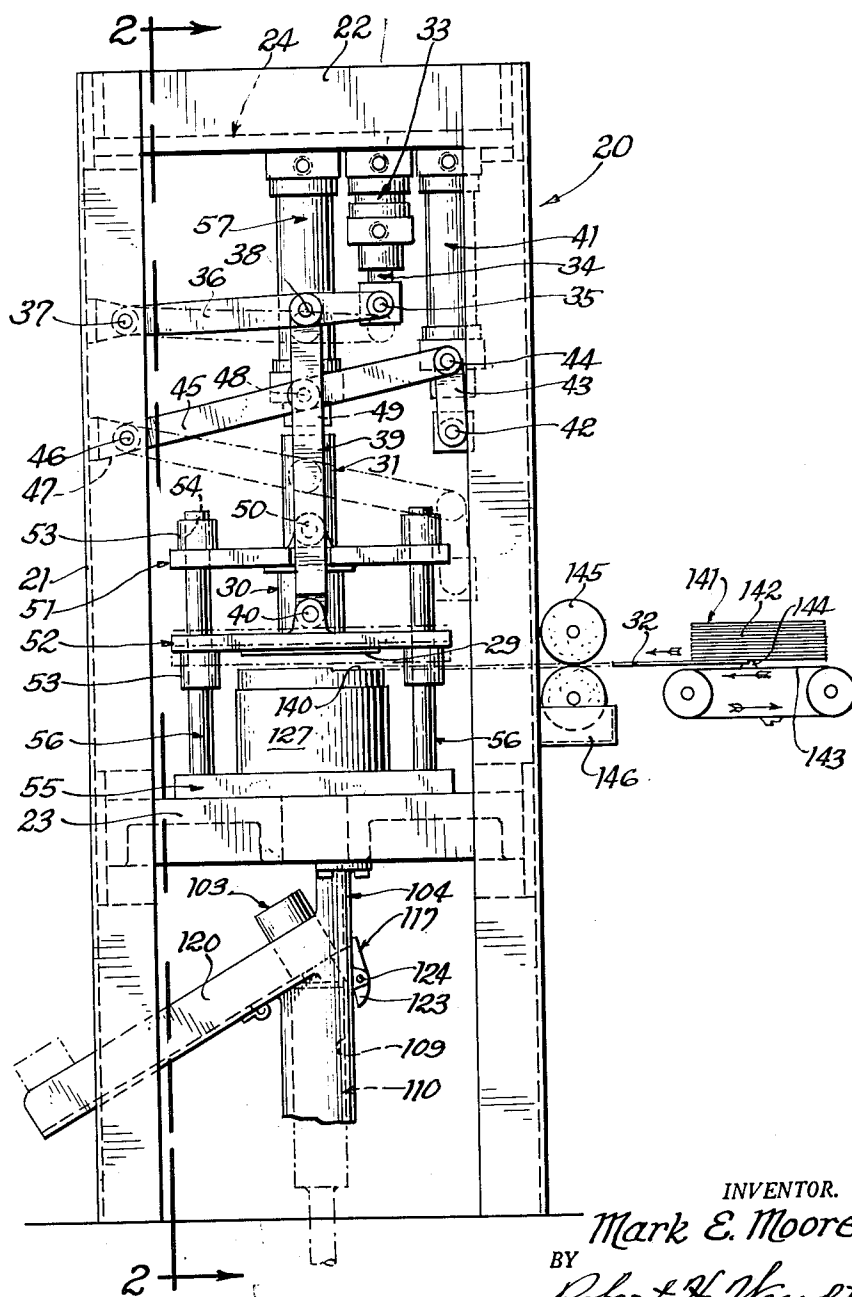


Filed May 20, 1950

APPARATUS FOR DRAWING SEAMLESS CANS

5 Sheets-Sheet 1

Fig. 1



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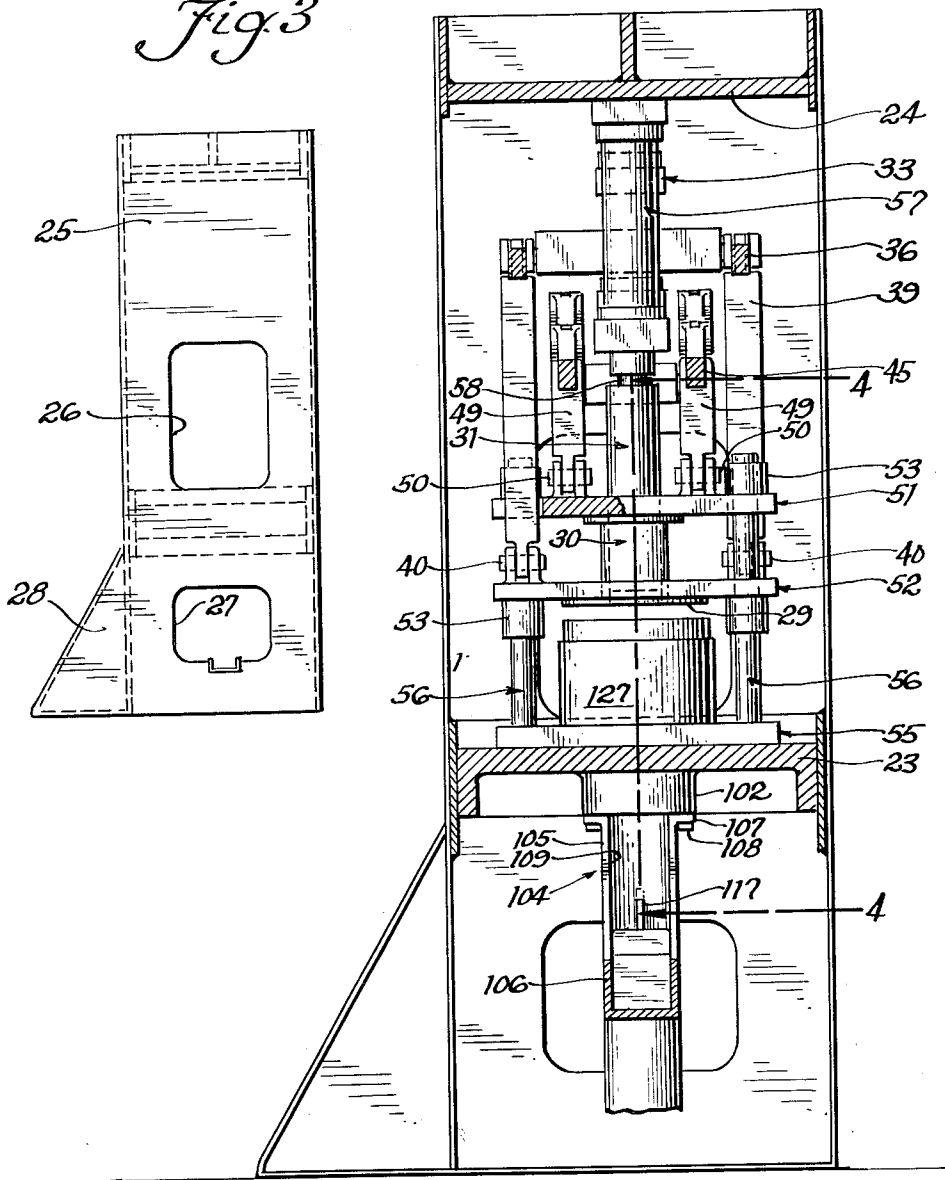
APPARATUS FOR DRAWING SEAMLESS CANS

Filed May 20, 1950

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Fig. 2

Fig. 3



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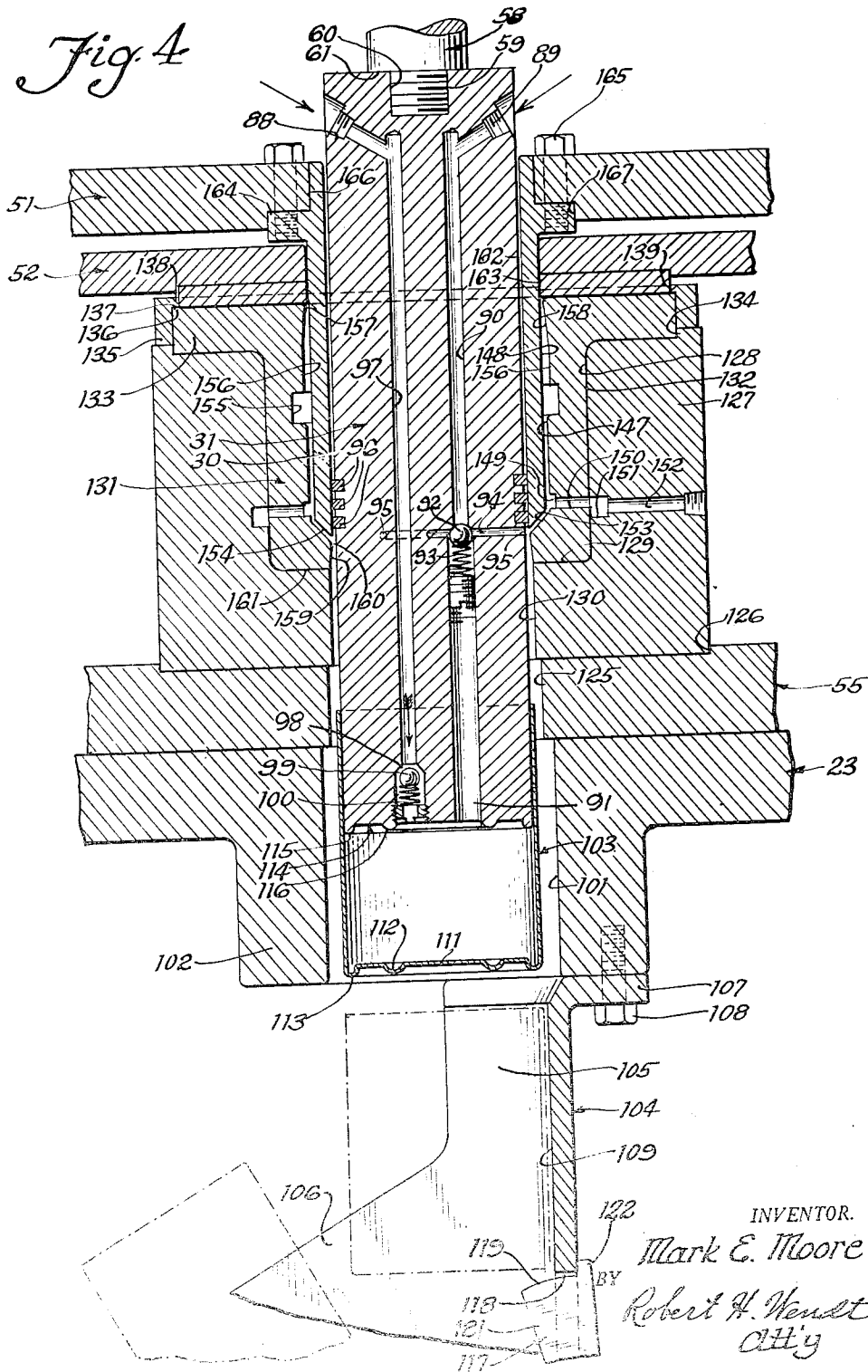
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APPARATUS FOR DRAWING SEAMLESS CANS

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Fig. 4



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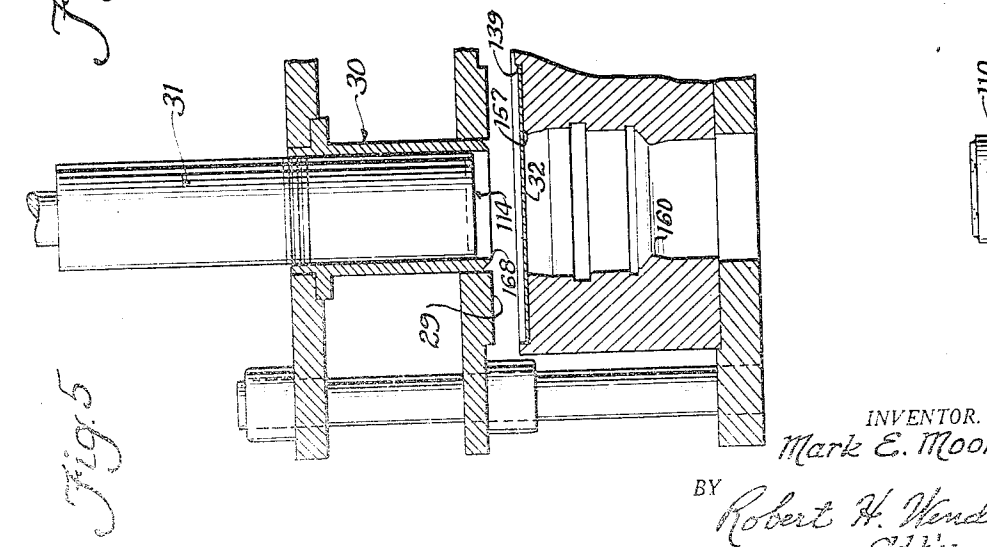
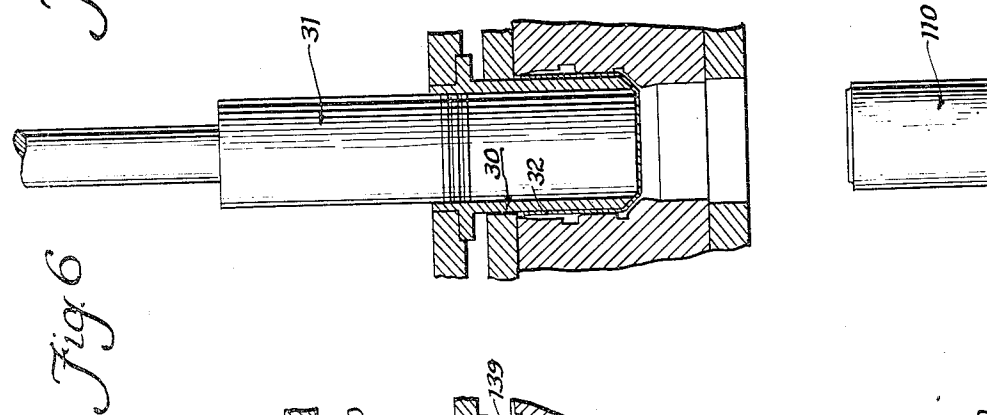
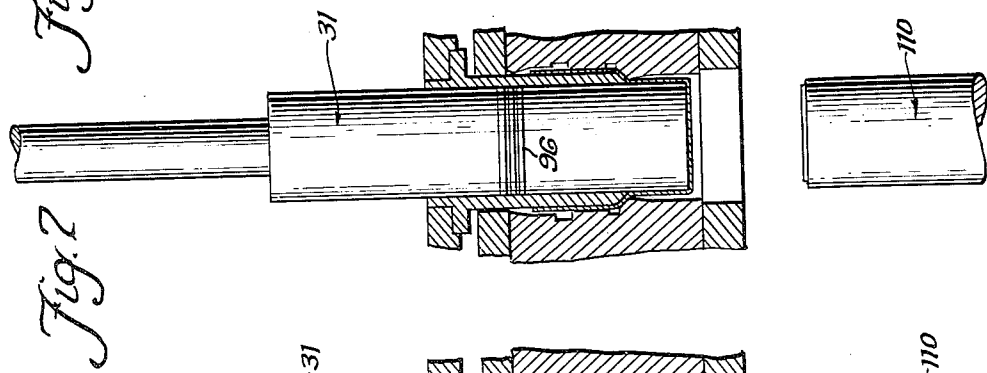
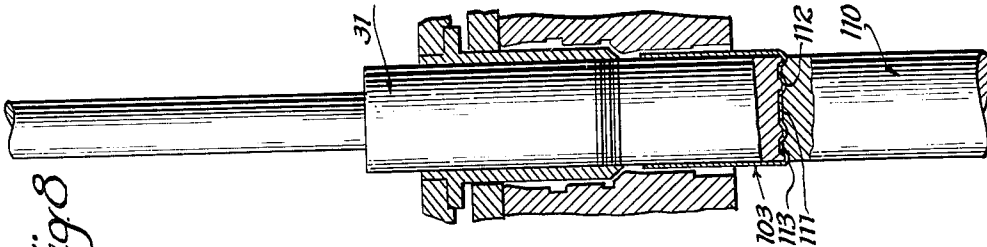
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APPARATUS FOR DRAWING SEAMLESS CANS

Filed May 20, 1950

5 Sheets-Sheet 4



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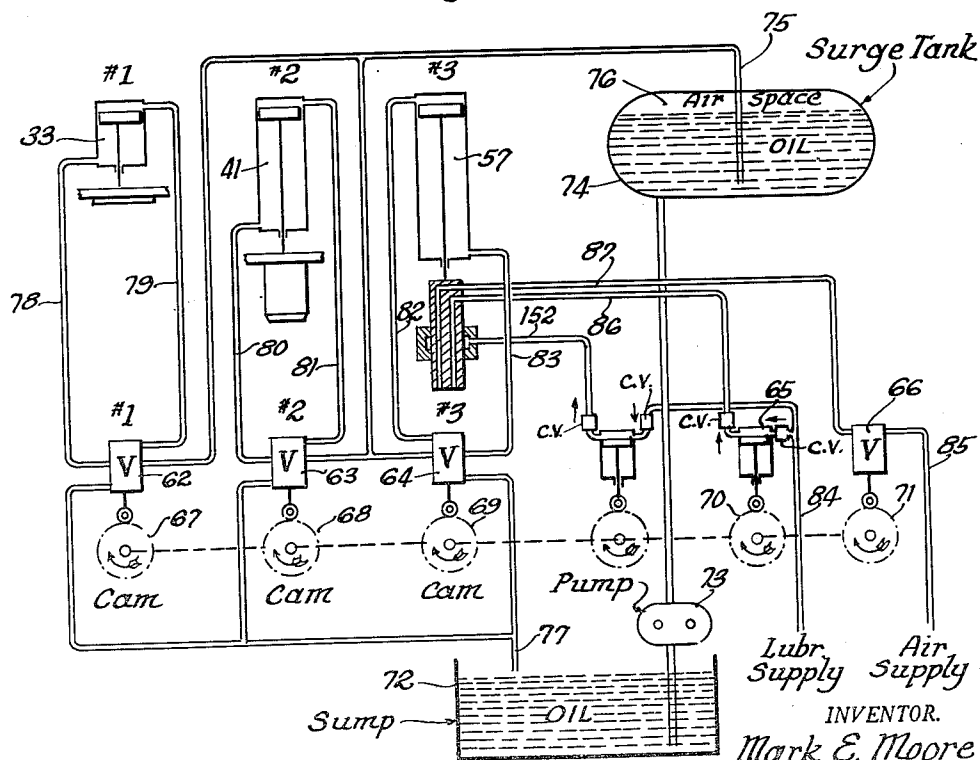
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APPARATUS FOR DRAWING SEAMLESS CANS

Filed May 20, 1950

5 Sheets-Sheet 5

Fig. 9



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2,679,816

APPARATUS FOR DRAWING SEAMLESS CANS

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Application May 20, 1950, Serial No. 163,117

1 Claim. (Cl. 113—46)

1

The present invention relates to apparatus for drawing seamless cans, and is particularly concerned with improved devices by means of which seamless cans made out of suitable metal, such as steel, aluminum, brass, copper, or any other suitable material, may be drawn from circular discs in a single stroke.

One of the objects of the invention is the provision of improved apparatus by means of which seamless cans may be drawn more quickly and more economically than by the methods of the prior art, for the reason that the present apparatus requires a single stroke with no intermediate handling of the product so as to reduce the labor and increase the output.

Another object of the invention is the provision of an improved die construction by means of which seamless cans may be drawn at a single stroke and discharged from the machine at a high rate of production, such as, for example, about fifty cans per minute.

Another object is the provision of an improved die construction which has novel methods of lubrication, and otherwise reducing the friction between the can parts and the parts of the die so that a maximum number of perfect cans may be drawn with a minimum number of imperfect or torn cans.

Another object is the provision of improved apparatus by means of which the amount of power required to operate the dies is substantially reduced, while still forming substantially perfect seamless cans at a single stroke and at a high rate of production per minute.

Another object is the provision of improved apparatus for drawing seamless cans which involves a plurality of successive operations upon the blank or can, but in which these operations are so quickly performed in succession that the metal of which the can is formed is still hot from the first and earlier operations, when the second or succeeding operations are performed, so that the metal does not have an opportunity to become hardened by cooling in between operations; and the work, which is performed in drawing the can and which is ordinarily dissipated in raising its temperature, is greatly reduced in its total amount so that cans may be drawn more easily with the expenditure of less power.

Other objects and advantages of the invention will be apparent from the following description and the accompanying drawings, in which similar characters of reference indicate similar parts throughout the several views.

Referring to the drawings of which there are five sheets accompanying this specification,

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Fig. 1 is a side elevational view of the press equipped with the die and other apparatus embodying the invention;

Fig. 2 is a vertical sectional view taken on the plane of the line 2—2 of Figure 1;

Fig. 3 is a front elevational view of the press of Figure 2;

Fig. 4 is a fragmentary vertical sectional view on a larger scale, showing the parts of the die of Figure 2 on the plane of the line 4—4 of Figure 2, looking in the direction of the arrows and showing a completely formed can at the time of its discharge from the inner post of the die;

Fig. 5 is a fragmentary sectional view taken on the same plane as Figure 4, with the inner post of the die in elevation, showing the parts as they appear after a disc has been fed to the die but before it is gripped by the pressure pad;

Fig. 6 is a view similar to Figure 5, showing the seamless can in the course of its formation, at the time when the inner post of the die has reached the end of the sleeve or punch of the die and the blank has been drawn entirely out of the space between the pressure pad and the face of the die;

Fig. 7 is another view similar to Figures 5 and 6, showing a seamless can in the course of its being drawn and showing the action of the inner post in the formation of the can after it has passed the lower end of the sleeve or punch;

Fig. 8 is a view similar to Figures 5, 6 and 7, with the parts of the die in the position which they assume when the seamless can has been wholly formed, and the lower forming die has also come into engagement with the bottom of the can to shape the bottom as desired in cooperation with the end of the inner post; and

Fig. 9 is a diagrammatic view showing the conduits and elements required for the hydraulic operation of such a die.

Referring to Figs. 1 to 3, the present apparatus is shown in connection with a hydraulic press, indicated in its entirety by the numeral 2; but I desire it to be understood that the die can be operated mechanically as well as hydraulically.

The press preferably includes a suitable framework, which may consist of a housing 25 joined at the top by horizontal frame portions 22, and joined at a point above the bottom by a bed member 23, which is rectangular in shape and may be square.

The top frame members 22 support a cross head plate 24, against which the hydraulic cylinders may react, and to which they may be attached. This framework may be covered by means of a

suitable housing 25, provided with lateral windows 26, 27 for access to the parts of the die.

The housing 25 is generally rectangular, but may have a pair of laterally projecting lower diagonal flanges 28 for housing the discharge opening where the finished cans are discharged.

All of the fixed parts of the framework and housing may be constructed out of suitable steel, and may be secured together by suitable bolts or other fastening means, but are preferably welded together to provide a rigid frame.

Referring to Fig. 4, the movable parts of the die are the pressure pad 29, the sleeve punch 30, and the inner post 31. Each of these is preferably provided with a separate mechanical or hydraulic means for the application of pressure and for moving these elements.

The pressure pad has a minimum amount of movement, moving upwardly only sufficiently to admit the disc-shaped blank 32 (Figure 1) and, therefore, the pressure pad is actuated by means of hydraulic cylinder 33, which is relatively short but powerful.

The plunger or piston 34 of this hydraulic cylinder is connected by means of a pin and slot 35 to a pair of levers 36, the opposite end of which is pivoted at 37 on the frame. Levers 36 are pivotally connected at 38 to connecting links 39, the lower ends of which are pivotally connected to the pressure pad at 40.

Thus the hydraulic cylinder 33, which is carried by cross head plate 24, is adapted to move the pressure plate 29 upward and downward; and when the pressure plate is in its lowermost position it is adapted to place a heavy pressure on the blank 32 to hold it against wrinkling as the blank is drawn from the flat condition and shaped into a can.

For example, the pressure in pounds per square inch placed by the pressure plate upon the blank may be about 100 lbs. per sq. in. The pressure varies, depending upon the thickness of the can and the character of the material of which the can is to be made, and this example is given as a suitable pressure for cans made of 30 gauge steel.

The sleeve punch 30 may be actuated by means of the hydraulic cylinder 41, carried by cross head plate 24, and having a plunger or piston rod which is pivotally connected at 42 to a pair of links 43. The links 43 are pivotally connected at 44 to a pair of levers 45, the opposite ends of which are pivotally mounted on the frame at 46 on a suitable pivot bracket 47.

The levers 45 are pivotally connected at 48 to a pair of downwardly extending links 49, which have their lower ends pivotally connected at 50 to a guide plate 51 which supports and guides the sleeve punch 30.

The pressure pad 29 also includes a suitable guide plate 52. These guide plates may be rectangular in shape, and are preferably square and are provided at each of their four corners with upwardly or downwardly extending tubular guides 53 and cylindrical bores 54.

The bed 23 of the press supports a suitable base plate 55 for the die assembly, which base plate carries four upwardly extending, equally spaced and parallel cylindrical guide rods 56. The guide plates 51 and 52, which support the sleeve punch 30 and pressure pad 29 are slidably mounted on the rods 56, and the elongated surfaces in the bores 54 engaging the rods guide the plates with a minimum possibility of binding.

The inner post 31 may be actuated by the cen-

trally located hydraulic cylinder 57, carried by the cross head plate 24 and located below at its center between the pairs of levers 36 and 45.

The piston or plunger of the hydraulic cylinder 57 is provided with a connecting rod or connecting rod portion 58, which is fixedly secured to the inner post 31. For example, connecting rod 58 may have a reduced threaded portion 59, received in a threaded bore 60, and driven home until the annular shoulder 61 on the connecting rod 58 engages the upper plane end of the inner post 31. Thus the inner post is adapted to be moved and it has pressure applied to it by the hydraulic cylinder 57.

The range of movement of the sleeve punch 30 is determined by its length, which in turn is determined by the length of the can to be formed; and the pressure applied to the sleeve punch by means of hydraulic cylinder 41 varies with different sizes of cans and the gauge and character of metal employed for the can.

The inner post 31 has the greatest range of movement since it moves first with the sleeve punch 30, and later moves down beyond the sleeve punch 30 to complete and discharge the can.

Therefore, the hydraulic cylinder 57 is longer and like the others the pressure applied depends upon the size of can, character, and gauge of metal.

Referring to Figure 9, this is a diagrammatic illustration of the oil and air circuits for the hydraulic cylinders for lubrication and for compressed air supply. For purpose of illustration the valves 62 are shown as being operable by means of suitable cams 67-71, all of which may be mounted upon a single timing shaft.

However, I desire it to be understood that the valves may be actuated automatically by the movement of the parts, such as the pressure pad, the sleeve punch, or the inner post, so that the arrival of these parts at predetermined positions determines the actuation of the valves for moving the next part or parts in the cycle of operation.

Thus the mechanism may be arranged so that when the hydraulic cylinder applies pressure to the blank disc this also actuates the valves 63 and 64 to cause them to begin the movement of the inner post and sleeve punch. Therefore the cams are merely used for purpose of a simplified explanation.

The system includes an oil sump 72 and an oil pump 73, having its inlet extending into the oil of the sump and discharging oil under pressure to a surge tank 74. The surge tank has its discharge pipe 75 depending into the oil which has entrapped air 76 in the space above the oil, so that the compressed air in the surge tank provides a supply of oil at a substantially constant pressure.

The oil supply pipe 75 has branches leading to the three valves 62-64, which have branch return pipes connected to an oil return pipe 77, returning the used oil to the sump. The valves 62-64 control conduits 78 and 79, 80 and 81, and 82 and 83, leading to the opposite ends of the hydraulic cylinders 33, 41 and 57, respectively, so that the valves 62-64 may supply oil under pressure to either side of the piston in each hydraulic cylinder to move the parts in either direction as required in the cycle in operation of the die.

The diagram, Figure 9, also includes valve 65, controlled by cam 70, for controlling a conduit 84, leading to a source of lubricant under pressure to supply lubricant to the die. The valve 66,

controlled by cam 71, controls a conduit 85, providing a supply of suitable air pressure, for the purpose of discharging the cans from the die and for assisting in the drawing of the cans during the cycle of operation of the die.

Lubricant and air supplies are connected by suitable flexible pressure conduits 86, 87 to the inner post 31, at the threaded bores 88 and 89 at the top of this post. For example, the threaded bore 89 may be for lubricant, and it may communicate with the longitudinally extending bore or conduit 90, which terminates at the lower end of the post 31 in a suitable outlet 91, controlled by a ball check valve, spring pressed into closed position by spring 93.

Check valve 92 prevents lubricant or air from going backward in the conduit 90. The conduit 90 preferably communicates with a transverse lubricant conduit 94, which may have a plurality of outlets 95, located just below the piston rings 96.

The piston rings are mounted in suitable piston ring grooves in the cylindrical inner post 31 for preventing the loss of lubricant or air upwardly through the clearances between the post 31 and sleeve punch 30.

The threaded bore 88 leads to a longitudinally extending conduit or bore 97 for air, which is provided with a discharge opening 98 at its lower end, controlled by a ball check valve 99, urged into closed position by spring 100.

Check valve 99 aids in maintaining suitable air pressures at times when the air has been shut off at the air valve. The structure of the die assembly is preferably as follows:

The bed 23 of the press is provided with a central bore 101, bordered by a depending tubular portion 102, through which the finished can passes to be discharged. The can in Figure 4 is indicated by 103.

The depending tubular formation 102 supports a can discharge guide 104, comprising a partially cylindrical body 105, provided with laterally projecting, parallel guide flanges 106. The can discharge guide is secured at its attaching flange 107 to the tubular formation 102 by screw bolts 108.

The can discharge guide 104 has an inner cylindrical surface providing a continuation of the cylindrical bore 109, which acts as a guide for the lower pressure plunger 110, which cooperates with the inner post 31 to form the lower end of the can. The lower end or bottom 111 of the can is preferably formed with an annular, outwardly projecting, pressed corrugation 112, taking the form of an inner groove partially circular in cross section and an outer rib.

The bottom 111 is also preferably formed with a rib 113, having an easy bend, which is partially circular in cross section and which extends all around the lower edge of the seamless can projecting downwardly.

The rib 113 approximates in shape and structure the seam which now appears on the bottoms of seamed cans, so that the present seamless can can be gripped more readily or centered and held by can handling machinery, such as a can opener. The upper end of the lower plunger 110 is, therefore, complementary in shape to the lower surface of the bottom 111 of the can.

The lower end 114 of the inner post 31 is complementary to the inside of the bottom of the can 111. Therefore, the bottom of the inner post is flat and plane except for the depending annular ribs 115, 116.

The lower plunger 110 may also be actuated by suitable mechanical or hydraulic means, and it moves up in the cylindrical bore 109, which has a suitable pivoted stop member 117 pivotally mounted in a slot 118 and having curved stop surface 119 for engaging the bottom of each can and deflecting it out of the housing 105 into the rectangular trough 120.

The stop member 117 pivots by gravity to the position of Figure 1 or Figure 4, but plunger 110 cams against the beveled surface 121 to move the stop member out of the bore 109 and out of the way of the plunger 110 as the plunger comes up.

An upward extension 122 on stop member 117 engages the outside of housing 105 and prevents the stop member 117 from pivoting farther in a counterclockwise direction from the left. A depending tail 123, below the point of pivot 124, prevents stop member 117 from moving too far in a clockwise direction.

The die supporting plate 55 is suitably secured to the bed 23 by adjustable bolts, not shown, so that its central cylindrical bore 125 may be centrally located above the bore 101. Base plate 55 has a concentric, circular recess indicated by the annular shoulder 126 for seating the die body 127 in concentric relation to the base plate 55.

Die body 127 may be made of soft steel and comprises a cylindrical metal member formed with a cylindrical bore 128, an annular shoulder 129 and a counterbore 130. Counterbore 130 has suitable clearance with respect to the formed can and is for passing the can and the inner post which supports the can.

Cylindrical bore 128 is for receiving the hardened steel die member 131, which is tubular in shape and has an outer cylindrical surface 132 fitting in bore 128, with a plane surface engaging the annular shoulder 129.

Hardened die member 131 has a radial pressure flange 133 seated in a shallow circular recess 134 in the die body 127 to hold the hardened die member 131 in concentric position. Hardened die member 131 is held in its bore 128 by bolts. Ring 135 has an overhanging annular shoulder 136 engaging the top of the radial flange 133 at its outer edge, and serves to locate the blank.

Retaining flange 137 is preferably beveled at 138 on its inner upper corner, but has an inner cylindrical portion 139 which locates and holds the blank disc 32 in proper position. As seen at 140 (Fig. 1), the upper retaining flange 137 is cut away on the feed side of the die to facilitate the entrance of the blank discs 32 from the right in Fig. 1.

A suitable feed mechanism, generally indicated at 141, includes a stack of discs 142 and a chain drive 143, the driving lugs 144 of which project upwardly far enough to engage only one disc 32 and move it to the left, where its motion is continued by lubricating rollers 145, one of which dips into a lubricant reservoir 146 to lubricate the blank.

Any type of feed and lubricating mechanism may be employed, and that shown is merely diagrammatic.

The hardened steel die member 131 may be made in one or several pieces, provided when assembled they are of the shape shown. This die member is provided with an internal round bore which is substantially cylindrical at its lower part 147. This cylindrical portion 147 has a clearance with respect to the external cylindrical surface 148 of the sleeve punch 30, which pro-

vides space for the can blank and is proportionate to the thickness of the blank at the time it is partially formed and located on the outside of the sleeve punch 30.

Below the cylindrical bore portion 147 there is an annular lubricant groove 149 which communicates with a through bore 150 in the hardened die member 131, which in turn communicates with an annular groove 151 and a conduit 152 in the die body 127.

A branch conduit from the oil supply conduit may also be connected to this conduit 152. The conduits just referred to supply lubricant to the outside of the partially formed can, the lubricant finding its way upward into the bore 147, outside of the can and downward over the frusto-conical surface 153, in the hardened die member 131, which is immediately below the annular lubricant conduit 149.

The frusto-conical surface 153 in the die member 131 is of the same angularity as the beveled surface 154 on the lower end of the sleeve punch 30. Above the cylindrical bore 147, in the die member 131, there is an annular rectangular groove which may serve as a lubricant reservoir for receiving excess lubricant; and above the annular groove 155 there is a cylindrical bore 156 of slightly greater diameter than the bore 147. Bore 156 provides relief about the partially formed can blank as it is drawn down into the round opening of the die member 131.

At its upper end the opening in the die member 131 is provided with a rounded corner 157, which has a clearance with respect to the sleeve punch 30, depending upon the amount of draw that is to be accomplished in the can blank at this point.

From the corner 157 the opening in the die member 131 becomes gradually larger, having a frusto-conical portion 158 down to the bore 156. Below the frusto-conical surface 153, at the lower end of the hardened die member 131, this member is provided with a round bore 159 leading from a rounded, annular corner 160, and the round bore 159 tapers upwardly and substantially frusto-conical and larger at the bottom to provide a relief about the can wall after it has been drawn over the corner 160 of the die member 131.

The lower end of the die member 131 may be plane at the lower end 161, fitting in the bore 128 against the annular shoulder 129. The sleeve punch 30 comprises a hardened steel tubular member having the cylindrical outer surface 148 and also having a cylindrical inner bore 162.

The outer cylindrical surface 148 has a sliding fit with the bore 163 extending through the pressure pad 29 and its supporting plate 52. At its upper end, above the pressure pad supporting plate 52, punch sleeve 30 has a radial supporting flange 164 provided with threaded bores for receiving the screw bolts 165, by means of which the sleeve punch is secured to the guide plate 51.

Guide plate 51 has a bore fitting about the upper tubular end of the sleeve punch 30, and guide plate 51 has a counterbore 167 for receiving the radial flange 164. The internal bore 162 of the sleeve punch 30 is cylindrical and has a sliding fit with respect to the inner post 31.

The inner post 31 comprises a hardened and solid cylindrical steel member attached at its upper end to the connecting rod or plunger 58, and provided at its lower end with the formations for shaping the bottom of the can.

Referring now to Figures 5 to 8, these are views

showing the method of making seamless cans in a single stroke operation.

In Figure 5 the inner post 31, the punch sleeve 30, and the pressure pad 29 have all been raised above the die member 131, and a circular steel disc or blank has been fed into the recess which is bounded by the annular wall 139. The pressure pad 29 descends against the blank 32 first and clamps it firmly against the die member 131 to hold the blank against wrinkling as it is drawn into can shape.

In the next step after this the inner post 31 and sleeve punch 30 descend together, the lower end 114 of the inner post being substantially flush with the lower end 168 of the sleeve punch 30. The sleeve punch and inner post act as one solid body engaging the blank disc 32 and drawing it downward over the rounded corner 157, forming a round partially formed can body of the shape shown in Figure 6.

As the inner post and sleeve punch descend the edge of the blank 32 is drawn inward underneath the pressure pad and gradually diminishes in diameter until it has been entirely drawn from beneath the pressure pad. When the inner post 31 and sleeve punch 30 have arrived at the position of Figure 6 and are ready for the second drawing operation, all of the blank should have been drawn out from beneath the pressure pad.

The next step in the formation of the can is its further reduction in size from the enlarged cylindrical shape of Figure 6, to the smaller cylindrical size of the internal post 31. This is accomplished by stopping the sleeve punch 30 in the position shown in Figure 7 and holding it there with hydraulic pressure while the inner post 31 continues to move downward to draw the partially formed can wall over the annular corner 160, further reducing it in size and elongating the can, a part of which has already been completed in Figure 7.

The inner post 31 continues to move downward until the entire can has passed the annular corner 160, and the entire can has been drawn into the smaller cylindrical shape which is complementary to the inner post 31.

During all of this time the lower bottom shaping plunger 110 has been rising, and immediately after the cylindrical wall of the can has reached its final shape in Figure 8, the bottom shaping plunger 110 comes into engagement with the bottom of the can and the bottom is shaped between the lower plunger 110 and the upper inner post 31, as shown in Figure 8.

Thereafter the bottom plunger 110 is withdrawn and the can is forced off the lower end of the inner post 31 by air pressure, but air pressure is not merely used for discharging the can, and is, like the lubricant, constantly applied to the inner post discharging out of its lower end into the inside of the partially formed can while the die is doing its work.

The air on the inside of the can blank 32, in Figure 6, provides a powerful internal pressure which tends to expand the can slightly and to separate the can walls from the post 31 by fluid air so that the can can be drawn more easily. While the can is being further elongated and diminished in size, as shown in Figure 7, the air under pressure comes out of the lower end of the inner post 31 into the can 32 and leaks upward along the side of the partially formed can.

The air cannot pass the piston rings 96 and, therefore, it tends to follow the inside of the can wall and to go between the can and the out-

side of the sleeve punch 30 in Figure 7, tending to space these two surfaces and to enlarge the can so that it is drawn more easily.

When the can is completely formed, as shown in Figure 8, the air pressure still tends to enlarge the can and to permit its discharge off the lower end of inner post 31 with greater facility, also acting to make the cans slide off.

The lubricant which is supplied through the conduit 90 is delivered first at points just below the piston rings from whence it is forced downward between the inner post and the punch sleeve 30, and leaks upward around the inner sleeve punch 30 inside the can wall.

Other lubricant is supplied outside the can wall at the annular groove 149, lubricating the outside of the can wall just before it is drawn over the annular corner 160. The prelubrication of the blank at its top and bottom as it is fed into the die provides lubrication between the blank and the pressure pad, and between the blank and the top of the hardened die member 131.

When the can has been completed, as shown in Figure 8, the lubricant is preferably shut off by its valve to prevent its loss, and as soon as the can has been discharged from the end of the inner post the air supply is shut off until the die parts have again been elevated to the position of Figure 5, and until they have been caused to descend into engagement with another blank 32. Then the air and the lubricant may both be turned on before the die operates.

My method of making seamless cans may be briefly summarized as follows:

Circular blanks of sheet metal are first punched out of the sheets and arranged in stacks, and they are fed from the bottom of the stack through an oiling device which coats the top and bottom with oil as they progress toward the die assembly.

The disc-like blanks are fed one by one into the die assembly between the pressure pad and the female die member, and they are first clamped in flat condition against the upper plane surface of the female die by the pressure pad.

The location of the blank at the time is concentric and is determined by a complementary concentric recess on the upper face of the female die member. The blank is subjected to sufficient pressure at its plane portions during the drawing operation to prevent wrinkling.

The next step comprises the drawing of the plane blank into enlarged cylindrical form by means of a composite die body comprising an internal cylindrical post and an external cylindrical sleeve until the plane part of the blank is wholly withdrawn from beneath the pressure pad and shaped into cylindrical form.

The next step comprises the continuance of the drawing operation by moving the inner one, that is the cylindrical inner post of that composite body onward in the same direction, drawing the partially formed can over an annular forming surface into a smaller bore while lubricating the wall of the can on the outside and the inside, and at the same time applying air pressure to the inside of the can wall during its successive forming operations. The oil is, of course, supplied at a higher pressure than the air, which oil pressure determines the amount of lubrication; proper amount of lubrication is determined by trial and error and by inspection of formed cans.

The application of the air pressure causes air to leak along the inside of the can wall, separat-

ing it slightly from the forming and supporting die parts on the inside of the can, expanding the can slightly due to the air pressure filling the inside of the can with the fluid air so that it can be drawn more easily with less power and less change of tearing.

The latter forming operation continues until the parts of the partially formed can have been wholly drawn off the outside of the punch sleeve into the smaller bore and shaped to the external cylindrical surface of the inner post, whereupon a lower forming die member is brought into engagement with the bottom of the can to shape the bottom of the can.

In this latter step the bottom of the can is simultaneously formed with a re-enforcing annular ridge and with an annular ridge adjacent the can wall to give it a stable lower supporting surface. When a supporting annular ridge is provided at the outer lower wall of the can, this is more easily made stable and in the same plane than the can is apt to be if its bottom were perfectly plane.

Finally, the formed can is released by the lower die and subjected to internal air pressure while it is on the upper die or internal post to expand the finished can and move it off the end of the post by the thrust developed by air pressure. The can is then guided into a trough which may lead to a conveyor or conductor for cans.

It will thus be observed that I have invented an improved apparatus by means of which seamless cans may be drawn at a single stroke by means of die parts which first form the can into a larger cylindrical shape and then continue to draw it into longer and thinner cylindrical shape, after which the bottom is preferably formed into a definite shape.

By means of my methods and apparatus, suitably controlled, more cans per minute can be made than with any other method and also less labor is employed. Every time a can has to be handled, either manually or by machine, to place it on a new die the cost is increased and this is avoided by means of my apparatus which forms the seamless cans at a single stroke.

I am aware that seamless cans have been previously made by means of a plurality of different operations upon a plurality of different dies in a plurality of steps, but in the devices of the prior art the intermediate products have been permitted to cool before they were acted upon by successive dies or operations. This alternate heating and cooling not only involves separate handling of the intermediate containers by the operators, but such methods harden the metal and require the expenditure of more power in the drawing of the can, this power being dissipated in the act of heating the can a plurality of times, whereas according to my method the blank or container is subjected to a plurality of successive operations immediately following each other while the can metal is still hot, so that the metal does not have a chance to cool and toughen and less power is dissipated in the form of heat.

While I have illustrated a preferred embodiment of my invention, many modifications may be made without departing from the spirit of the invention, and I do not wish to be limited to the precise details of construction set forth, but desire to avail myself of all changes within the scope of the appended claim.

Having thus described my invention, what I

claim as new and desire to secure by Letters Patent of the United States, is:

In an apparatus for drawing seamless cans, the combination of a supporting bed, a frame, a female die carried by the bed, and having an upper clamping surface, a bore, and a counterbore, with a first annular drawing shoulder at the upper end of said bore, and a second annular drawing shoulder between said bore and counterbore, a sleeve punch in said bore and terminating in a bevelled lower edge, said bore having a complementary bevelled surface above said second drawing shoulder; a pressure pad surrounding said sleeve punch above said clamping surface, a male post slidably mounted in said sleeve punch to be received in said counterbore, three hydraulic cylinders and pistons, including a first piston connected to actuate said pressure pad, a second piston connected to actuate said sleeve punch, and a third piston connected to actuate said male post, said male post having a conduit for conducting air under pressure to the lower end of said post, and having a second conduit for conducting lubricant under pressure to the interior of said sleeve punch, said second conduit discharging in said sleeve punch below a plurality of piston rings carried by said male post and below the top of said sleeve punch, said female die having a third conduit for lubricant under pressure, discharging above its bevelled surface and second drawing shoulder, said first piston clamping the edges of a circular blank against said female die to

prevent wrinkling, said second and third pistons advancing simultaneously to draw said blank over said first shoulder to form a large cylindrical container, and said third piston advancing said male post thereafter in said sleeve punch to draw said container over said second drawing shoulder, while said container is lubricated inside and out and subjected to expanding air pressure, the said container passing through said female die and being discharged from the male post by internal air pressure.

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