L. BAUROTH.

METHOD OF FORMING METALLIC BARREL BODIES.

APPLICATION FILED NOV. 27, 1911.

1,039,885.

Patented Oct. 1, 1912.

3 SHEETS—SHEET 1.

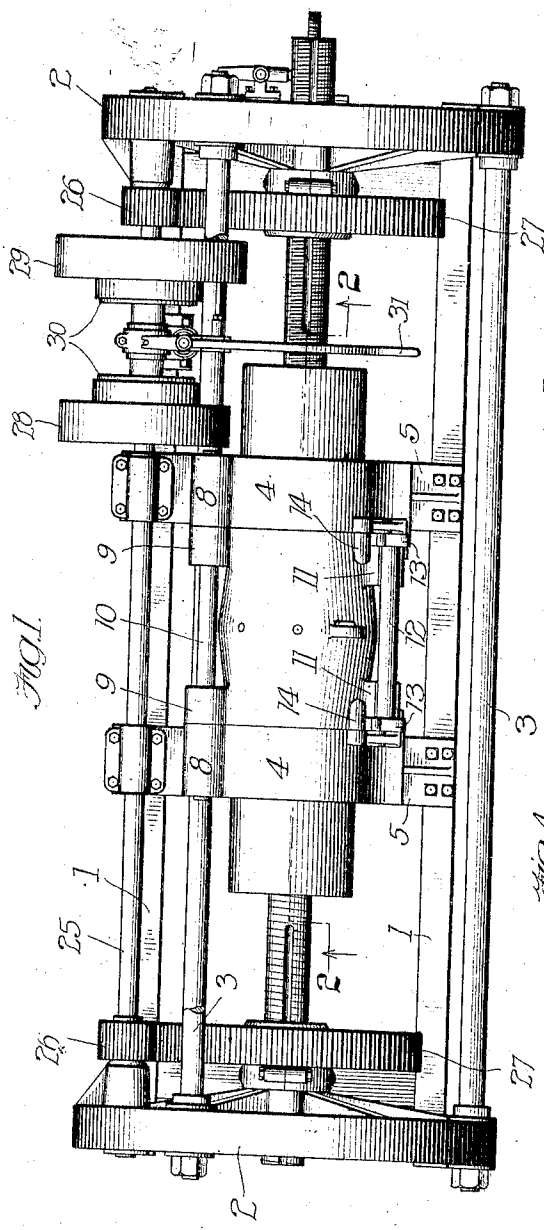

FIG. 1.

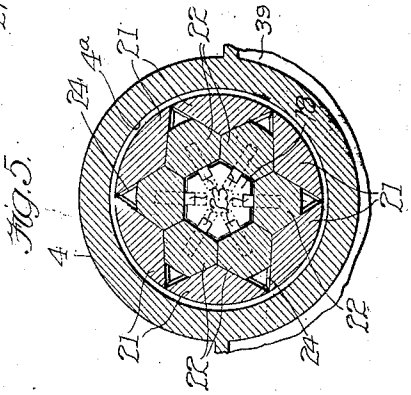

FIG. 5.

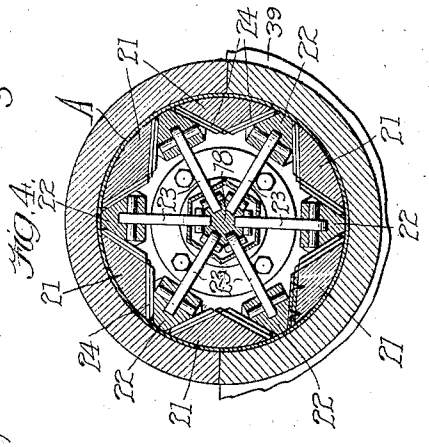

FIG. 4.

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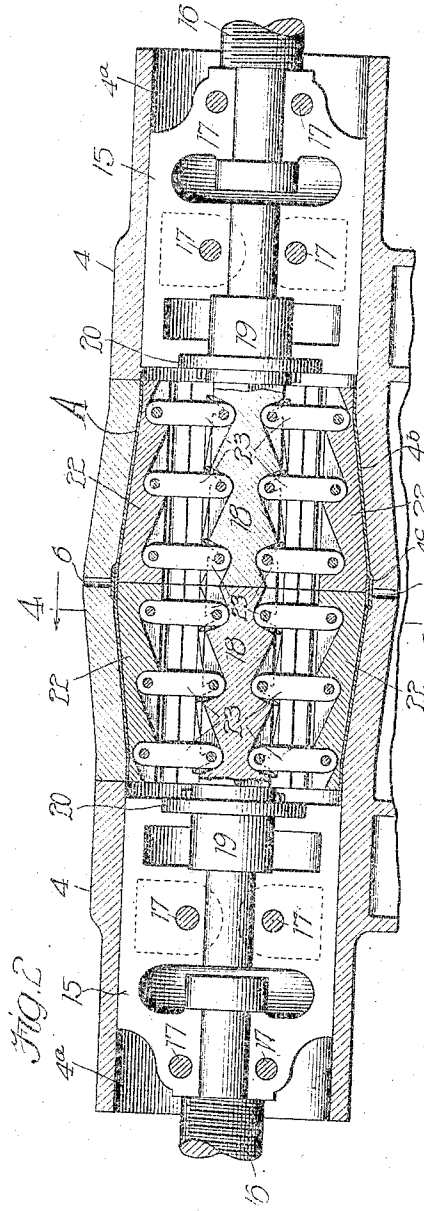

Fig. 2.

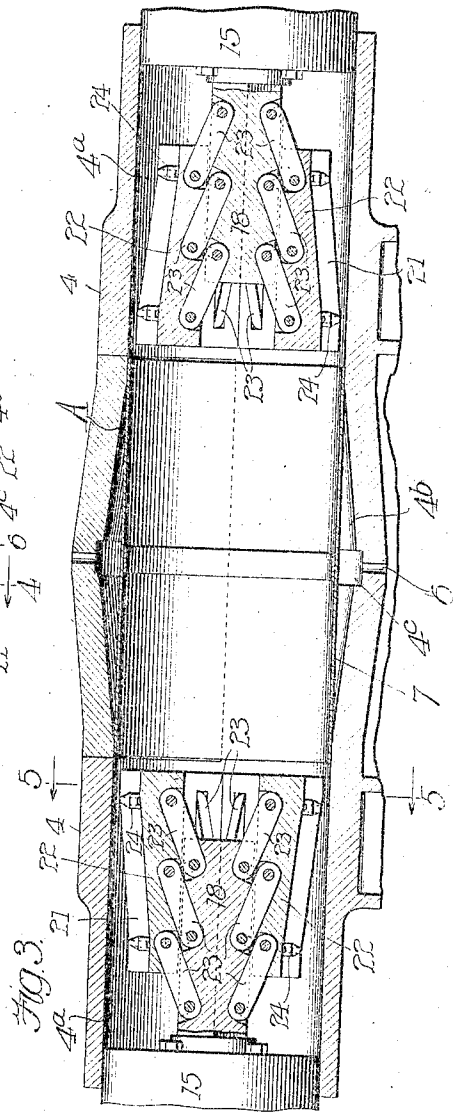

Fig. 3.

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3 SHEETS—SHEET 3.

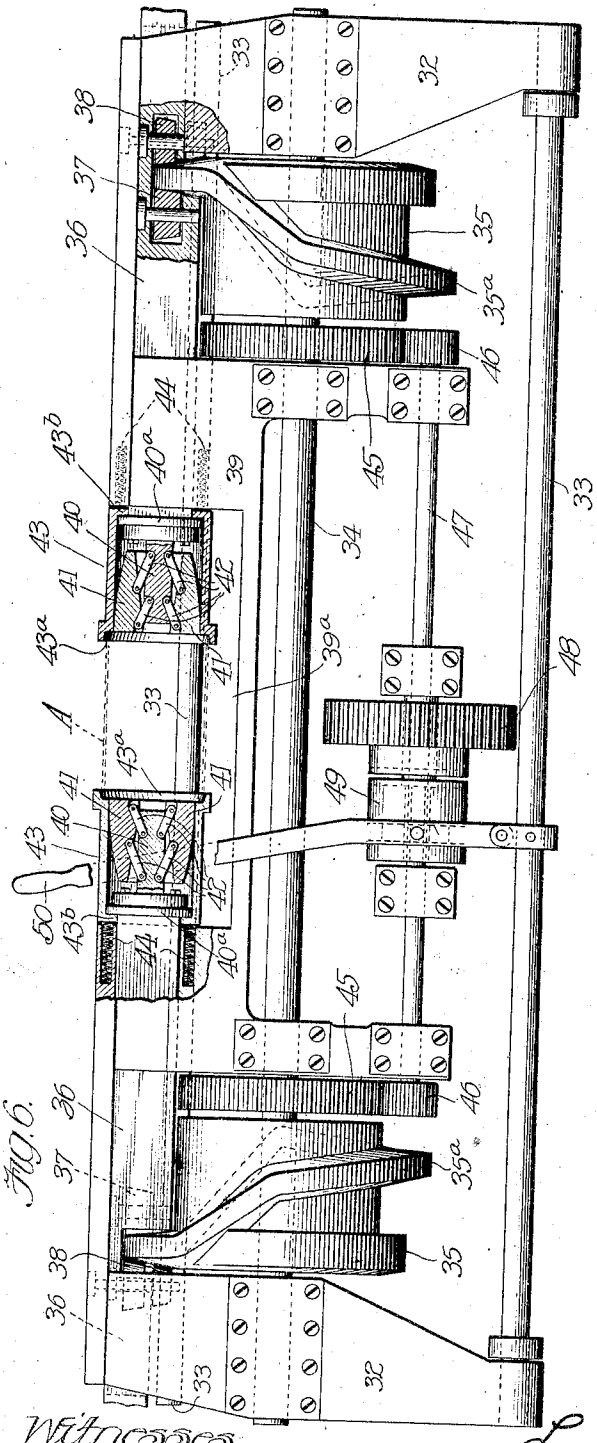

Fig. 6.

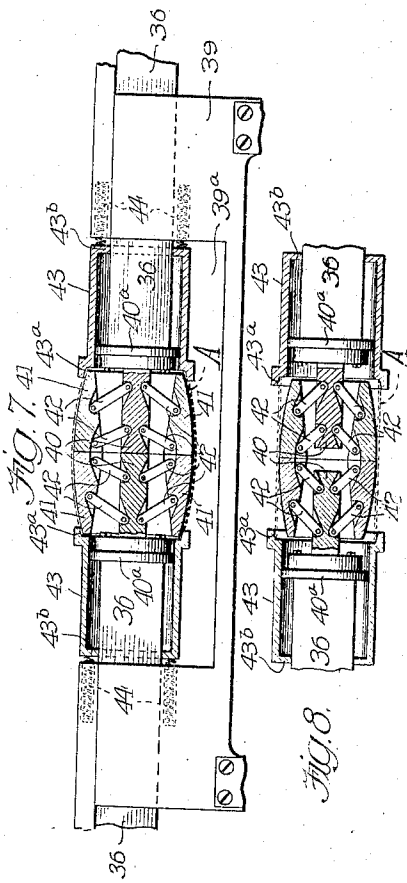

Fig. 7.

Fig. 8.

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UNITED STATES PATENT OFFICE.

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METHOD OF FORMING METALLIC BARREL-BODIES.

1,039,885. Specification of Letters Patent. Patented Oct. 1, 1912.

Application filed November 27, 1911. Serial No. 662,609.

To all whom it may concern:

Be it known that I, LEONHARD BAUROTH, a citizen of the United States, residing at Toledo, in the county of Lucas and State of Ohio, have invented a certain new and useful Method of Forming Metallic Barrel-Bodies, of which the following is a specification.

My invention consists in a new and useful method of making or forming the bodies of metallic barrels of bilge form; and speaking in general terms my method consists in taking a cylindrical blank of proper diameter and length, according to the size of the barrel body desired, and of suitable material, such as sheet steel and, after placing the same in a hollow die whose inner surface corresponds to the shape or bilge of the barrel, applying pressure from within until the blank is expanded outwardly into the shape of the die, such pressure being applied initially and then progressively outwardly toward the opposite ends of the blank. As a result of this initial application of the pressure and the subsequent progressive pressure toward the ends, perfect undistorted and uniform barrel bodies are formed.

My present invention relates to the method or process of forming bilged metal barrel bodies and is irrespective of any particular apparatus, inasmuch as any suitable apparatus capable of practising or carrying out said method may be employed.

For the purpose of a clear and definite disclosure of my invention I have chosen to illustrate and will hereinafter describe certain apparatus which I have found in practice to be suitable for the purpose but it will be understood that my method is independent of apparatus and is not to be limited in any way to the apparatus shown or any other character of apparatus. Moreover, I make no claim herein for said apparatus.

Referring to the accompanying drawings illustrating two forms of apparatus which may be used to carry out my method, Figure 1 is a plan view of one form thereof; Fig. 2 a sectional elevation on the line 2—2 of Fig. 1; Fig. 3 a similar view of the parts but shown in a different position; Fig. 4 a cross section on the line 4—4 of Fig. 2; Fig. 5 a cross section on the line 5—5 of Fig. 3; Fig. 6 a plan view of another form of apparatus and Figs. 7 and 8 detail views of the expanders in different positions.

Referring to the particular apparatus shown in Figs. 1 to 5 explaining the character of my method during the description of such apparatus, the main frame or base 1 of the machine has at its opposite ends the standards or end frames 2, between which extend tie rods 3. In this particular machine a hollow die is used within which the cylindrical blanks are received and then expanded, such die consisting of a body portion 4 provided with flanges or projections 5 which are secured to one of the beams 1. The die is provided with a longitudinal bore having at each end a cylindrical portion 4^a and a bilged barrel-shaped intermediate portion 4^b. This latter portion or section is provided with a suitable number of air holes 6 to permit the escape of air trapped between the cylindrical blank indicated at 7 and the inner surface of the die and the latter is further provided at or near its center with a shallow groove 4^c when it is desired to introduce a strengthening rib within the barrel. The intermediate portion or section of the die is divided longitudinally along a horizontal plane into halves, the lower of which is integral with the end sections and the upper of which is hinged thereto as at 8, Fig. 1, for the purpose of permitting the ready insertion of the cylindrical blanks and the removal of the same after they have been expanded. The hinge portion of the die is provided with perforated ears 9 which receive and turn upon a hinged bolt or pintle 10, said bolt being received in the perforated portions of the parts 8 above referred to. Any suitable means may be employed for holding and locking the hinged member in closed position, the particular means herein shown consisting of lugs 11 formed upon said hinged member and adapted to be engaged by an eccentric bolt or shaft 12, carried by links 13 which are pivoted to the main portion of the die. For convenience in operation the bolt 12 is provided with handles 14. Owing to the eccentric character of the bearings of the bolt, a partial rotation of such bolt will act upon the lugs 11 forcing them

downwardly thereby holding the hinged member closed.

The means for expanding the cylindrical blanks consists, in the present instance, of two similar expansible heads which are movable toward and away from each other within the hollow die and are carried by slides 15 reciprocating within the cylindrical ends 4^a of the die. Each of these slides is connected with a screw 16 by which it is reciprocated and which in turn is fed or operated by any suitable mechanism to be hereinafter described. The inner end of each screw is connected in suitable manner to its slide, the latter for convenience of assembling being formed in halves separated from each other along a diametrical plane and secured together by bolts 17. Each expanding head consists of a central portion or support 18 and a number of laterally movable sections. The support 18 is provided with a stem 19 and a flange 20, the same being received by the inner end of its slide. The laterally movable sections are in two series, there being a plurality of outer die members 21 which engage the blank and a plurality of intermediate die members 22 which directly support the outer die members and which also in the final expanding operation engage the blank. The central support is in the present instance a prism hexagonal in cross section as indicated in Fig. 5, and to each of its faces is pivoted one of these intermediate members 22 by parallel motion links 23, here shown as three in number. The support and intermediate members are suitably recessed, as shown, to accommodate the links when such intermediate members are in contact with the support, said members themselves being substantially hexagonal prisms so shaped that when the expanding head is contracted they form a practically continuous body around the central support, but their adjacent outer faces lie in planes which together form reëntrant angles. It is within these angles that the outer die members 21 rest and slide, the members of the two sets or series being connected together by a tongue and groove connection indicated at 24, Figs. 4 and 5, which may be of any ordinary or desired form, the tongues and grooves, however, extending transversely of the faces of the members. As indicated in Fig. 3, when the expanding heads are contracted the members of the two movable series project beyond the inner ends of the central members. When, however, these heads are thrust inwardly, the ends of the laterally movable members first meet and as the supports continue to approach each other, the sets of intermediate members of the two heads mutually force each other outwardly on their linked connections and the outer die members slide with relation to the intermediate members and separate to accommodate the outward movement of the latter. When the expansion has been completed the supporting members are in contact at their ends or substantially so, and both the members 21 and 22 are in contact with the inner surface of the barrel blank, the intermediate member, however, engaging it only along comparatively narrow strips.

For the practice of my method the expanding sections or members 21 and 22 are so shaped or tapered longitudinally that the first expanding action will cause the extreme inner ends of the die members to initially engage the interior of the barrel blank A midway of its length and to then apply the pressure progressively outwardly toward opposite ends. Consequently the first action upon the barrel blank is a gripping thereof at its central portion so that it is firmly and positively centered with respect to the die and the subsequent action is the application of further pressure at such central portion and of pressure applied progressively and outwardly toward the opposite ends with the result that the barrels are perfectly and uniformly formed and are undistorted. Moreover, the blank is expanded to proper barrel form in a uniform manner and without regard to any difference in the strength of steel in the cylinder at different points thereof.

As hereinbefore stated any suitable means may be employed for driving the screws 16. In the present instance these screws are driven from a power shaft 25 having at its opposite ends pinions 26 which in turn mesh with large gear wheels 27 which are suitably journaled on the end frames and centrally threaded to receive the screws 16. The driving shaft is provided with oppositely rotating pulleys 28 and 29 one or the other of which is placed in action by means of the clutch 30 controlled by the shifter rod 31. As herein shown and in practice I prefer to employ an automatic device for shifting the clutch when the expander heads reach their extreme positions, but as this automatic mechanism is immaterial to my method, the same need not be herein described.

In Figs. 6, 7, and 8 I have illustrated another apparatus capable of practising my method or process. As shown, this apparatus or machine is provided with end frames or standards 32 rigidly connected by tie rods 33. A main shaft 34 is journaled at its ends in said standards and provided near its ends with two similar cam drums 35 which are adapted to operate two plungers 36 and cause them to be moved toward and away from each other. Each plunger intermediate its length is provided with cam rollers 37 and 38, against which bears

the rib portion 35ª of a cam drum, such drum being so formed that in one rotation the plunger will make a full cycle of reciprocation. These plungers are adapted to reciprocate in the main frame or bed 39 of the machine, a portion of which is cut away at 39ª in order to provide a space for the barrel blank holders and the expanding mechanism. Each plunger at its inner end carries an expanding head comprising a central support 40 secured to the inner end of its plunger and provided with the series of die members 41 of the same character and construction as those illustrated in the machine hereinbefore described, these die members being pivotally connected to the central support by means of links 42 similar to the links of the other described construction, but here shown as of a lesser number. Likewise, the die members are decreased in cross-section from their outer to their inner ends, for the same reason as in the case of the die members of the other machine. Surrounding each expanding head, when in collapsed or retracted position, is a work holder 43 which is in the general form of a hollow cylinder with an outer socketed portion 43ª adapted to receive its end of the barrel blank A. The other or inner end of the holder has an inwardly directed annular flange 43ᵇ which fits upon its plunger 36 and coöperates with and engages an annular flange 40ª at the inner end or base of the plunger 40. The work holders are normally held pressed toward each other and against the ends of the barrel blank with a yielding pressure in suitable manner, as by means of the coil springs 44 which bear at the outer ends against the inner ends of such holders until the said flanges are in contact, as shown in Fig. 6. By the construction and arrangement described, the plungers in their extreme outward movements will slightly retract the work holders and permit the disengagement of the latter from the work. The machine operates the same as the one hereinbefore described, it being particularly noted that the expanding heads just after coming together, as in Fig. 8, initially engage the barrel blank at its middle portion and then progressively exert pressure from such middle portion toward both ends, until the blank is formed into the shape of a bilged barrel, as shown in Fig. 7. After the blank has been inserted between the work holders it is held in that position by the springs 44, and even until after it has been acted upon by the expanding heads. It will be understood that these holders apply pressure to the ends of the barrel blank and keep pressing against such ends in the contracting movement of the latter incident to the formation of the bilged barrel body from such blank. In the return movement of the plungers the work holders will be slightly retracted against the tension of their springs, thereby permitting the product to be removed from the machine.

The shaft 34 may be operated by any suitable driving connections, as, for instance, through the medium of the gears 45 on said shaft, pinions 46 on driving shaft 47 having a drive gear 48 driven in any suitable manner and adapted to be operatively connected with the drive shaft 47 by any suitable form of clutch, such as that indicated at 49, such clutch being provided with a shifting handle 50.

I claim:

1. The method of forming bilged metal barrel bodies which consist in applying pressure to the interior of a blank, such pressure being applied initially substantially midway of its length to grip and hold the blank.

2. The method of forming bilged metal barrel bodies which consists in applying to the interior of a blank outward pressure initially substantially midway of its length to grip and hold it and then progressively outwardly toward opposite ends.

3. The method of forming bilged metal barrel bodies which consists in applying to the interior of a blank outward pressure initially substantially midway of its length to grip and hold it and then progressively outwardly toward opposite ends, and applying pressure to the ends of the blank which contract during the formation of the bilge.

4. The method of forming bilged metal-barrel bodies which consists in applying to the interior of a cylindrical blank beginning midway of its length and working progressively to both ends the pressure of an internal expanding die.

5. The method of forming bilged metal-barrel bodies which consists in initially gripping the interior of a cylindrical blank midway of its length by means of an internally applied expanding die and expanding the blank by pressure applied by such die progressively from the middle portion outwardly to the opposite ends.

6. The method of forming bilged metal-barrel bodies which consists in introducing a cylindrical blank into a die having an interior form corresponding with the desired bilge of the barrel body and then forcing the blank to the form of said die by pressure applied initially to the central portion of the blank and then progressively outwardly toward opposite ends.

7. The method of forming bilged metal barrel bodies which consists in introducing a cylindrical metal blank into a die having an interior form corresponding with the desired bilge of the barrel body and applying to the interior of the blank beginning midway of its length and working progressively

to both ends the pressure caused by two meeting expandible dies.

8. The method of forming bilged metal barrel bodies which consists in initially gripping the interior of a cylindrical blank substantially midway of its length and expanding the blank by pressure applied progressively from the middle portions outwardly to the opposite ends.

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