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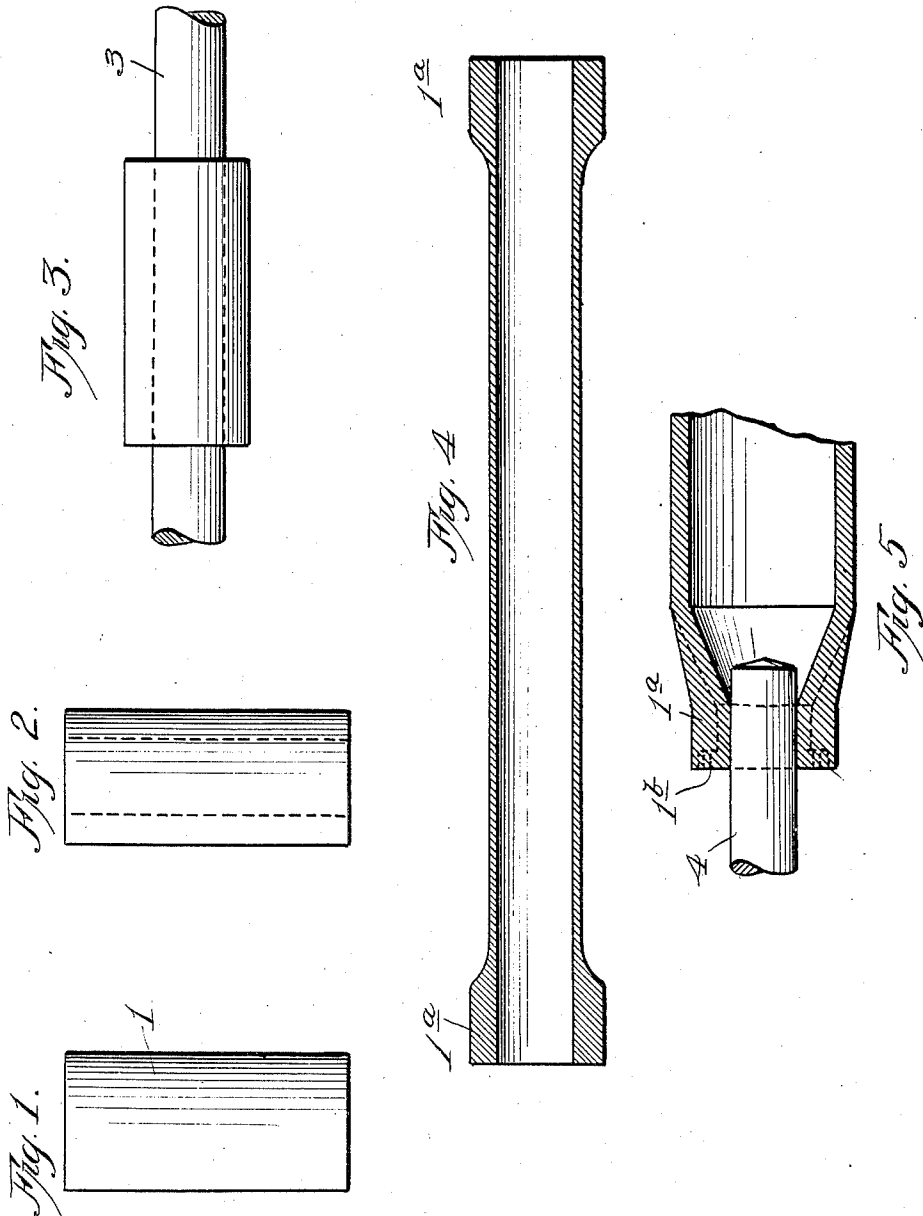
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W. M. CROSS

PROCESS OF MAKING FORGED CHAMBERS

Original Filed Oct. 31, 1923

2 Sheets-Sheet 1



Witness:

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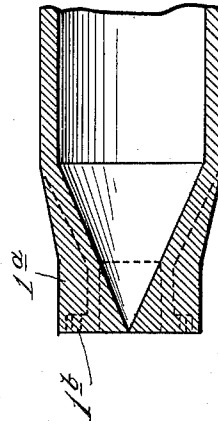
Fig. 6.



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Fig. 7.



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UNITED STATES PATENT OFFICE.

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PROCESS OF MAKING FORGED CHAMBERS.

Original application filed October 31, 1923, Serial No. 672,019. Divided and this application filed August 15, 1924. Serial No. 732,320.

This invention relates to improvements in forged chambers or retorts and refers more particularly to receptacles preferably made of forged steel and adapted to withstand excessive heat and pressure.

This application is a divisional of a previous application, Serial No. 672,019, filed October 31, 1923.

Among the salient objects of the invention are, to provide retorts or chambers which are forged from steel, preferably having a sulphur content less than .2 of 1%; to provide enlarged chambers particularly for the use in the destructive or pressure distillation of hydrocarbon oils wherein the retorts will be subjected to excessive temperatures and pressures for considerable periods of time and to excessive ranges of temperature consisting in excessive heat during the treatment of the oil and the subsequent cooling when cleaning the apparatus; to provide retorts or chambers having a relatively uniform texture and the same co-efficient of contraction and expansion throughout, which are important factors where the temperature ranges and pressures are excessive; to provide a process for making the above described chambers, and, in general, to provide a process hereinafter more fully explained.

In the drawings:

Fig. 1 is a side elevational view of an ingot from which a chamber is made.

Fig. 2 shows an ingot drilled to receive a mandrel.

Fig. 3 shows the ingot mounted on the mandrel.

Fig. 4 is a sectional view showing the method of forging leaving the enlarged end portions.

Fig. 5 is an enlarged sectional detail showing the method of working down the enlarged end portions.

Fig. 6 is a side view of the finished retort shown with heads bolted in place.

Fig. 7 is a fragmentary sectional detail showing an alternate method of forming the ends of the chamber.

Referring in detail to the drawings, and in connection therewith describing the method of forging the chambers, an ingot such as that shown at 1 is first drilled longitudinally as shown at 2 in Fig. 2. The ingot is then mounted upon a forging mandrel 3 where it

is continuously rotated and forged by suitable forging means not shown. The mechanism utilized in the forging of the ingot is preferably a forged press in which the mandrel is continuously or intermittently rotated during the forging operation which is effected by steam hammer or other suitable means. In the forging operation the ingot is drawn out to the desired length and wall thickness such as shown in Fig. 4, the enlarged end portions 1^a remaining with an excess of stock which is subsequently swedged down onto a smaller mandrel inserted in the ends of the chamber such as shown in Fig. 5 and 4. These enlarged end portions are then machined away, forming the flanges 1^b and constricted portions just behind the flange the size of the smaller mandrel 4 upon which they are forged.

After the enlarged end portions are forged onto the smaller mandrel, the excess material, or that portion of the chamber comprising the enlarged end portions, as shown in 1^a in Fig. 5, is machined away resulting in a chamber shown in Fig. 6 with an enlarged central chamber and constricted portions between the enlarged chamber portion and the end flanges. The flanges are drilled for bolts which serve to hold on the end plates or heads 6.

If desired, the chambers may be machined both internally and externally to expose any defects or weaknesses in the steel and to remove hammer marks. This machining operation, however, may be dispensed with if desired and the chambers used after removing the scale and machining only the end flanges which receive plates or heads 6.

The chambers referred to in this invention, comprising principally such retorts larger than 10 feet in length and with corresponding diameter, it is a well-known fact that relatively small chambers have been forged to withstand excessive pressures, but heretofore these chambers or retorts have been all relatively small size for confining gases which are to be transported, or for treating gases or liquids at high temperatures and pressures in various types of processes.

In the treating of hydrocarbon oils where the oil is to be subjected to excessive pressures and temperatures and to undergo treatment for considerable periods of time after which

it is necessary to shut down, cool and clean the process and resume or continue the oil treatment, it is essential that the apparatus be such to withstand these excessive ranges of temperature and pressure without excessive deterioration.

Where it is necessary to use apparatus having welded joints, the difference in texture of the metal and the difference in the coefficient of expansion and contraction produces difficulties, as the relatively rapid changes in temperatures and pressure soon weaken the metal and disastrous explosions often-times result.

Where, however, the apparatus is constructed of tubes and chambers with forged connections, and the chambers forged as hereinbefore explained, the uniformity of the material and the strength of the tubes, the forged steel retorts and forged connections permits the operating of the process under pressure and temperature conditions which could not be withstood by welded apparatus.

The steel used in making these ingots is preferably low in sulphur and suitable for forging, preferably having a sulphur content of less than .2 of 1%. The steel or cast ingots are cylindrical in form, the length and diameter governing the length of the chamber to be made and the thickness of the walls desired. A further governing factor of the wall thickness is the diameter of the hole which is bored longitudinally of the ingot. Prior to the treating operation, the ingot is annealed to rid the steel of cracks and prepare it for subsequent forging. Any surface cracks are chipped out subsequently to the annealing operation. After the ingot is treated, it is mounted upon a forging press mandrel and is forged into the final wall thickness and drawn to the length desired. During the forging operation the mandrel is rotated while being forged, so that the wall thickness is kept approximately the same throughout the chamber. In forging, the cylinder is left with the thickened or up-set end portions. During the forging operation, normally the length of the chamber will be increased from two and one-half to three times with a corresponding diminished thickness of the walls. At this stage in the process, the inside of the chamber may be machined in order to find defects and remove the scale therefrom.

The enlarged ends are then successively inserted in smaller mandrels and the thickened portions swedged down on to the mandrel, producing a constricted opening in the ends of the chambers. In forging chambers for use in converting oils under pressure ranging from 500 to 1,000 pounds and temperature from 500° to 900° F., a forged chamber 42 feet in length, 40 inches in diameter near its central portion and swedged to 16 inches at the end, have been made. The swedging operation is performed on both the en-

larged end portions and excess material machined away, leaving a bottled neck flanged end for end plates or heads which are bolted thereto.

In place of the flange ends, any suitable method of closing the ends of the chamber may be used, such, as a hinged door, fastened by a toggle arrangement, or otherwise.

In forging the enlarged end portions to form the constricted bottled neck construction, it is usually necessary to reheat the ends of the chamber during the swedging operation, also during the swedging of the enlarged end portions the chamber is rotated in order that the constricted end openings will be uniformly forged onto the smaller mandrel.

The chambers or retorts may be subsequently drilled and tapped or connections made therewith in order to introduce and withdraw fluids to be treated in the chamber. These connections may be made directly into the external wall or through the enclosing heads or plates affixed to the end flanges.

In Fig. 7 is shown an alternate method of forming the bottle shaped ends of the retort, instead of swedging the enlarged ends onto a smaller mandrel 4 as shown in Fig. 5. The ends which have an excess of metal, as shown in 1^a, Fig. 4, are forged or swedged together in the manner shown in Fig. 7 and are then bored and machined, as shown in the dotted lines in Fig. 7, to produce the flanged bottled neck shape.

I claim as my invention:

1. A method of making forged receptacles adapted to withstand excessive temperatures and pressures, consisting in annealing and drilling an ingot longitudinally, simultaneously rotating and forging the ingot on a mandrel to a predetermined length, diameter and leaving end portions having a greater wall thickness, forging the ends on a mandrel of smaller diameter to produce constricted openings and bottled neck shaped ends.

2. A method of making forged receptacles adapted to be subjected to high heat and pressure comprising the steps of annealing and drilling an ingot longitudinally, simultaneously rotating and forging the ingot on a mandrel to a predetermined length, diameter and leaving end portions having a greater wall thickness, machining connections from the thickened end portions.

3. A method of making forged receptacles adapted to be subjected to high heat and pressure comprising the steps of annealing and drilling an ingot longitudinally, simultaneously rotating and forging the ingot on a mandrel to a predetermined length, diameter, and leaving end portions having a greater wall thickness, machine flanged connections from the thickened end portions and integral with the ingot.

4. A method of making forged chambers,

consisting in annealing an ingot of steel of low sulphur content and drilling it longitudinally, mounting the drilled ingot on a mandrel rotating it and forging it in a forging press to a predetermined length, diameter and wall thickness with thickened end portions, swedging the thickened ends onto a mandrel of smaller diameter and machining the end portions to a bottled neck shape with flanged extremities for receiving enclosure plates.

5. A method of making forged chambers which are subjected to great pressures and high temperatures, consisting in annealing an ingot of steel of low sulphur content and drilling it longitudinally, mounting the drilled ingot on a mandrel, rotating it and forging it in a forging press to a predetermined length, diameter and wall thickness with thickened end portions, constricting the end diameter of the thickened ends onto a mandrel of smaller diameter and machining the chamber internally and externally and the swedged ends to a bottled neck shape with flanges for receiving enclosing heads, connections for introducing and withdrawing fluids.

6. A method of making forged receptacles adapted to be heated to temperatures in excess of 500° F. and subjected to pressures of 30 atmospheres comprising the steps of annealing and drilling an ingot longitudinally, simultaneously rotating and forging the ingot on a mandrel to a predetermined length, diameter, and leaving end portions having a greater wall thickness, forging the ends closed, machining end connections and drilling end holes of lesser diameter than the finished diameter of the ingot.

7. A method of making forged receptacles adapted to be heated to temperatures in excess of 500° F and subjected to pressures of 30 atmospheres comprising the steps of annealing and drilling an ingot longitudinally, simultaneously rotating and forging the ingot on a mandrel to a predetermined length, diameter, and leaving end portions having a greater wall thickness, forging the ends closed, machining flanged end connections and drilling end holes of lesser diameter than the finished diameter of the ingot.

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