

Sept. 5, 1933.

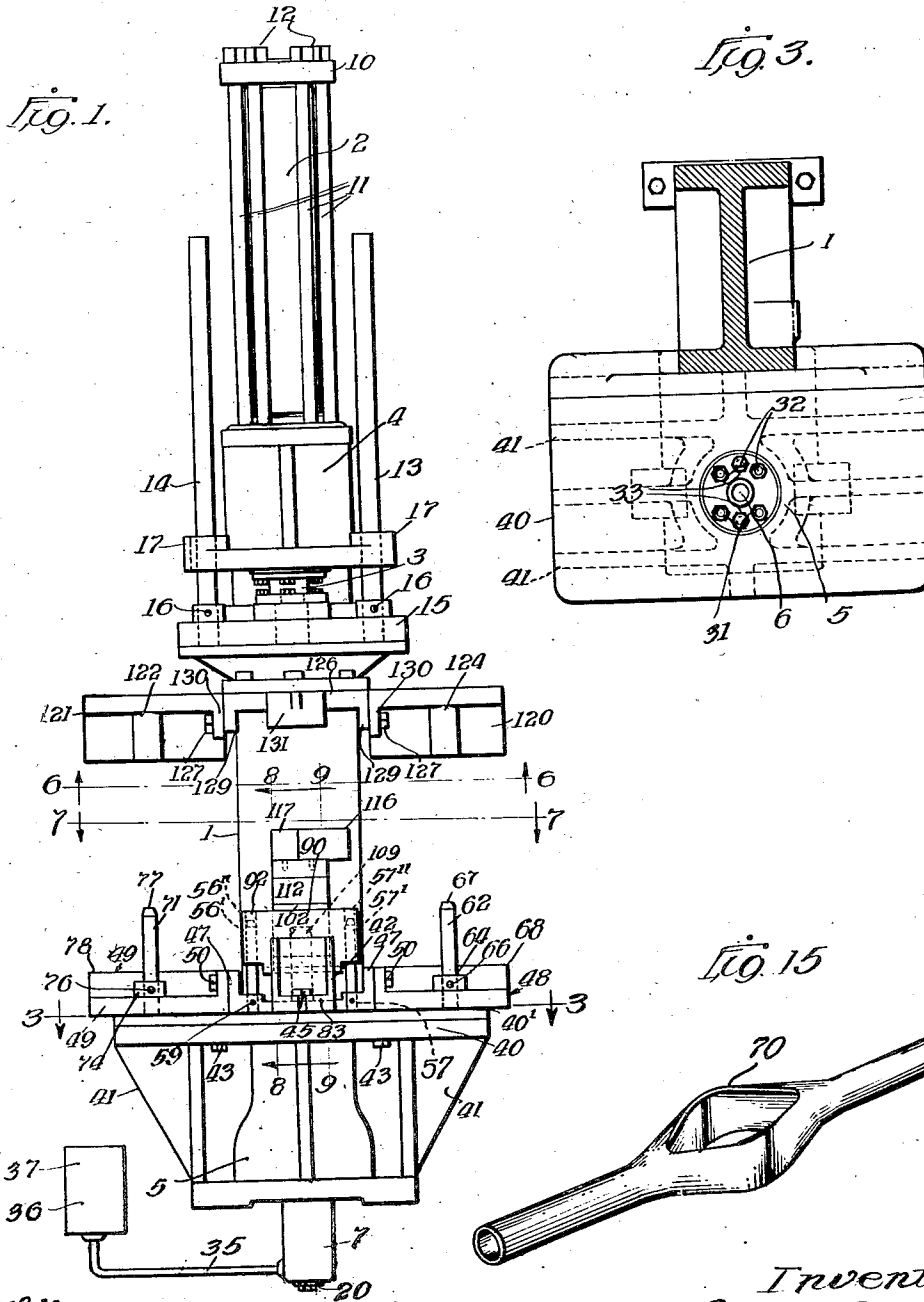
G. SPATTA

1,925,850

METHOD OF AND MEANS FOR SPREADING A SLOTTED TUBE

Filed Feb. 3, 1930

6 Sheets-Sheet 1



Witnesses:

Harry P. L. White
Robert Cramer

Inventor:
George Spatta

Max Jacobson Portcher, Attorney
at Law

Sept. 5, 1933.

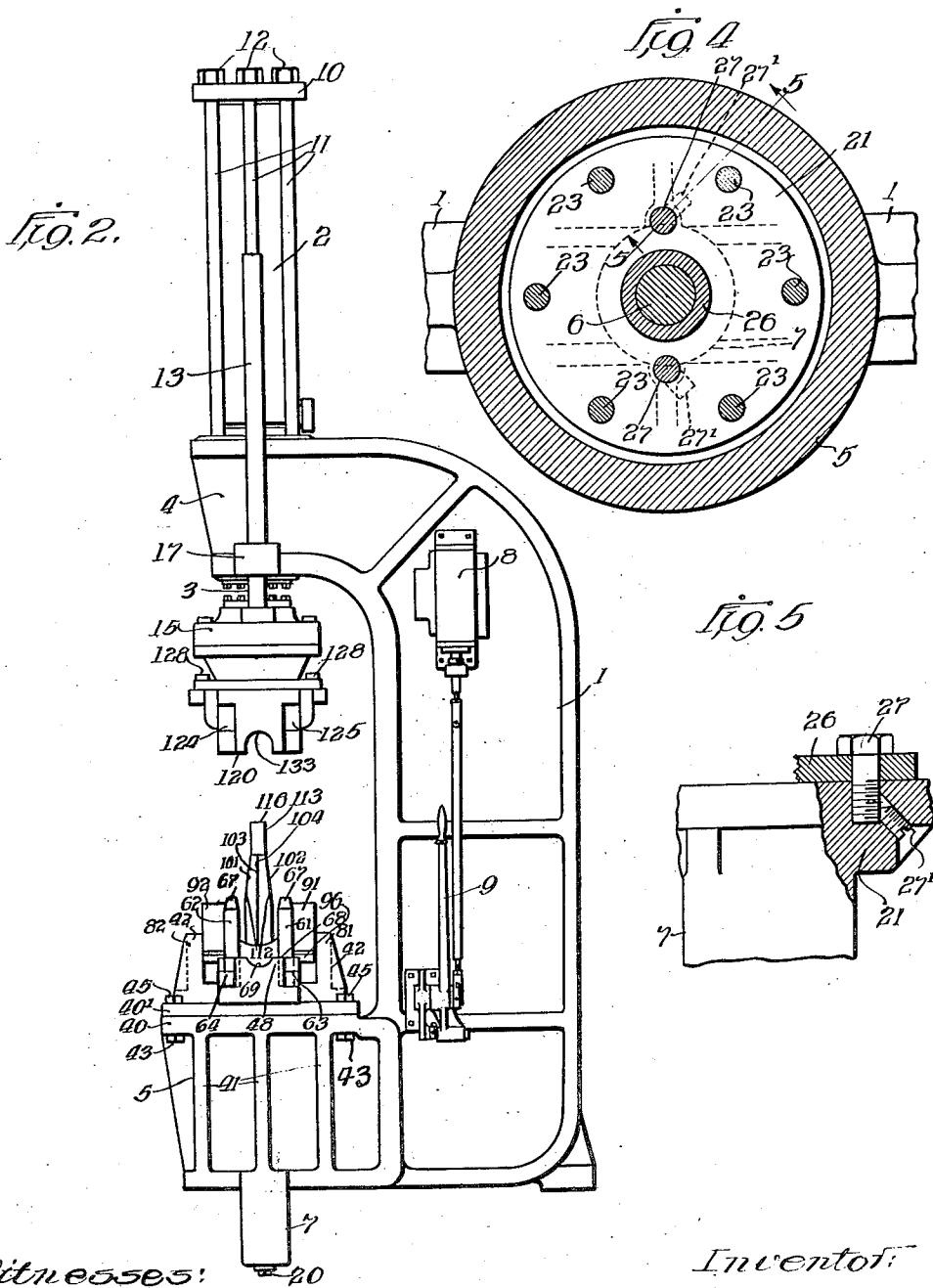
G. SPATTA

1,925,850

METHOD OF AND MEANS FOR SPREADING A SLOTTED TUBE

Filed Feb. 3, 1930

6 Sheets-Sheet 2



Witnesses:

Harry R. White

Robert Cramer

Inventor:

George Spatta

134 *My commission expires* *City*

Sept. 5, 1933.

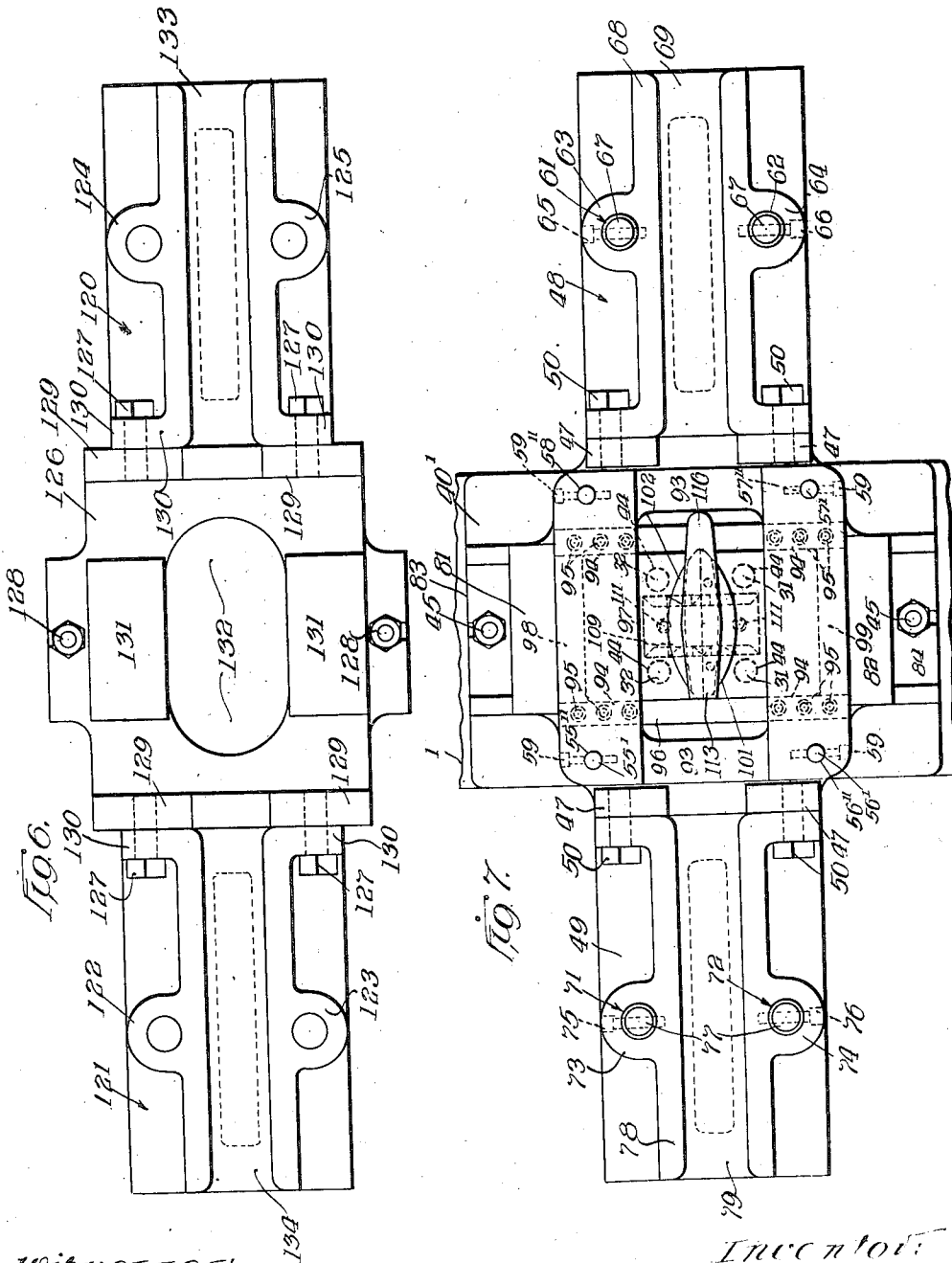
G. SPATTA

1,925,850

METHOD OF AND MEANS FOR SPREADING A SLOTTED TUBE

Filed Feb. 3, 1930

6 Sheets-Sheet 3



Witnesses:

Harry B. L. White
Robert Cremer

Robert Cremer

Inventor:
George Spalla:

George Spalla:

1891
Maurice Jackson Boucher-Daniel
at 493

2443

Sept. 5, 1933.

G. SPATTA

1,925,850

METHOD OF AND MEANS FOR SPREADING A SLOTTED TUBE

Filed Feb. 3, 1930

6 Sheets-Sheet 4

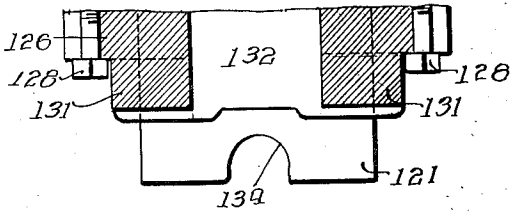
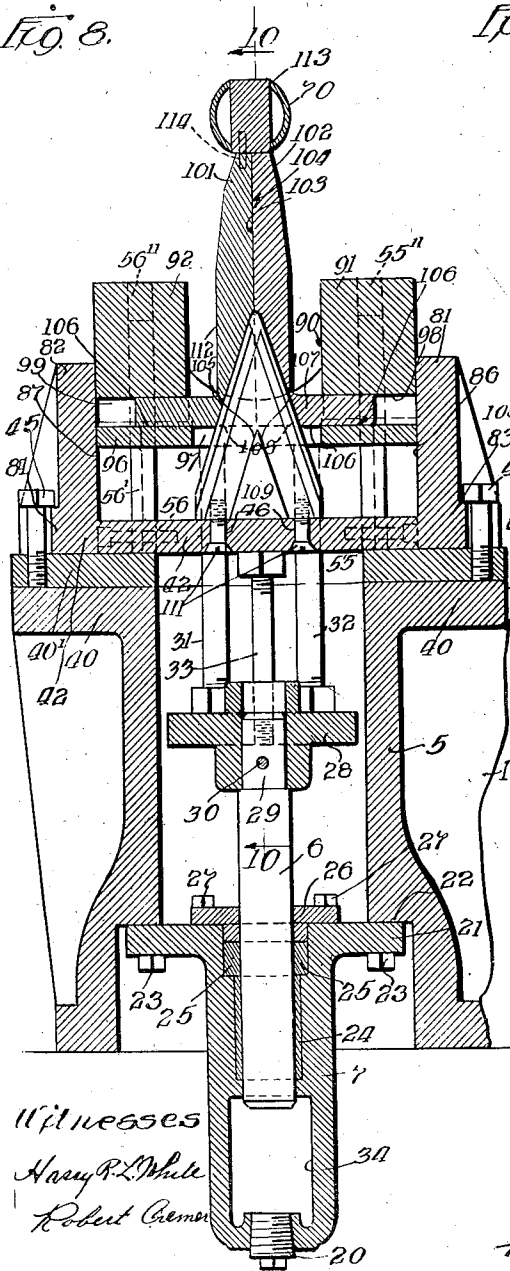


Fig. 8.

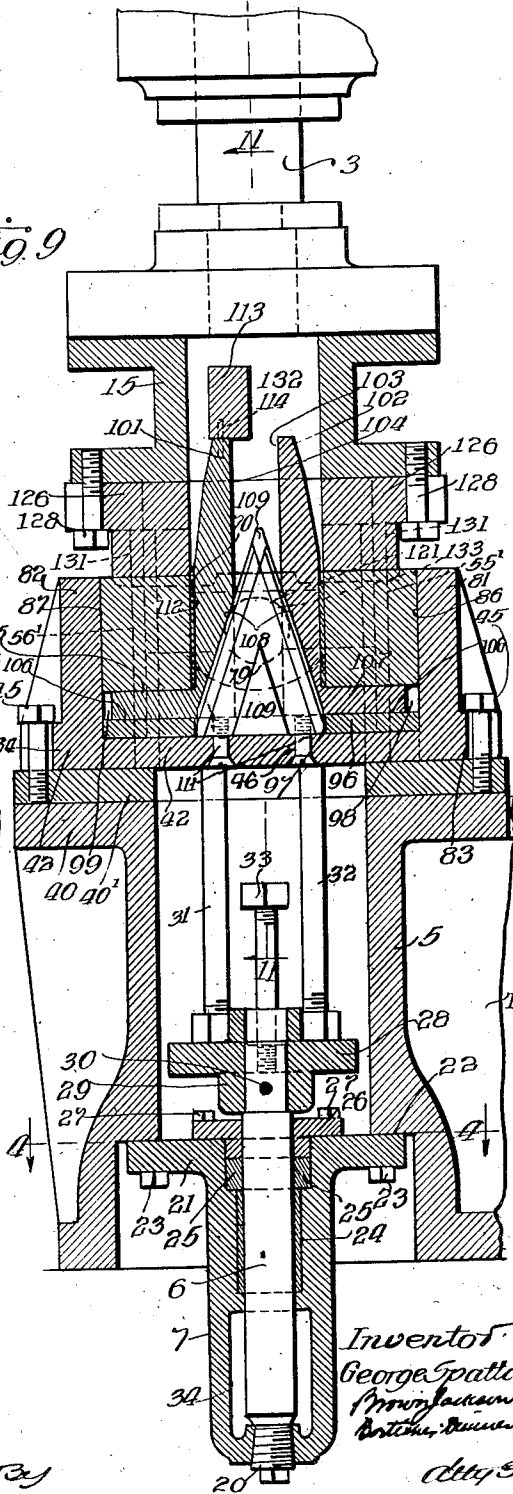
Fig. 9



Witnesses

Harry P. L. White
Robert C. Green

721



Inventor
George Spatta
By
Arthur J. Brown

Oct 13

Sept. 5, 1933.

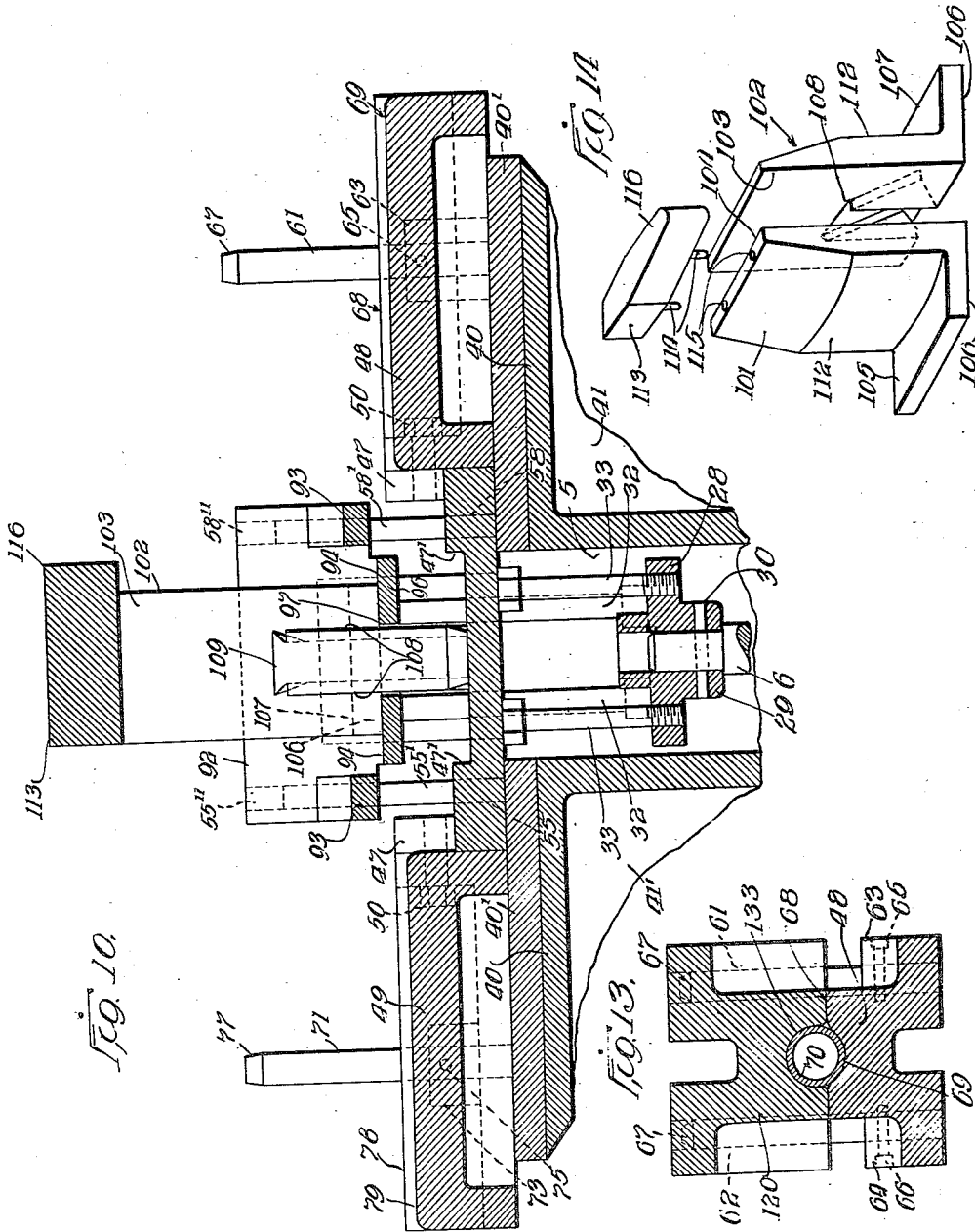
G. SPATTA

1,925,850

METHOD OF AND MEANS FOR SPREADING A SLOTTED TUBE

Filed Feb. 3, 1930

6 Sheets-Sheet 5



Witnesses:

Harry P. L. White
Robert Cramer

Inventor
George Spatta

Attorney
Cramer

Sept. 5, 1933.

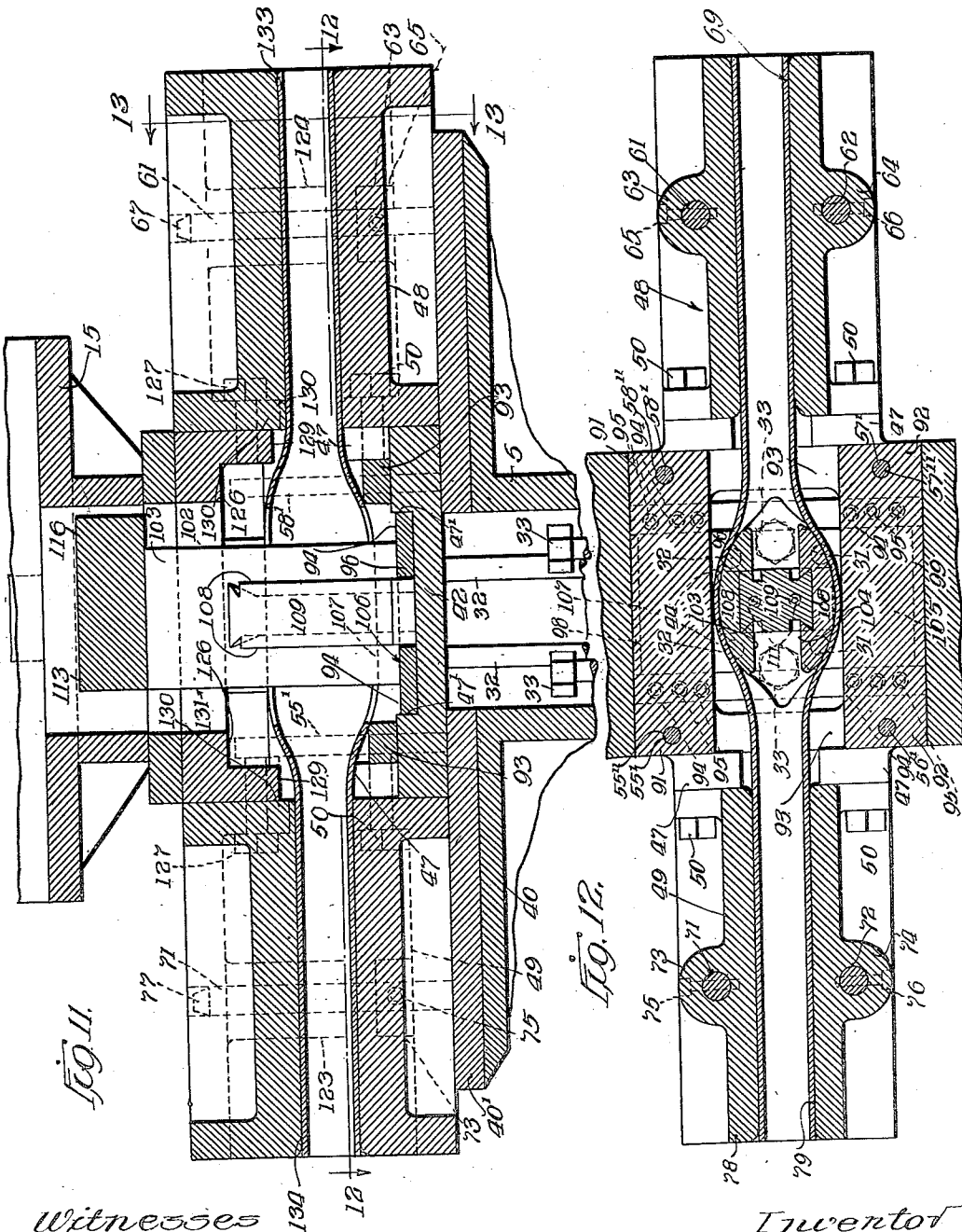
G. SPATTA

1,925,850

METHOD OF AND MEANS FOR SPREADING A SLOTTED TUBE

Filed Feb. 3, 1930

6 Sheets-Sheet 6



Witnesses
Harry R. L. White
Robert Cremer

Inventor
George Spatta
Attest
Morton J. Roussier
Clerk

UNITED STATES PATENT OFFICE

1,925,850

METHOD OF AND MEANS FOR SPREADING
A SLOTTED TUBEGeorge Spatta, Buchanan, Mich., assignor to
Clark Equipment Company, Buchanan, Mich.,
a corporation of Michigan

Application February 3, 1930. Serial No. 425,426

27 Claims. (Cl. 153—48)

This invention relates to a method of and means for spreading a slotted tube.

In my copending application, Serial No. 416,537 filed December 26, 1929, I disclose a process for forming banjo type rear axles for automotive vehicles from a piece of seamless tubing, which process includes slotting the tube at its central portion, reducing the diameter of the end sections of the tube, spreading the slotted central portion of the tube preparatory to forming the banjo, and other subsequent operations. The instant invention, relates to a machine particularly designed to spread the slotted central portion of the blank in the performance of the third step of the process outlined in the above copending application.

In the manufacture of axle housing of this type in accordance with the teachings of my copending application, the slot punched in the central portion of the tubular blank has a perimeter substantially equal to the perimeter of the circular opening in the center of the banjo of the completed axle. This matching of perimeters of the slot and finished product is accurately carried out so that the metal at the edges of the slot is left as nearly undisturbed as it is possible to leave it during the process of forming of the axle housing.

The walls adjacent the slot are arcuate, and in the step of the process disclosed in the present application, these walls are first curled outward into approximately planar condition so that they are parallel to each other and equidistant from the axis of the tubular blank. In this step of the process, due to the normal arcuate shape of the walls, and the curling of these walls outward during the performance of the process, the metal at the edge of the slot is stretched somewhat and by particular design of the dies employed in the machine herein disclosed, this stretching of the metal is confined to the central portion of the slot, that is midway between the ends of the slot.

As is brought out in my above mentioned copending application, the critical sections of the blank are through the ends of the slot and it is therefore highly desirable that the forming steps in the process be performed with a minimum disturbance of the metal at these critical points. I have therefore designed dies and a machine for operating these dies, so that the tubular blank can be flattened and the walls between the slots pulled outward and subsequently formed into the banjo housing with a minimum disturbance of the metal through the critical sections of the blank.

In the preferred manner of carrying out the spreading step of the process, I provide a pair of dies which are shorter than the length of the

slot and wider than the width of the slot. A guide is attached to the dies and the blank fitted over this guide. It will of course be understood that this operation is performed with the work heated to forging temperature, the arrangement for heating the work to this temperature being disclosed in my copending application, Serial No. 420,596 filed January 13, 1930 to which reference is here made for the details of this arrangement.

The dies over which the heated blank is threaded by means of the guide is located in a forming machine which carries on a movable ram a clamping member arranged to engage the blank at its end sections and to force it downward over the die. Since the width of the dies is slightly in excess of the width of the slot, the edges of the slot are moved outward so that the midsection of the walls intervening between the two slots in the central portion of the die are moved into approximately parallel straight lines.

After the blank has been forced down over the die and this first step of the spreading operation performed, the downward movement of the clamping members is continued to force the blank, and the dies engaged by it, downward until the blank comes in contact with a stationary set of clamping members which cooperate with the movable set to grip the ends of the blank and force them into alignment with each other.

During the downward movement of the dies, they are spread apart to separate the already flattened walls of the central portion of the blank and to finally force those walls against a pair of relatively stationary flat faced blocks which align the two walls of the blank parallel with each other and form them as perfectly flat planar sections.

The ram and movable clamping member carried by it are then lifted, and the blank and dies likewise lifted, the lifting operation of the dies closing them away from the finished blank to permit ready removal of the blank from the press.

In the preferred embodiment of the press employed in carrying out this process, the dies, forming blocks and accessory equipment associated therewith are carried on a hydraulic ram which works into a cylinder that is closed into an air chamber containing air which is under pressure. By this arrangement the pressure bearing the ram and dies upward is fixed at a definite value, and the pressure of the operating cylinder of the movable ram is sufficient to exert

a preponderance of force on this moving ram so that it is capable of forcing the lower ram downward against the pressure of its confined cylinder. By this arrangement, as soon as the pressure of the operating ram of the machine is released, the die ram moves upward to unlock the dies and loosen the work in the machine.

While the machine disclosed is designed primarily for the performance of a particular step in a series of forming operations in the manufacture of rear axle housings, obviously its advantages are not limited to this process and by suitable design of the dies and auxiliary equipment, the machine can be adapted to other similar operations without departing from the teachings of the invention.

Now to acquaint those skilled in the art with the teachings of my invention, reference is made to the accompanying drawings in which a preferred embodiment of it is shown by way of example and in which:

Figure 1 is an elevational view taken from the front or working face of the machine showing the arrangement of the dies, clamps, and rams;

Figure 2 is a side elevational view of the machine shown in Figure 1;

Figure 3 is a cross-sectional view taken along the line 3—3 of Figure 1 looking in the direction of the arrows;

Figure 4 is a cross-sectional view taken along the line 4—4 of Figure 9 showing the details of the lower ram cylinder head;

Figure 5 is a fragmentary cross-sectional view taken along the line 5—5 of Figure 4;

Figure 6 is a bottom side plan view of the upper clamping member taken along the line 6—6 of Figure 1 looking in the direction of the arrow;

Figure 7 is similar top side plan view of the lower clamping members and dies taken along the line 7—7 of Figure 1;

Figure 8 is a cross-sectional view taken along the line 8—8 of Figure 1 looking in the direction of the arrows and showing the dies in their normal position;

Figure 9 is a similar cross-sectional view taken along the line 9—9 of Figure 1 showing the dies in their fully operated positions;

Figure 10 is a cross-sectional view taken along the line 10—10 of Figure 8 looking in the direction of the arrows;

Figure 11 is a cross-sectional view taken along the line 11—11 of Figure 9 looking in the direction of the arrows;

Figure 12 is a cross-sectional view taken along the line 12—12 of Figure 11 looking in the direction of the arrows;

Figure 13 is a cross-sectional view through the clamping members taken along the line 13—13 of Figure 11;

Figure 14 is perspective view of the dies, and guide block of the machine; and

Figure 15 is a perspective view of the blank at the completion of the spreading operation.

Referring to the drawings now in more detail, the machine for performing the spreading operation comprises a framework 1 upon the upper end of which is mounted a cylinder 2 and a ram 3 which projects through a hollow portion 4 in the upper end of the frame and is operated by the cylinder 2 in a vertical direction.

At the opposite end of the machine, is a second hollow portion 5 in which is located a second ram 6 and cylinder 7, the ram 6 supporting the dies

of the machine and cooperating with the ram 3 to forge the blank.

Preferably, cylinders 2 and 7 are hydraulic cylinders controlled by a hydraulic valve 8 located on the frame 1 of the machine and controlled by the lever arrangement 9, which lever arrangement and control valve are well understood by those skilled in the art and need not be explained in detail herein particularly since they are not of the essence of the instant invention.

The frame 1, is preferably a casting of iron or steel of suitable dimensions to withstand the stresses imposed upon it by the operation of the rams 3 and 6. In a particular embodiment of my invention, the ram 6 is urged upward under a pressure of 10 tons exerted on it by the cylinder 7, and the ram 3 is urged downward with an effective pressure of 20 tons so that there is a preponderance of pressure of 10 tons urging the working parts of the machine downward.

The frame 1 cylinders 2 and 7 and associated parts must necessarily be properly proportioned to withstand the above stresses which are given by way of example.

Preferably the cylinder 2 comprises a cylindrical tubular member having its lower end butted against a suitable cylinder head disposed in the hollow portion 4 of the framework 1, and a second cylinder head 10 disposed over its upper end, these cylinder heads being held in place by external bolts 11 which are threaded into the framework 1 and which contain nuts 12 bearing against the upper surface of the upper cylinder head 10. This arrangement puts the walls of the cylinder under compression normally, and while it is preferable, it may be modified within the teachings of my invention.

The ram 3 which is operated by the cylinder 2 is guided in a straight line downward by the guide bars 13 and 14 which are fitted into sockets in the crosshead 15 mounted on the lower extremity of the ram, and keyed in the sockets by pins 16 projecting through the walls of the sockets and the registering ends of the rods. Collars 17 cast integral with or suitably attached to the upper end of the framework 1 adjacent the hollow portion 4 are fitted around the guide rods 13 and 14 with a sliding fit, which prevents the ram 3 from turning with respect to the cylinder 2, but at the same time permits to move freely in a vertical direction.

As will be best seen in Figures 8 and 9, the lower hollow portion 5 of the framework 1 contains a cylindrical opening disposed with its axis vertical, and in which the ram 6 and its operating cylinder 7 are disposed. The lower end of the operating cylinder 7 is closed and equipped with a clean out plug 20, and the upper end contains a flanged collar 21 which is attached to a shoulder 22 on the inside of the framework 5 by bolts 23 which are threaded into the walls of the framework. The upper end of the cylinder 7 is lined with a liner 24 and packed with a packing member 25 which is held in place by the flanged collar 26, which collar is in turn held on the flanged portion 21 of the cylinder 7 by bolts 27. This arrangement packs the ram 6 tightly in the cylinder against leakage, and at the same time permits free longitudinal movement of the ram in the cylinder. As will be best seen in Figure 5, each bolt 27 is locked in place by a set screw 27' which is set at an angle from the under side of flange 21 and engages the lower portion of the bolt. This arrangement locks the bolts se-

curely and guards against the possibility of their being loosened by shocks during the operation of the press and against consequent loosening of the packing 25 and liner 24.

5 On the upper head end of the ram 6 I have provided a crosshead 28 which is of general circular cross-section and held on a shoulder portion 29 of the ram by any suitable means such as the pin 30. This crosshead 28 carries thrust rods 31 and 32 and stop rods 33, the purposes of which will be hereinafter more fully brought out.

10 The operating chamber 34 of the cylinder 7 is connected by suitable pipe 35 to an expansion tank 36 which is partially filled with a fluid such as oil, and which contains an air pocket 37 into which the fluid can expand in the operation of the machine.

20 The lower end of the framework 1 of the machine, projects outward laterally of the machine as will be seen in Figures 1 and 2 to form a substantially flat top table 40 the ends of which are supported by flanges 41 and 41'. Upon this top portion are mounted the stationary portions of the die structure, and as will be seen in Figure 1, taken in conjunction with Figures 7, 8, 9 and 1, these structures may be mounted on a base 40', or if desired may be mounted upon the table surface 40. The base 40' is mounted on the table in any convenient manner such as by the stud screws 43 projected through the flanged edge of the table 40 and into the base 40'.

30 The die structure comprises a central plate portion 42, Figure 8, which is of general rectangular shape and is mounted upon the sub-base 40' in any convenient manner such as by the bolts 45. This plate 42 forms as a mounting for the stationary portions of the die structure, and for the guides and guide bars through which the action of the cooperating movable dies are controlled.

40 Centrally located in the plate 42 are a plurality of holes 44 through which the thrust rods 31, 32 carried by the lower ram are projected and brought into engagement with the stationary die structure in a manner which will be hereinafter pointed out. The guide rods 31 and 32 accurately set in but are free to slide through the holes 44, this sliding fit serving the additional purpose of preventing a rotation of the ram 6 as it is being moved against the pressure in the cylinder 7.

45 Centrally located in the plate 42 are a pair of screw holes 46 through which are projected machine screws for holding a wedge block in place, the construction of this block and its purpose being brought out more fully hereinafter.

50 Four bosses 47 rise vertically at the corners of the block 42 from transverse shoulders 47' and serve as abutments against which the flanged ends of the stationary clamping members 48 and 49 are abutted and held by set screws 50 which are threaded into suitable openings in the mounting bosses 47.

60 Four holes 55, 56, 57 and 58 are located in the corners of the block 42 adjacent the mounting bosses 47, these holes serving as pockets into which vertically extending guide rods 55', 56', 57' and 58' are projected and held therein by means of set screws 59. The set screws 59 are threaded into laterally extending threaded openings and into engagement with the bottom end of the guide pins to securely hold those pins in place in their respective pockets. These guide bars 55' to 58', inclusive, serve as guides for a

vertically moving part of the die structure, as will presently appear.

As will be seen in Figures 1, 7, 10 and 13, the stationary clamping block 48 is provided with vertically extending guide rods 61 and 62 which are fitted into sockets formed in the bosses 63 and 64 and held therein by any suitable means such as set screws 65 and 66. The upper ends of these guide rods are tapered as at 67 so that they may be easily brought into alignment with a collar on the movable clamping member carried by the upper ram 3 of the press.

The block 48 also contains a flat upper surface 68 in the center of which is an arcuate depression 69 running longitudinally of the block and formed at a radius which accurately fits it over the small cylindrical end section of the blank 70 that is to be formed in the machine. The block 48 is preferably an iron casting and where it is possible to do so pockets or depressions are formed in it to reduce its weight as much as possible without weakening it unduly.

Similarly the block 49 is provided with a pair of upwardly projecting guide rods 71 and 72 fitted into sockets formed in the collar 73 and 74 and held therein by set screws 75 and 76. The upper ends of these guide rods are also tapered as at 77 to register with the companion collar on the movable clamping member carried by the ram 3. The flat upper surface 78 of the member 49 is also provided with an arcuate slot 79 which likewise registers with and accurately engages the outside diameter of the opposite end of the tubular blank 70 which is being formed in the press.

As will be seen in Figure 1 and Figures 7 to 11 inclusive, a pair of guide blocks 81 and 82 are projected upward from the plate 42 adjacent the center of the machine and transversely of it. These blocks comprise a flange portion 83 and 84 through which the bolts 45 are projected and threaded into the base plate 40' to hold the block thereon. The blocks also comprise a vertical portion the inside surfaces 86 and 87 of which are machined flat and disposed perpendicularly to the upper surface of the plate 42 and parallel to each other. The blocks 81 and 82 are disposed equidistant from the central line of the dies and machine, which central line is disposed centrally of the grooves 69 and 79 in the clamping members 48 and 49 respectively.

Fitted within the guide blocks 81 and 82 is a movable die block 90 which contains two forming blocks 91 and 92 and a base portion 93. The forming blocks are machined to fit accurately against the surfaces 86 and 87 of the stationary blocks 81 and 82, and are provided with vertical holes 55'' and 56'' 57'' 58'' through which the guide 55' pins 56' 57' and 58' are projected to guide the block in the press.

Two pairs of rectangular bosses 94 are projected from the flat bottom base of the die block 90, these bosses being provided with threaded holes 95 which receive machine screws that are employed to mount the bottom plate 96 on the die block, as will be seen in Figures 7, 8 and 10. This bottom plate 96 is preferably made of a rolled steel such as boiler plate, and is provided with a rectangular slot 97 through which the wedge block that is mounted on the plate 42 by the screws 46 is projected to engage the movable dies located within the die block 90.

Except for this rectangular opening 97, the plate 96 covers the central portion of the bottom of the die block 90. The supporting shafts 31 and 32 which are carried by the ram 6 and which

project through openings 44, in the plate 42, are abutted against the plate 96 to support the die block 90 in the press.

A rectangular slot 98 is machined in the bottom surface of the forming block 91 of the die 90, this block being closed by the end of the bottom plate 96 to form a rectangular pocket into which the supporting flange 107 of the movable die 102 is projected, as will presently appear. Similarly the forming block 92 is provided with a rectangular slot 99 which together with the bottom plate 96 forms a similar pocket for receiving the supporting flange 105 of the other movable die 101 of the structure.

Fitted within the movable block 90 are the dies 101 and 102 which are shown in detail in Figure 14 and the mounting of which is shown in Figures 7, 8 and 9. These dies contain adjacent flat faces 103 and 104 which abut each other and are perpendicular of the flat plate 42 of the press when the dies are mounted on it.

At the bottom of the dies are rectangular projections disposed at right angles to these faces 103 and 104, the projection 105 of the die 101 fitting into a corresponding slot 99 in the forming block 92 to support the die 101 therein. Similarly the projection 107 of the die 102 fits into a slot 98 in the block 91 to support the die therein. The bottom faces 106 of the projections 105 and 107, are flat and fit against the upper surface of the plate 96, to thereby support the dies 101 and 102 in the block 90.

Near the bottom of the surfaces 103 and 104 of the dies is an inclined dovetail slot 108 having a component in each of the two dies, and registering with the wedge block 109 which is similarly dovetailed and fitted into these dies. The wedge block 109 is attached to the plate 42 between the blocks 81 and 82, by any preferred means such as the bolts 111 which hold it stationary in the press. The wedge projects upward through the centrally located rectangular opening 97 in the bottom plate member 96, and is located centrally of the dies 101 and 102 and of the block 90, and between the rods 31, 32 and 44 which support the die assembly in the press.

The dies 101 and 102 are formed with arcuate outside surfaces which register with the slot in the blank to be spread in the press, and which surfaces taper to a somewhat larger arcuate portion 112 located near the bottom of the dies. To facilitate bringing the blank into registration with the upper portion of the dies, a guide 113 is mounted on the die 101 by dowel pins 114 which register with openings 115 in the upper surface of the die 101. This guide is small enough to be easily fitted into the slot in the blank, and contains a tapered portion 116 which accurately conforms to the walls of the slot to position the blank properly in the die.

The supporting rods 31 and 32 which project upward out of the crosshead 28 of the ram 6, abut against the lower surface of the plate 96 to thereby support them and the block 90 in the press. When the block 90 and dies 101 and 102 are forced downward against the pressure of the ram 6, the stationary wedge 109 sliding through the dovetailed groove 108 in the dies forces them outward, the projections 105 and 107 sliding laterally in the slots 99 and 98 respectively. The dies coming to rest adjacent the forming blocks 91 and 92 as shown in Figures 9 and 12. When the downward pressure is released and the ram 6 operated to raise the dies and block 90, the dovetailed connection between

the wedge 109 and the slot 108 in the dies closes them to their normal position in which they are shown in Figure 8. The upward movement of the arm 6 is arrested by the stop bolts 33 which strike against the lower surface of the plate 42, these bolts being adjustable so that the die is stopped at the instant that its two vertical surfaces 103 and 104 are brought into registration with each other.

As will be best seen in Figures 6 and 11, the operating ram 3 of the machine is provided with a crosshead 15 upon which are mounted the movable clamping members 120 and 121 which member 121 registers with the member 49 of the stationary clamping group, being brought into registration therewith by the collars 122 and 123 which register with the guide pins 72 and 71, respectively.

The clamping member 120 is likewise provided with collars 124 and 125 which register with the guide pins 62 and 61 respectively to bring the member 120 into registration with the stationary clamping member 48. The clamping members 120 and 121 are attached to the pressure member 126 by bolts 127 and the pressure member 126 is in turn attached to the crosshead 15 by bolts 128 to thereby support the entire structure upon the crosshead 15 of the ram 3.

The pressure member 126 is provided with the flanges 129 into which the bolts 127 are threaded and against which the seats 130 of the clamping members are abutted. Pressure member 126 is also provided with pressure blocks 131 which are brought into registration with the forming blocks 91 and 92 of the die to force those blocks downward during the downward movement of the ram 3. A central opening 132 in the pressure block 126 permits the upper end of the dies 101 and 102 and the guide 113 to project through the pressure block when the latter is operated to its extreme lower position.

As will be best seen in Figure 13, the clamping block 120 is provided with a longitudinal groove 133 which is formed as a segment of a cylinder, and of such size as to accurately engage the outer surface of the blank 70. The groove 133 is deeper than the radius of the outer diameter of the blank 70 so that this engagement embraces slightly more than half of the outer surface of the blank to thereby firmly grip that blank during the downward travel of the clamping member and blank in the operation of the press.

The clamping member 121 is provided with a similar groove 134 which engages the opposite end of the blank 70.

In the operation of the machine, the slotted tubular blanks are heated to forging temperature in accordance with the teachings of the process outlined in my above mentioned copending application, and are fitted into the machine with the slot in the blank brought into registration with the guide 113 on the die. The control lever 9 is then operated to actuate the cylinder 8 which causes pressure to be applied to the cylinder 2 which moves its ram and the instrumentalities carried thereby downward. The clamping members 120 and 121 engage the end sections of the blank, and as the ram 3 moves downward forces that blank over the upper part of the dies 101 and 102.

This part of the operation curls the cylindrical section of the walls between the slots outward, stretching the metal at the edges of the slot at points midway of the length of the slot. The ram 3 continues downward, forcing the blank

over the lower portion 112 of the dies to complete the initial step of the spreading operation. At this time, the pressure blocks 131 of the movable ram 3 engage the slots 91 and 92 of the die assembly, and as the ram 3 continues in its downward movement, the die blocks 91 and 92 are forced downward against the pressure in the closed cylinder 7 acting on the ram 6.

As the die blocks 91 and 92 are moved downward, the dies 101 and 102 are likewise moved downward and since they are in engagement with the wedge block 109, this downward movement causes the dies to be spread apart, thereby spreading the walls of the blank between the slots in that blank.

Thus it will be seen that the central walls of the tube which have been freed by the slots are changed from their original shape, which is that of part of a right cylinder with a horizontal axis, into a different shape, namely, to parts of a cylinder with a vertical axis or vertical axes. This causes the central parts of the tube walls, which in a vertical direction were curved, to be straightened, and the adjacent parts of the tube walls to be warped to a shape which forms a junction between the horizontally disposed cylindrical end portions and the central vertically disposed cylindrical portion. This change in shape is made by forcing the slotted portion of the blank down over the wedge shaped parts of the dies 101 and 102 and onto the cylindrical portions 112—112. The spreading of the members 101—102 thereafter carries outwardly, i. e., away from each other, the central parts of the walls.

Since the length of the dies 101 and 102 is substantially less than the length of the slots in the blank, any stretching of the metal which may take place during this spreading operation occurs midway of the slots in the blank and the metal in the critical section of the blank, which as has been hereinbefore pointed out is through the end section of the slot, is undisturbed.

When the ram 3 has completed its downward travel, the blocks 91 and 92 are lowered to bring their lower faces into registration with the upper face of the plate 42, and the dies 102 and 103 are forced outward to the position in which they are shown in Figure 9. It will be observed that the walls of the blank are thereby forced out into engagement with the inside surfaces of the forming blocks 91 and 92 so that they are flat and arranged parallel to each other and perpendicular to the axis of the blank.

The lever 9 of the machine is again operated to control the valve 8 to withdraw the pressure from the cylinder 2 thereby permitting the pressure in the closed cylinder 7 and exerted against the ram 6 to raise the ram 6 so that the die blocks 91 and 92 and the dies 101 and 102 are moved upward into their normal position in which they are shown in Figure 8. This upward movement of the dies 101 and 102 causes them to be closed by the action of the dovetailed connection between these dies and the stationary wedge 109, and this withdrawal of the dies from the inside surface of the blanks permit ready removal of the blank from the press. The reoperation of the valve 8 to relieve the pressure on the ram 3 also causes a pressure to be built up in the lower part of the cylinder 2, which pressure raises the ram 3 and instrumentalities carried thereby to the position in which it is shown in Figures 1 and 2, leaving the lower dies readily accessible to there-

by permit the easy removal of the blank from the machine.

It will be noted that the ram 3 is guided in its downward travel by the guide rods 13 and 14 which prevent its rotation relative to the machine, and that the clamping members 120 and 121 are guided into engagement with their corresponding clamping members 49 and 48 by guide pins which accurately position the two members relative to each other. The movable forming blocks 91 and 92 are likewise guided in their downward movements by pins 55', 56', 57' and 58', as well as by the engagement of their outward surfaces with the surfaces 86 and 87 of the stationary blocks 81 and 82.

This insures that the movement of the forming blocks 91 and 92 will be perpendicular and without translation of these blocks. Similarly the dies 101 and 102 are accurately guided in their downward and transverse movement by the projections 105 and 107 which accurately fit into slots 99 and 98 the guide blocks 92 and 91 respectively and also through the action of the wedge 109 and its dovetailed connection with the slot 108.

By this arrangement, the blank is maintained in straight condition with the axes of the end sections in alignment, and the spreading of the central portion of this blank is accurately made with the walls of the blank moved outward equidistantly from the longitudinal axes of the blank, and maintained parallel to each other and in plane vertical to the longitudinal axes of the blank.

The blank thus formed is accurately held to the required dimension so that a subsequent operation can be performed on it with a minimum gathering and stretching of the metal in the mid-section of the blank.

While I have chosen to illustrate my invention by disclosing a preferred embodiment of it adapted to the manufacture of a particular type of product, I have done so by way of example only as there are many modifications and adaptations which can be made by one skilled in the art without departing from the teachings of the invention.

Having thus complied with the Statutes and shown and described a preferred embodiment of my invention, what I consider new and desire to have protected by Letters Patent is pointed out in the appended claims.

What is claimed is:—

1. The method of shaping the centrally slotted portion of a cylindrical blank which comprises clamping the ends of the blank adjacent the portion to be formed, shaping the arcuate portions of the blank adjacent said slots into sections of a cylinder disposed transversely of the blank, and spreading the wall sections thus formed away from each other.

2. The method of shaping the central portion of a cylindrical blank having oval slots disposed in its opposite faces, which comprises forcing the blank transversely over a stationary member disposed in the central portions of said slots to form the portions of the intervening walls as sections of a cylinder disposed transversely of the blank, and spreading the central portions of said intervening walls.

3. The method of shaping the central portion of a slotted cylindrical blank without disturbing the metal in its critical sections which are disposed at the ends of said slots, which comprises forming the walls of the blank intervening be-

tween the slots outward at their central portions into sections of a cylinder disposed transversely of the blank, the edges of said blank being stretched thereby, and spreading apart the cylindrical wall sections on opposite sides of the slot to shape the blank.

4. A separating press for spreading and straightening the walls adjacent a pair of slots in a tubular blank comprising, a pair of dies having a width slightly greater than the width of the slots in the blank and a length substantially less than the length of the slots, a pair of flat faced blocks disposed on opposite sides of said dies, means for forcing a slotted tubular blank over said dies to thereby form the walls adjacent the slots into sections of a cylinder disposed with its axis transversely of the blank by stretching the metal at the central edges of the slot, and means for spreading said dies to force said blank walls against said blocks to spread the walls and to further stretch the metal at the edges of the central portion of the walls and to thereby straighten those walls.

5. In a spreading press for shaping the central portion of a slotted tubular blank, a pair of stationary clamping members containing arcuate surfaces for engaging the end sections of said blank, a plurality of vertical guide posts attached to said members, a vertical ram disposed above said members, a corresponding pair of movable clamping members mounted on said ram and movable thereby, collars on said movable members engageable with said guide posts to bring the movable members into registration with the stationary members, a second ram disposed below said stationary members in alignment with said first ram, and dies mounted on said second ram and between said stationary clamping members and operated by the joint action of said rams to spread the central portion of said blank.

6. A separating press comprising a C-shaped frame-work having hollow portions adjacent its open ends, a closed cylinder mounted below the lower hollow portion of the frame, a ram in said cylinder projecting through the hollow portion of said frame, a bed plate mounted on the lower end of said frame above said hollow portion, dies mounted on said ram and guided by said bed plate, a pressure cylinder mounted on the upper end of said frame, a ram in said cylinder, dies carried by said ram and moved downward by pressure in said pressure cylinder to engage said bottom dies and to move them against said bed plate against the pressure of said closed cylinder on its ram.

7. In a spreading press for shaping the central portion of a slotted tubular blank, a pair of stationary clamping members adapted to engage the cylindrical end sections of the blank, a pair of movable clamping members adapted to engage the blank and to bring it into registration with the stationary clamping members, dies disposed between said stationary clamping members and adapted to be registered with the slots in said blank when it is placed in the press, means for spreading said dies during the downward movement of said movable clamping member as the blank is being brought into registration with the movable member, and means for raising said dies and blank to close the dies.

8. In a spreading press for shaping the central portion of a slotted tubular blank, a pair of stationary clamping members adapted to engage the cylindrical end sections of the blank, a pair of movable clamping members adapted to engage

the blank and to bring it into registration with the stationary clamping members, dies disposed between said stationary clamping members and adapted to be registered with the slots in said blank when it is placed in the press, means for lowering said movable clamping members and the blank into registration with the stationary members, means for spreading the dies during the lowering of said movable member to shape the portion of the blank engaged thereby, and a cam for raising said dies and blank to close the dies.

9. In a spreading press for shaping the central portion of a slotted tubular blank, a pair of stationary clamping members adapted to engage the cylindrical end sections of the blank, a pair of movable clamping members adapted to engage the blank and to bring it into registration with the stationary clamping members, dies disposed between said stationary clamping members and adapted to be registered with the slots in said blank when it is placed in the press, a ram, said movable members being mounted on the ram, means for operating said ram to lower said movable members and the blank into registration with the stationary members, means for spreading the dies during the lowering of said movable members to shape the portion of the blank engaged thereby, and a cam for raising said dies and blank to close the dies.

10. In a separating press for spreading and shaping the central portion of a slotted tubular blank, the combination of a cylinder having a vertically disposed ram fitted in it, a pair of stationary blocks adjacent the free end of said ram, a pair of flat faced blocks mounted on said ram to be moved vertically by it but held against horizontal movement by said stationary blocks, said movable blocks having horizontally disposed slots adjacent their bottom edges, a pair of dies disposed between said movable blocks and having projections fitting into said slots, said dies being movable vertically with the movable blocks and horizontally toward them, means fixed with respect to said fixed blocks and engaging said dies to move them towards the movable blocks and dies, and means movable vertically to first engage a blank on said dies to force it over them and then to engage said movable blocks to force them and the dies downward against pressure in said cylinder acting on said ram.

11. In a separating press, a pair of dies movable away from each other but normally disposed adjacently, means for forcing a slotted blank over said dies to force them through slots in the blank, said means including means engaging the portions adjacent to but spaced from the dies to hold these portions in alignment, and means for separating the dies to spread the blank adjacent the slots.

12. In a separating press, a pair of dies movable away from each other but normally disposed adjacently, a pair of planar stationary blocks toward which the dies move when separated, means for forcing a slotted blank over said dies to force them through slots in the blank, and means for separating the dies to spread the blank adjacent the slots, to thereby force it against said blocks to shape it.

13. In a separating press, a pair of dies movable away from each other but normally disposed adjacently, a guide attached to one of said dies and adapted to be registered with the slots in a slotted blank that is to be spread in the machine to guide the dies into said slots, means for forcing the blank over the dies to force them into said slots,

and means for separating the dies to spread the blank adjacent the slots.

14. In a separating press for spreading and shaping the central portion of a slotted tubular blank, the combination of a pair of flat faced blocks spaced apart a fixed distance from each other and movable together in a vertical plane, a pair of dies disposed between the blocks and movable in a vertical direction and also in a horizontal direction toward said blocks, and a pair of clamps movable vertically to engage a blank in the press to force it over said dies and to force them and said blocks downward.

15. In a separating press for spreading and shaping the central portion of a slotted tubular blank, the combination of a pair of flat faced blocks spaced apart a fixed distance from each other and movable together in a vertical plane, a pair of dies disposed between the blocks and movable in a vertical direction, and stationary means for spreading said dies to move them toward said blocks during their downward movement.

16. In a separating press for spreading and shaping the central portion of a slotted tubular blank, the combination of a pair of flat faced blocks spaced apart a fixed distance from each other and movable together in a vertical plane, a pair of dies disposed between the blocks and movable in a vertical direction and in a horizontal direction toward said blocks, and a stationary wedge engaging said dies to move them toward said blocks during their downward movement.

17. In a spreading press, a pair of dies each having an internal dove-tail slot disposed at an angle to the die and to the corresponding slot of the other die, a stationary wedge dove-tailed into said slots, means for moving said dies downwardly over said wedge to separate them, and means for raising the dies over the wedge to close them.

18. In a spreading press, a pair of dies each having an internal dove-tail slot disposed at an angle to the die and to the corresponding slot of the other die, a pair of blocks supporting said dies, a stationary wedge dove-tailed into said slots, means engaging said blocks for lowering them and the dies over said wedge to separate the dies, and means for raising the blocks and dies over the wedge to close the dies.

19. In a separating press for spreading the wall sections interposed between a pair of diametrically opposite slots in a tubular blank, a pair of dies having transverse width greater than the transverse width of said slots, and having length less than the length of the slot, means for positioning said dies in said slots, and means for forcing the blank over the dies.

20. In a forming machine, a forming block comprising two parallel members, a base plate connecting said members, there being a rectangular slot in the central portion of said plate, a pair of dies mounted on said plate between said members, a wedge projected through said slot and engaging said dies, and means for moving said block with respect to said wedge to thereby cause it to move the dies with respect to the block.

21. In a forming machine, a forming block comprising two parallel members, a base plate connecting said members, there being a rectangular slot in the central portion of said plate, a pair of dies mounted on said plate between said members, a wedge projected through said slot and engaging said dies, and means for moving said block first in one direction and then in the opposite

direction with respect to said wedge to thereby cause it to move the dies first in one direction and then in the opposite direction with respect to the block.

22. In a forming machine, a forming block comprising two parallel members, a base plate connecting said members, there being a rectangular slot in the central portion of said plate, a pair of dies mounted on said plate between said members, a wedge projected through said slot and engaging said dies, means for applying pressure to said members to move said block and dies downward over said wedge which simultaneously moves said dies toward said members, and means for applying pressure to said plate to move said block and dies upward with respect to said wedge.

23. In a forming machine, a forming block comprising two parallel members, a base plate connecting said members, there being a rectangular slot in the central portion of said plate, a pair of dies mounted on said plate between said members, a wedge projected through said slot and engaging said dies, means for applying pressure to said members to move said block and dies downward over said wedge which simultaneously moves said dies toward said members, means for applying pressure to said plate to move said block and dies upward over said wedge, and means on said wedge for moving said dies toward each other to close them during said upward movement.

24. In a forming machine, a forming block comprising two parallel members, a base plate connecting said members, there being a rectangular slot in the central portion of said plate, a pair of dies mounted on said plate between said members, a wedge projected through said slot and engaging said dies, means for applying pressure to said members to move said block and dies downward over said wedge which simultaneously moves said dies toward said members, means for applying pressure to said plate to move said block and dies upward over said wedge and a dovetail connection between said wedge and dies for moving the dies toward each other to close them during said upward movement.

25. In a forming machine, a forming block having a flat face, a die having a curved face, means for forcing a tubular blank over the die, and means for forcing the die into juxtaposition to the flat face of said block to press the blank thereagainst to shape it, said blank forcing means engaging the same to hold it true during the operation of said die forcing means.

26. In a forming machine, a forming block having a flat face, a die having a curved face, means for forcing a tubular blank over the die to partially shape the blank, and means for forcing the die into juxtaposition to the flat face of said block to press the blank thereagainst to further shape it, said blank forcing means engaging the same to hold it true during the operation of said die forcing means.

27. In a forming machine, a pair of forming blocks having flat faces adjacent to and parallel to each other, a die between said blocks, said die having oval shaped contour, means for forcing a tubular blank over the die to partially shape its walls, and means for forcing the die into juxtaposition to said parallel faces to press the blank thereagainst to further shape its walls, said blank forcing means engaging the same to hold it true during the operation of said die forcing means.

GEORGE SPATTA.