No. 704,693. Patented July 15, 1902.

E. CHURCHILL, JR. & H. A. HALL.

REFINING ENGINE.

(Application filed Mar. 17, 1902.)

(No Model.) 2 Sheets—Sheet 1.

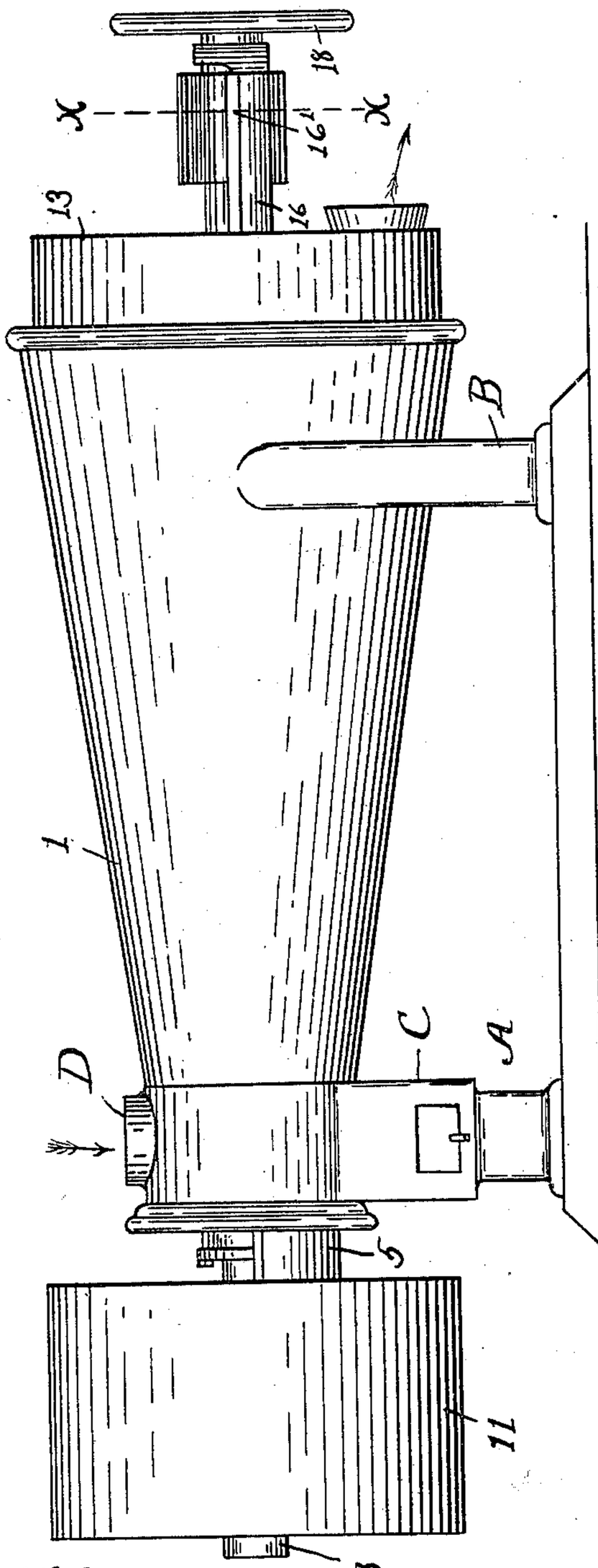

Fig. 1.

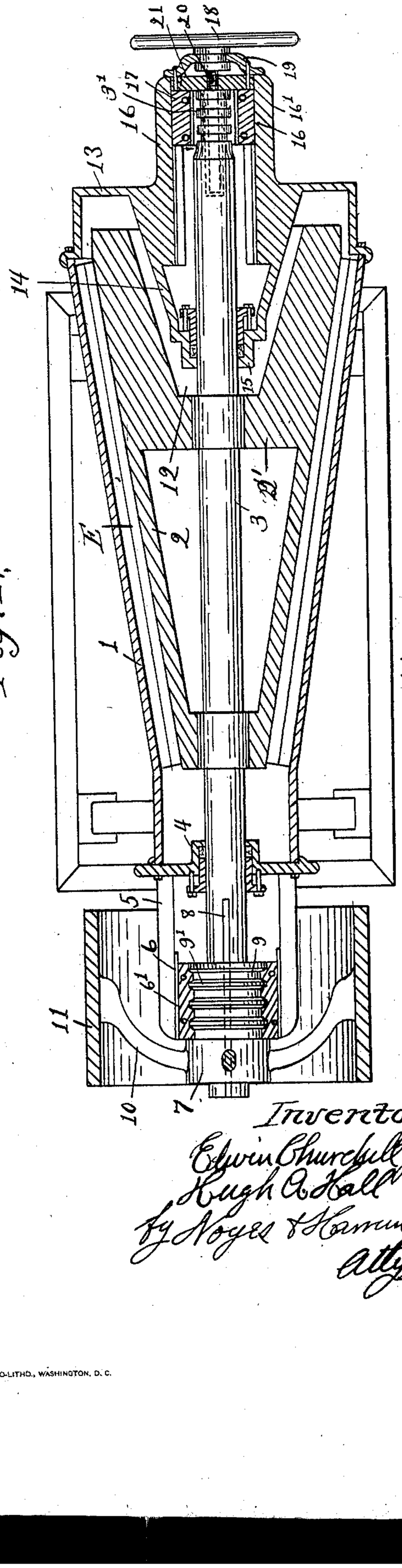

Fig. 2.

Witnesses:
H. B. Davis
J. L. Hutchinson.

Inventors.
Edwin Churchill Jr.
Hugh A. Hall
by Noyes & Hamman
Attys.

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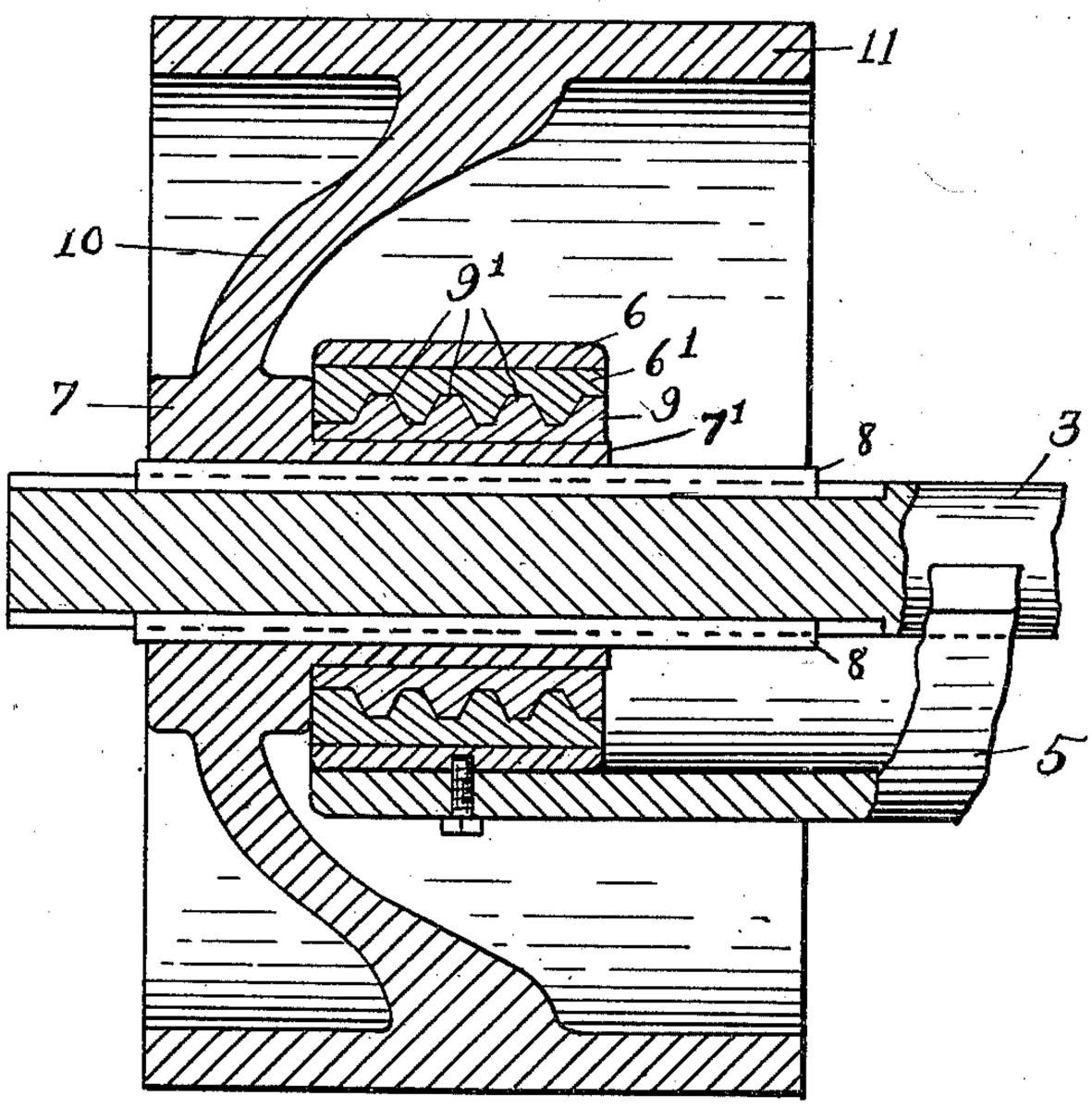
Fig. 3.



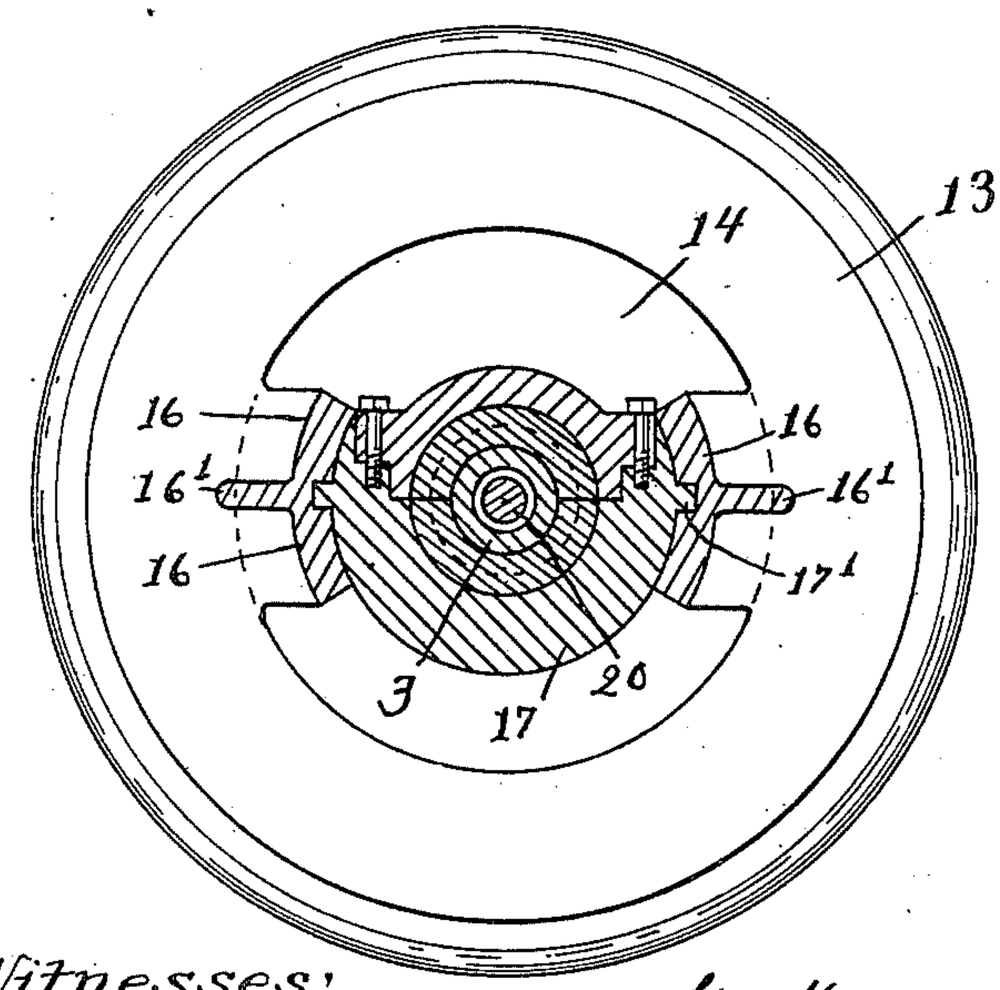
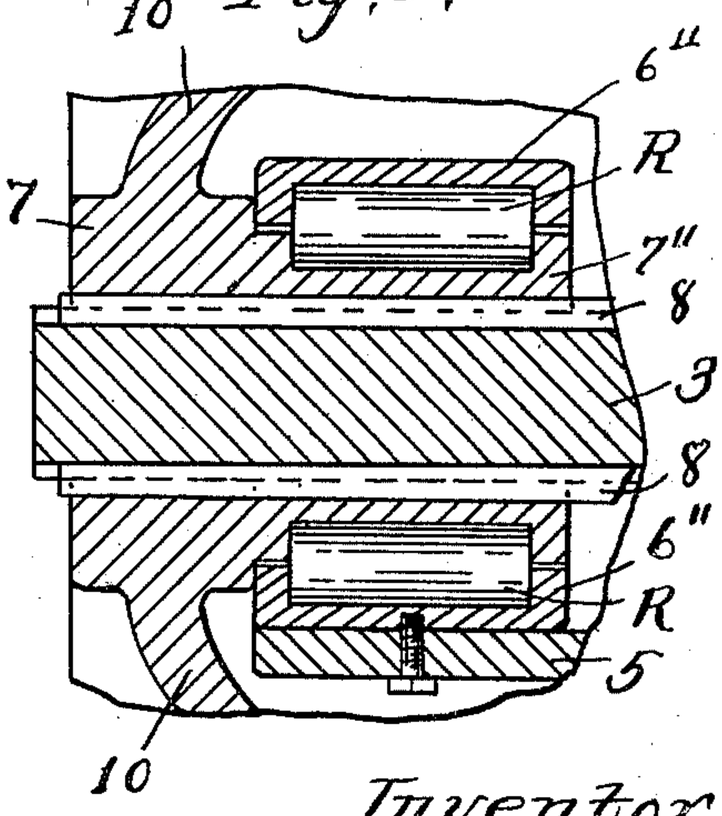


Fig. 4.

Fig. 5.



Witnesses:
H. B. Davis.
J. L. Hutchinson.

Inventors:
Edwin Churchill Jr.
Hugh A. Hall
by Noyes & Hamilton
Attys.

UNITED STATES PATENT OFFICE.

EDWIN CHURCHILL, JR., AND HUGH A. HALL, OF LAWRENCE, MASSACHUSETTS.

REFINING-ENGINE.

SPECIFICATION forming part of Letters Patent No. 704,693, dated July 15, 1902.

Application filed March 17, 1902. Serial No. 98,559. (No model.)

To all whom it may concern:

Be it known that we, EDWIN CHURCHILL, Jr., and HUGH A. HALL, of Lawrence, county of Essex, and State of Massachusetts, have invented an Improvement in Refining-Engines, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention relates to that class of pulp-refining machines which are generally known as "Jordan engines."

Prior to our invention the driving-pulley for the shaft of the plug has generally been arranged on the shaft between two fixed journal-bearings, the standards or supports of said bearings extending down to a common base, upon which the main part of the machine is also supported. It has also been customary to provide a sliding connection between the driving-shaft and the pulley, so that the shaft can be moved longitudinally in order to move the plug up closer to the casing when the blades have become shortened by wear, the pulley being held from lateral movement by the adjacent journal-boxes. This construction and arrangement is open to various objections, the principal of which are as follows: It is very difficult to keep the two bearings precisely in alinement on account of the strain which is placed upon the shaft by the plug as it grinds the stock, there being a strong tendency to force the shaft to an oblique position, which in turn tends to force the bearings out of alinement. It also often happens that the driving-belt for the pulley must be carried up through the floor below, and this necessitates the cutting of the base, which, aside from often being difficult to accomplish, weakens it, so that the bearings may be more easily thrown out of line. This construction also occupies considerable floor-space, which is often very valuable.

The objects of our invention are to obviate the difficulties above noted and to produce a machine of the above-named character in which the pulley is held from lateral movement when the shaft is adjusted and which is much shorter than engines of this character now in use. We accomplish this object by providing a combined thrust and journal bearing at the small end of the shell, which is secured to a solid casting, the latter being in turn bolted to the end of the shell, and by splining the driving-pulley onto the shaft and journaling the pulley in said bearing so that it is held from lateral movement. We further provide a construction of pulley which causes the driving force which is applied to the face of the pulley to be applied directly opposite the bearing, so that there will be practically no tendency to cause the shaft to run unevenly, and thus throw the grinding-plug out of the central position which it should constantly assume in order to grind the pulp evenly. We not only shorten the engine by omitting the second bearing for the pulley, but we further shorten it by providing a chamber in the large end of the shell, which extends into the adjacent end of the plug and provides a space within the shell into which the adjustable bearing of the engine may be moved when the plug needs readjustment.

For a more complete understanding of our invention reference is made to the accompanying drawings, in which—

Figure 1 is a side elevation showing a Jordan engine constructed according to our invention. Fig. 2 is a horizontal cross-section thereof. Fig. 3 is a vertical central cross-section of the pulley and shaft on an enlarged scale. Fig. 4 is an enlarged cross-section on line $x\,x$ of Fig. 1. Fig. 5 illustrates a modification.

As shown in the drawings, the shell 1 is supported at each end by standards A and B, the standards A extending from the under side of a sand-box C, which is directly below the inlet-pipe D. The shell is provided with the usual conical grinding-plug 2, said shell and plug having the usual coacting knives E. A shaft 3 passes through said casing and has the plug firmly secured thereto. A stuffing-box 4 is arranged in the small end of said shell, and the shaft 3 passes therethrough. A semicylindrical support 5 is bolted to the small end of the shell, and a journal-box 6 is secured in the outer end thereof. The hub 7 of a pulley is splined onto the shaft 3 by the feathers 8, and said hub 7 is provided with a projecting end portion 7′, which extends

through said bearing. A sleeve 9, of iron or other suitable material, is shrunk on or otherwise attached to the projecting end of said hub, so that aside from the fact that said sleeve 9 may be heated and removed when worn it is practically integral with said hub. Said sleeve 9 is provided with a series of circumferential tapering ribs 9′, which engage corresponding grooves in the Babbitt metal 6′ of the journal-box 6. The arms 10 of the pulley extend obliquely from the hub 7 and are connected to the rim 11 opposite the middle of the journal-box 6. Said arms may obviously be made in the form of a continuous web. With this construction the shaft will be free to slide within the pulley to permit adjustment of the grinding-plug; but the pulley cannot move laterally with respect to the journal, it being held from such movement by the ribs 9′.

Any other suitable form of combined thrust and journal bearing or bearing in which the pulley may be journaled and which is adapted to hold the pulley from lateral movement may be substituted for that above described—as, for instance, the form of roller-bearing shown in Fig. 5, in which the projecting portion 7″ of the pulley-hub is provided with a single groove or chamber, in which a series of rolls R are located, the journal-box 6″ being also provided with a corresponding groove or chamber to receive the rolls, so that said rolls are located partly in the hub and partly in the bearing, and thus hold the pulley from lateral movement. We prefer the tapered rib-bearing, however, as the conical sides thereof tend to hold the plug in or direct it to the central position with respect to the shell.

The arms of the pulley extend obliquely to such a position that the center of the rim of the pulley comes about midway of the journal 6, so that the pull of the belt on the pulley will be brought against the journal evenly throughout its length and there will be less tendency to twist the pulley to an oblique position than if its rim were at one side of the journal. This arrangement of the pulley-face prevents the entrance of dust and other foreign substance into the bearing.

The larger end of the conical plug is provided with a conical recess 12, which extends about one-third of the distance to the small end thereof. The walls 2′ of the plug which surround this recess are preferably made solid, and a centrally-arranged annular shoulder 2″ is cast integral therewith and is tightly connected to said shaft, thereby closing the end of the recess 12. A head 13 is bolted to the end of the casing 1, tightly closing the same, and said head is provided with a frusto-conical portion 14, which extends into the recess 12 of the plug and is provided with a stuffing-box 15 at its inner end, through which shaft 3 passes. The head 13 is also provided with segmental-shaped guideways 16, having strengthening-ribs 16′, in which the journal-box 17 is slidably supported and held against rotation by ribs 17′, which are located in the horizontal plane of the center of the machine, as indicated in Fig. 4. The outer surface of box 17 is cylindrical in form and is fitted closely between the curved inner faces of arms 16, said arms engaging the side of the boxes on opposite sides of the ribs 17′, so that the box 17 is firmly held in alinement. The adjacent end of the shaft 3 is journaled in the box 17 and is provided with a series of ribs 3′, which engage corresponding grooves in the babbitt 17′ of the box 17, said shaft terminating at the outer end of the box. A hand-wheel 18 is swiveled in a bridge-piece 19 at the outer end of the guideway 16 and is provided with a screw 20, which is threaded in a nut 21, the latter being bolted securely to the outer end of the journal-box 17. The adjacent end of the shaft is bored out or made hollow for a distance substantially equal to the distance which the plug will need to be adjusted toward the small end of the shell to take up wear. The diameter of this bore is greater than that of screw 20, so that the shaft may rotate freely irrespective of the screw. When it is desired to move the plug toward the small end of the casing to bring the worn blades of the casing and plug closer together, the hand-wheel 18 is turned to the left, forcing the box 17, and with it the shaft and plug, inwardly. The parts are so arranged that when the blades are worn down as far as possible the journal-box 18 will have been moved nearly to the stuffing-box 15. Any tendency which the pulp may have to collect in the chamber 12 between the walls 2′ and the inwardly-projecting head 14 will be overcome by the centrifugal force generated by the rotating plug, which will constantly act to throw the pulp up the inclined outer end walls thereof.

By supporting the bearings at each end of the shell directly from the shell itself instead of upon independent standards we are enabled to aline the bearings much more perfectly than if they were supported by independent standards, as has previously been the custom.

In the term "combined thrust and journal bearing" as used in the specification and claims we intend to include any form of bearing which will permit rotation of the part journaled and hold the same from longitudinal movement with respect to the bearing.

While we have shown a preferred form of our invention, yet various changes may be made therein without departing from its spirit.

Having described our invention, what we claim as new, and desire to secure by Letters Patent of the United States, is as follows:

1. A machine of the character described comprising a shell, a longitudinally-adjustable grinding-shaft arranged therein, a driving-pulley which is slidably connected with said shaft, but held to turn therewith, a stationary bearing within which said shaft rotates, and a swiveled connection between said

pulley and bearing for holding said pulley from axial movement in both directions, substantially as described.

2. A machine of the character described comprising a shell, a longitudinally-adjustable grinding-shaft arranged therein, a driving-pulley slidably connected thereto but held to turn therewith, a stationary bearing within which said shaft rotates, a circumferential rib on said pulley which engages a corresponding groove in said bearing and holds said hub from axial movement in both directions, substantially as described.

3. A machine of the character described comprising a shell, a longitudinally-adjustable grinding-shaft arranged therein, a driving-pulley which is slidably connected with said shaft, but held to turn therewith, a stationary bearing, an axially-projecting hub on said pulley which is journaled in said bearing and surrounds said shaft, and a circumferential rib on said hub which engages a corresponding groove in said bearing and holds said hub from axial movement in both directions, substantially as described.

4. A machine of the character described comprising a shell, a longitudinally-adjustable grinding-shaft arranged therein, a driving-pulley which is slidably connected with said shaft, but held to turn therewith, a stationary bearing within which said shaft rotates, and a swiveled connection between said pulley and bearing for holding said pulley from axial movement in both directions, said pulley having arms which extend obliquely from the hub and having its rim encircling said bearing, substantially as described.

5. A refining-engine comprising a shell, a plug therein, a shaft to which said plug is rigidly attached, a driving-pulley having its axis in alinement with the axis of said shaft, the hub of said pulley being slidably connected with said shaft, but held to turn therewith, a stationary bearing in which the hub of said pulley is journaled, said bearing being adapted to permit rotation of said pulley therein, while holding the same against lateral movement in either direction, arms which extend obliquely from said hub, a rim which is secured to the outer ends thereof and is arranged with its face opposite said bearing, and means for adjusting said shaft longitudinally, substantially as described.

6. A machine of the character described comprising a suitably-supported shell, a longitudinally-adjustable grinding-shaft partly arranged in said shell, a bearing-support rigidly connected to said shell, a bearing secured to said support and within which said shaft rotates, a driving-pulley slidably connected with said shaft but held to turn therewith, and a swiveled connection between said pulley and shell holding said pulley from axial movement in both directions, substantially as described.

7. A refining-engine comprising a shell, a plug therein, a shaft to which said plug is rigidly attached, a driving-pulley having its axis in alinement with the axis of said shaft, the hub of said pulley being slidably connected with said shaft, but held to turn therewith, a bearing portion which is rigid with said hub and projects laterally therefrom, a rigid support which extends longitudinally from one end of said shell, a bearing which is secured thereto, and in which said laterally-projecting hub portion is journaled, said bearing being adapted to prevent rotation thereof while holding the same from longitudinal movement in either direction, and means for adjusting said shaft longitudinally, substantially as described.

8. A refining-engine comprising a shell, a conical-shaped plug which is located therein, an axially-arranged shaft to which said plug is secured, said plug being provided with a recess which extends inwardly from its base end, a head which is secured to the adjacent end of said shell and extends into said plug-recess, thereby forming an external recess which extends toward the apex end of the plug, and a bearing for said shaft adjustable in said external recess, substantially as described.

9. A refining-engine comprising a shell, a conical-shaped plug which is located therein, an axially-arranged shaft to which said plug is secured, said plug being provided with a recess which extends inwardly from its base end, a head which is secured to the adjacent end of said shell and extends into said plug-recess, thereby forming an external recess which extends toward the apex end of the plug, a combined thrust and journal bearing in which said shaft is journaled, said bearing being adapted and arranged to be adjusted and held in said external recess, and means for moving said bearing toward the shell, substantially as described.

10. A machine of the character described comprising a longitudinally-adjustable grinding-shaft having an axial bore in one end, an adjustable thrust-bearing in which the bored end of said shaft is journaled, and an adjusting-screw for said bearing which is partly arranged in the bore of said shaft, substantially as described.

11. A refining-engine comprising a shell, a grinding means, and a shaft for operating the same, means for adjusting said shaft longitudinally, comprising an adjustable combined thrust and journal bearing in which one end of said shaft is journaled, a swiveled adjusting-screw, a threaded connection between said bearing and screw, the journaled end portion of said shaft being axially bored and said adjusting-screw being partly located therein, the diameter of said bore being sufficient to permit said shaft to rotate independently of said screw, substantially as described.

12. A refining-engine comprising a shell, a conical-shaped plug which is located therein, an axially-arranged shaft to which said plug

is secured, said plug being provided with a recess which extends inwardly from its base end, a head which is secured to the adjacent end of said shell, and extends inwardly into said recess thereby forming an external recess which extends toward the apex end of the plug, a longitudinally-extending bearing-support which is rigidly secured to said head and is provided with guideways which extend into said recess, a combined thrust and journal bearing which is slidably supported in said ways, and in which said shaft is journaled and held from longitudinal movement, means for adjusting said bearing within said external recess, and for holding it in its adjusted positions, substantially as described.

13. A refining-engine comprising a shell, a conical-shaped plug which is located therein, an axially-arranged shaft to which it is secured, said plug being provided with a conical-shaped recess which extends inwardly from its base end, a head which is secured to the adjacent end of said shell and is provided with a hollow frusto-conical portion which is located in said recess, a stuffing-box in the apex end of said frusto-conical portion through which said shaft passes, a combined thrust and journal bearing which is adapted and arranged to be adjustably supported within said frusto-conical portion, said shaft being journaled in said bearing, and means for holding said bearing in its adjusted positions, substantially as described.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

EDWIN CHURCHILL, JR.
HUGH A. HALL.

Witnesses:
LOUIS H. HARRIMAN,
J. L. HUTCHINSON.