the piercing mandrel from the confined billet, thereafter releasing the confined and pierced billet and moving the released billet by movement of said ram in the same direction as said initial movement of the ram through a scalping die to remove a thin outer skin from the released billet, and then continuing movement of the billet beyond the scalping die by continued movement of the ram in said direction.

2. The method, as recited in claim 1, wherein the billet is confined against a removable means comprising a gate lock, which is withdrawn from operative position prior to the scalping of the pierced billet.

3. The method, as recited in claim 2, wherein the slug or breakout produced incidental to the piercing operation is removed from the pierced billet simultaneously with the withdrawal of said gate lock.

4. The method, as recited in claim 1, wherein said scalped material is severed into segments during the scalping operation.

5. In a method of prepiercing and scalping an unpierced billet for subsequent extrusion into hollow shells, the steps which comrpise pushing a billet into a container by movement of a ram in a predetermined direction, whereby to compress or upset the billet in the container, retracting the ram from the billet, piercing the billet axially by piercing means moving in the same direction as said ram movement, retracting the piercing means from the pierced billet, shearing off the slug or breakout on the end of the billet caused by the breakthrough of the piercer through the billet, and causing the pierced billet to move in the same direction as said initial movement of the ram and pass through a scalping die, to remove a skin portion of the billet.

6. The method, as recited in claim 5, including the step of cutting said skin portion into segments incidental to said scalping operation.

7. In a press of the character described, a container having a cylindrical inner wall, means independent of said container disposed at one end of said container and comprising a vertically movable gate, one wall of which provides an abutment, means for supporting a billet to be pierced and scalped, a ram for forcing said billet from said supporting means into said container and against said abutment, whereby to compress said billet to a predetermined external diameter, means movable independently of said ram for piercing said billet while in said container, and means disposed at that side of said gate remote from said container and comprising a scalping die having an annular cutting edge for removing a thin outer skin from said billet.

8. A press, as defined in claim 7, wherein said gate is provided with an opening having a circular cutter therein for shearing off the slug or breakout produced by the piercing of the billet.

9. A press, as defined in claim 8, including a series of circumferentially spaced knives mounted on said scalping die and adapted to sever said skin into segments during removal of said skin.

10. A press, as defined in claim 9, wherein said means for supporting the billet comprises angularly disposed plates, and means for adjusting said plates in a direction normal to their planes.

11. In a press of the character described, a stationary platen, a movable platen, hydraulically actuated means mounted on said stationary platen for moving said movable platen relatively to said stationary platen, a ram mounted on said movable platen, a piercing mandrel disposed within said ram, hydraulically actuated means mounted on said movable platen for moving said piercing mandrel independently of said ram, billet-supporting means disposed at that end of said ram remote from said movable platen, a container disposed at that end of said supporting means remote from said ram and adapted to receive a billet from said supporting means, a gate disposed at that end of said container remote from said supporting means and having a wall providing an abutment for the front of said container, and an opening adapted to receive the slug or breakout resulting from piercing of the billet by said mandrel, means for hydraulically moving said gate vertically upward out of the path of movement of said billet, a second stationary platen disposed at that side of said gate remote from said container and having an opening therein for passage of said billet when said gate has been elevated, said second stationary platen having means for guiding said gate during movement of the latter, and a scalping die mounted at one end of the opening in said second stationary platen for removing a thin outer skin from the billet as it passes through said opening.

12. A press, as defined in claim 11, including hydraulically driven means for removing said slug or breakout from the opening in said gate after the gate has been elevated.

13. In a method of prepiercing and scalping billets for subsequent extrusion into hollow shells, the steps which comprise pushing a billet into a container by movement of a ram in a predetermined direction, whereby to compress or upset the billet in the container and against a movable abutment, retracting the ram from the billet, piercing the billet axially by piercing means moving in the same direction as said ram movement, retracting the piercing means from the pierced billet, removing said abutment to permit continued movement of the pierced billet out of the container, causing said ram to push said pierced billet out of said container, and by continued movement of the ram, pushing said pierced billet through a scalping die having an annular cutting edge for removing a skin portion of the pierced billet.