

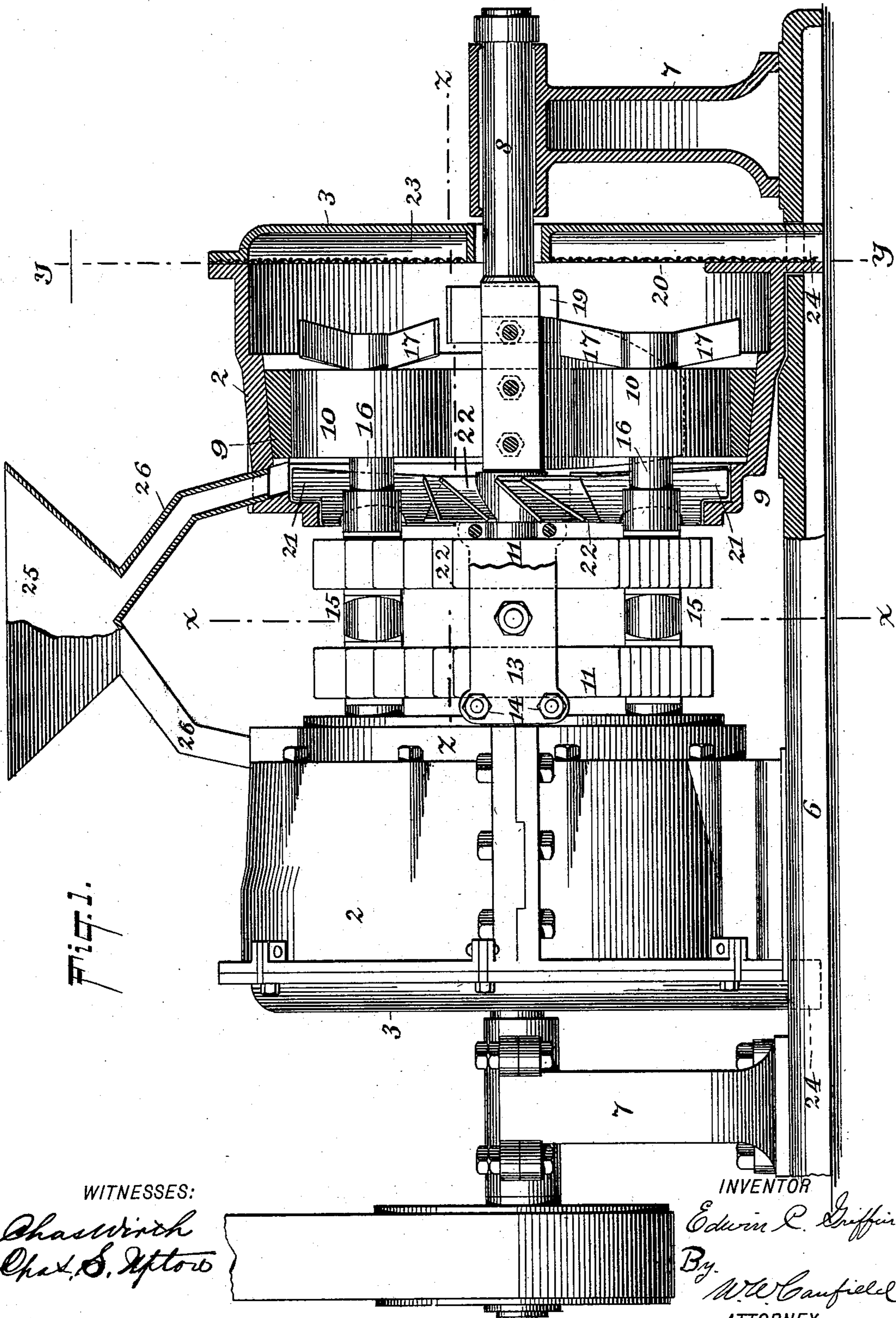
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3 Sheets—Sheet 1.

E. C. GRIFFIN.  
PULVERIZING MILL.

No. 507,432.

Patented Oct. 24, 1893.



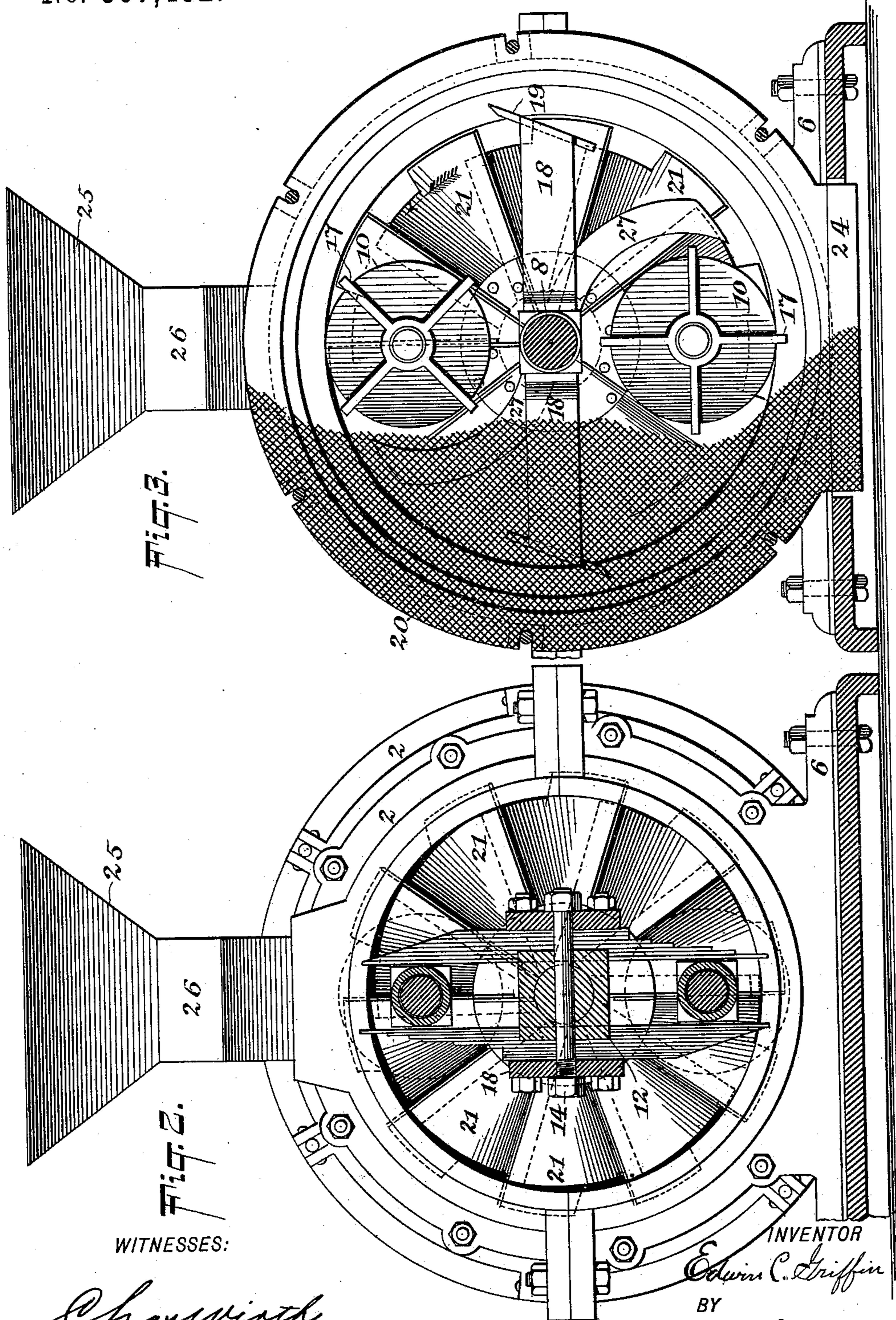
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WITNESSES:

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BY

*W. W. Canfield*

ATTORNEY.

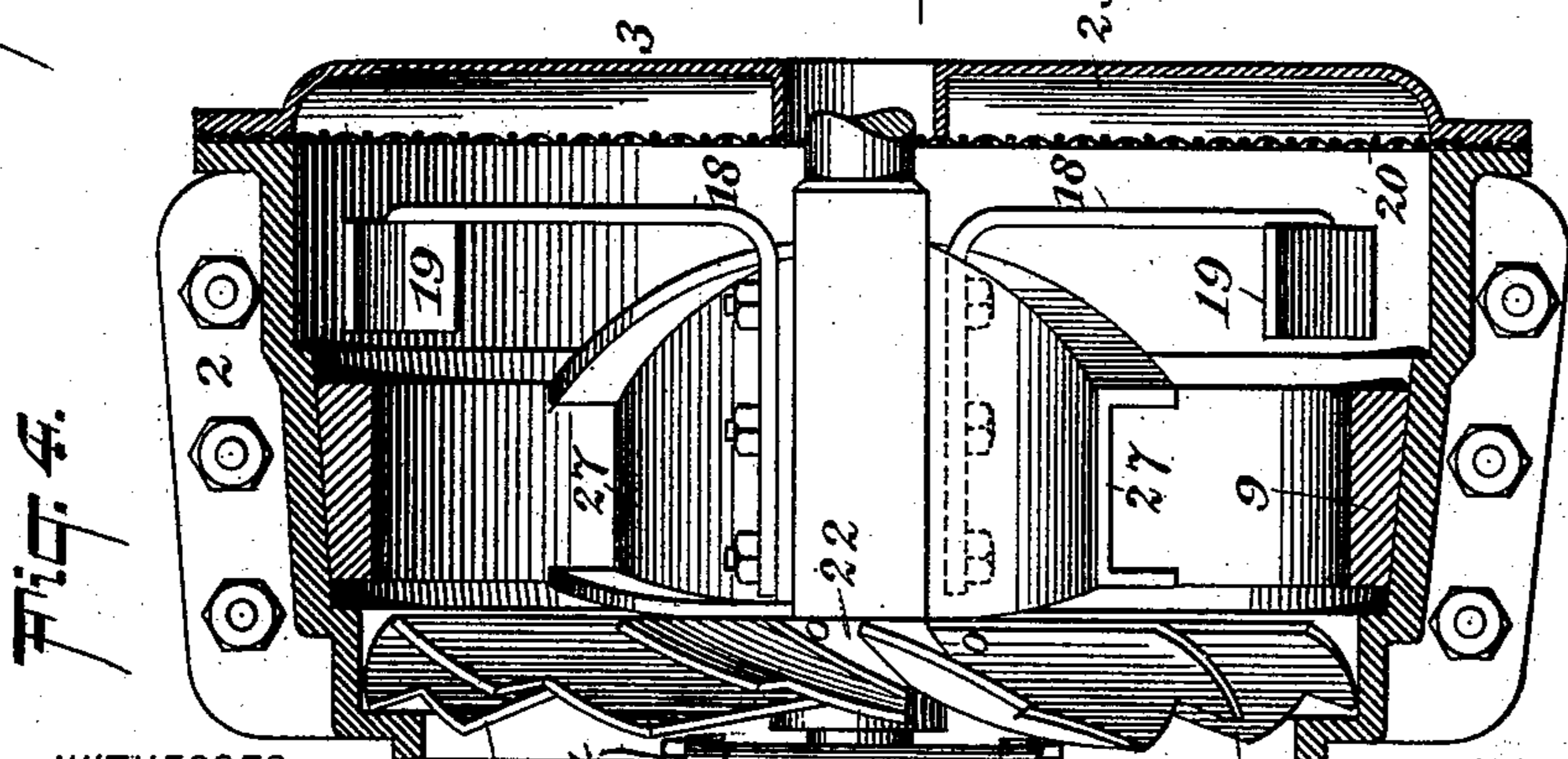
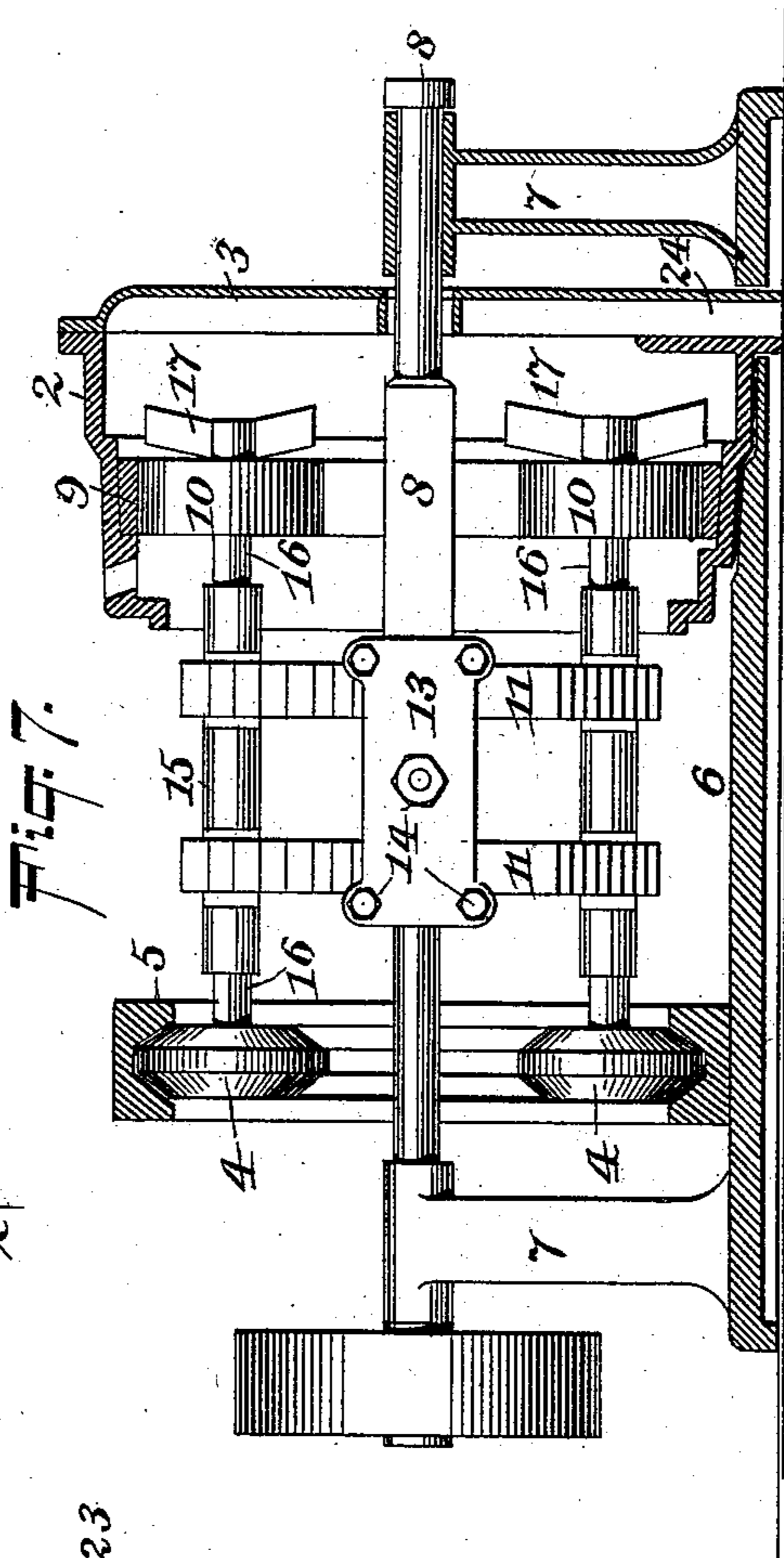
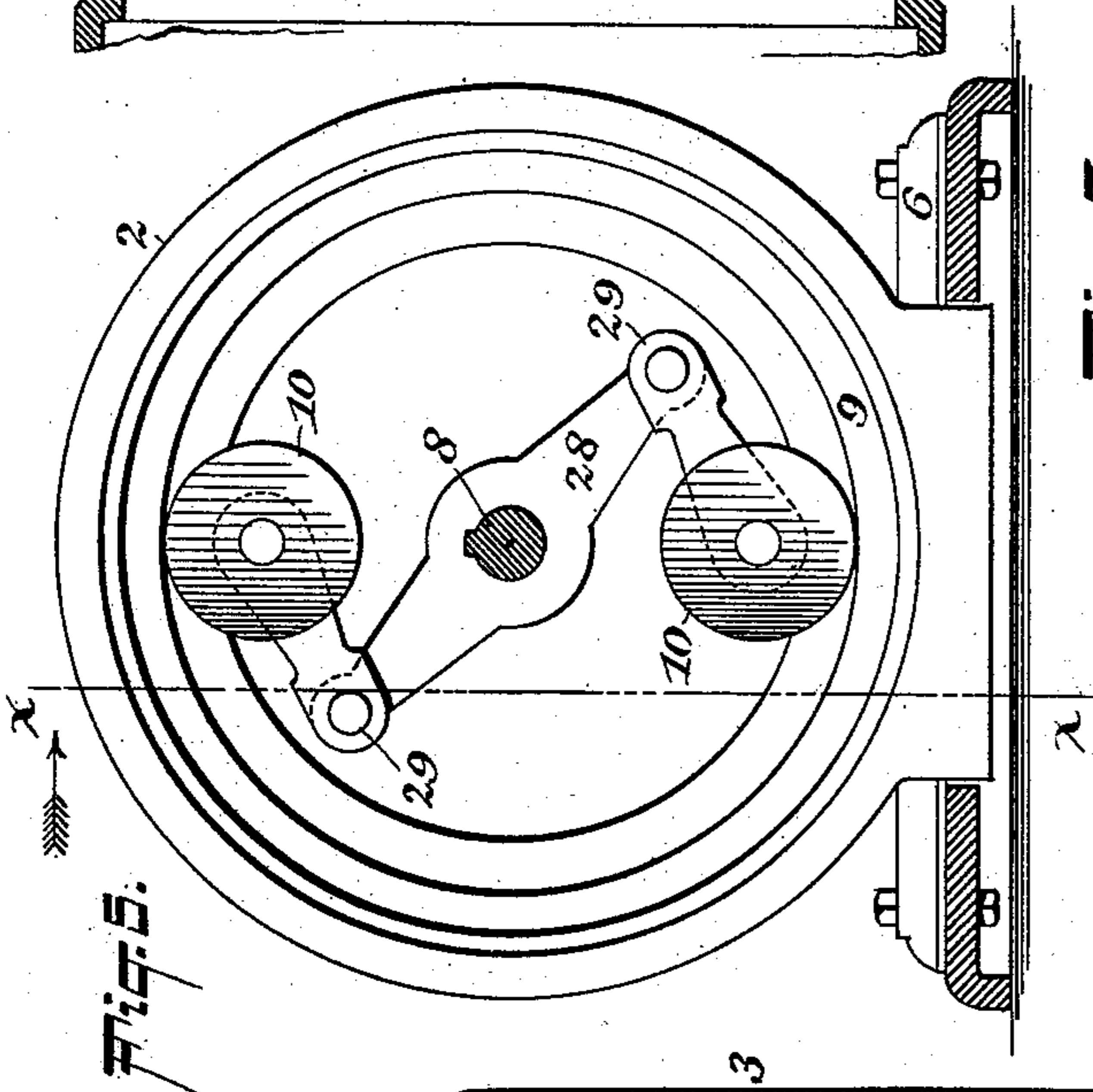
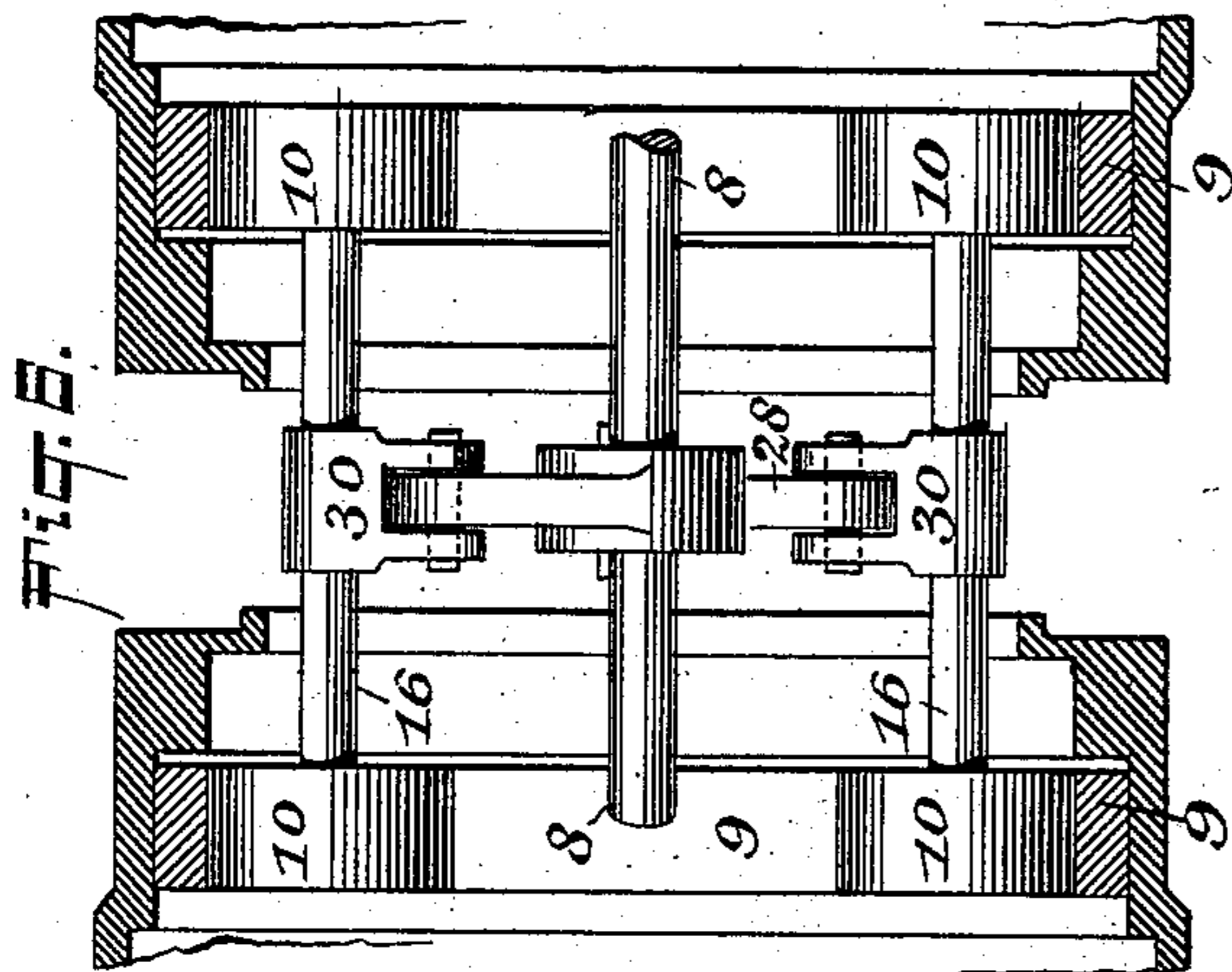
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WITNESSES:

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# UNITED STATES PATENT OFFICE.

EDWIN COLVER GRIFFIN, OF NEWTON, MASSACHUSETTS.

## PULVERIZING-MILL.

SPECIFICATION forming part of Letters Patent No. 507,432, dated October 24, 1893.

Application filed December 12, 1892. Serial No. 454,941. (No model.)

*To all whom it may concern:*

Be it known that I, EDWIN COLVER GRIFFIN, a citizen of the Dominion of Canada, and a resident of Newton, in the county of Middlesex and State of Massachusetts, have invented new and useful Improvements in Pulverizing-Mills, of which the following, taken in connection with the accompanying drawings, is a specification.

My invention relates to that class of pulverizing mills in which the reduction or pulverization of ores and other substances is accomplished by the revolution of rolls within and against the inner surface of a ring or die, the rolls being held against the surface of the die by centrifugal force; and among the several objects sought to be accomplished by this invention, are, to provide a more satisfactory and economical method of driving the rolls, than has heretofore been devised, thereby saving power, preventing wear and securing economy of operation; to provide arrangements for controlling the material to be operated upon, so that its reduction may be accomplished in the best, most rapid, thorough and economical manner; to provide for the delivery of the finished product from the mill as fast as it is ground so that the operation of the reduction of the material may not be retarded by the presence within the grinding chamber of the material already pulverized, and to provide a mill that shall be perfectly self-balanced, simple in construction and operation, durable and possessing a capacity far beyond that of the ordinary pulverizing mill in proportion to the power employed.

The invention is fully disclosed in the following specification of which the accompanying drawings form a part wherein similar numerals of reference designate like or equivalent parts wherever found throughout the several views, and in which—

Figure 1, is a side elevation partly in section of my improvement; Fig. 2, a vertical transverse section on the line  $x, x$ , of Fig. 1; Fig. 3, a vertical transverse section on the line  $y, y$ , of Fig. 1, with parts broken away; Fig. 4, a partial central longitudinal horizontal section on the line  $z, z$ , Fig. 2. Fig. 5, represents an end view of a modified form of the construction shown in Fig. 1, a portion of the casing being removed; Fig. 6, a longitudinal

section on the line  $x, x$ , of Fig. 5, with parts of the casing broken away, and Fig. 7, a partial central vertical longitudinal section of another modification of the construction shown in Fig. 1.

Recognizing the fact that one of the weak points in mills of this class is the defective apparatus employed for driving the grinding rolls, I have especially endeavored to overcome this difficulty and exhibit in this specification a construction that removes this objection and provides an entirely satisfactory method of driving and operating the rolls.

Referring to the drawings, the reference numeral 2, designates the cases which contain the dies against which the grinding rolls revolve and which form together with the end pieces 3, the surrounding shell of the grinding chamber or chambers. These casings are preferably annular in form, and in the drawings are shown in two parts, for convenience in handling and shipment. They may, however, be formed solid or in one piece and in any form or shape desired. In this improvement two of these grinding chambers are preferably placed side by side, as shown in Fig. 1, by which a mill is produced which is simple and effective and which can be operated with the fewest possible parts and connections and which is perfectly self-balanced. In place of using two of the grinding chambers, however, a single one may be employed as shown in Fig. 7, in which case counterbalance rolls 4, of the form shown, are mounted upon one end of the roll shafts and run in contact with a guide ring 5.

The grinding chambers, or the casings thereof, are firmly secured to a base 6, as shown in any desired manner, which base may be made in any suitable form.

Extending longitudinally through the grinding chambers, with bearings in standards or supports 7, which are also secured to the base, is the driving shaft 8, to one end of which is secured a pulley to which the power to drive the mill is applied, and secured in any desired manner within the grinding chambers, preferably in the position shown in Figs. 1 and 4, are the annular dies or rings 9, against, or in contact with which the rolls 10, are revolved in the operation of pulverization.

On the main driving shaft, between the

grinding chambers, as shown in Fig. 1, are the means for carrying the shafts of the grinding rolls and by which the latter are operated, which in this construction, the form preferred consist of leaf springs 11, which give elasticity to the driving mechanism and greatly lessen the liability of breakage; these springs, however, may be made rigid and of any desired material and be securely fastened to the driving shaft. Preferably, however, these springs are firmly secured to a casing or boxing 12, which is rigidly attached to the main shaft, by means of plates 13, and bolts 14, as shown. Within the openings between the ends of these arms or springs which are arranged in pairs as shown, are placed the journal boxes 15, in which the shafts 16, which carry the rolls 10, revolve. That portion of these journal boxes 15, which come in contact with the springs or arms 11, is preferably square in cross section, and these boxes are capable of movement toward and from the driving shaft, being held in position simply by the pressure of the springs or arms 11.

Within each grinding chamber and at or near each end of the roll shafts 16, are mounted or securely fastened the grinding rolls 10, and secured to the end of the roll or rolls, are fans or vanes, or stirrers 17, which serve to agitate the material and the air within the grinding chamber and to assist in delivering the pulverized material therefrom. These fans or vanes 17, may be placed upon either or both ends of the rolls as desired, preferably upon the outer ends as shown in Fig. 1, and are of such strength as to materially aid in stirring up and agitating the material and thus assist materially in the process of pulverization.

That portion of the driving shaft within the grinding chambers, is preferably square in cross section, and connected therewith, by means of curved or angle plates or bars 18, in any desired manner, are stirrers, plows, or fans 19, shown in Figs. 1 and 4. These stirrers 19, are preferably set at any angle as shown and the object thereof is to stir, or pick up the unpulverized material that may collect in the bottom of the grinding chamber outside of the rolls and throw it back upon the die ring where it is again operated upon by the rolls. They also assist in pulverizing the material by agitation and in discharging the pulverized product from the grinding chamber.

Within the outer end of the grinding chamber or chambers is arranged a screen 20, through which the pulverized product is discharged and the size or "mesh" of which governs the degree of fineness to which material is reduced.

The inner ends of the grinding chamber or chambers, are closed by a revolving end or casing, which in the construction shown, and preferably, consists of a propeller in the form of fans or vanes 21, attached to the driving shaft by means of inclined projections or lugs 22, which are formed with, or attached to, the

shaft in any desired manner. If desired, however, a diaphragm or plate may be substituted for these fans. In either case, however, which ever is used should be rigidly attached to the driving shaft and revolve with it and openings therethrough should be provided, for the roll shafts 16, which pass through and revolve with these propeller fans or inclosing plates.

Between the screen 20, and the end casing 3, of the grinding chamber or chambers, and formed by these parts, is the receiving chamber 23, into which the pulverized product from the grinding chamber is discharged, and from which it passes into a hopper or other receptacle, not shown, beneath the mill in the usual manner, through passages 24.

In the construction shown, the material to be pulverized, after having been crushed or reduced to the desired fineness is placed in a hopper 25, from which it passes into the grinding chambers through passages or chutes 26, and is discharged upon, or in front of chutes 27, which are secured to and revolve with the driving shaft and by which the material is deposited or delivered in front of the grinding rolls to be operated upon thereby. The delivery of the material from the chutes or passages 26, upon or in front of the chutes 27, is assisted or aided by the propeller fans 21, by which the material is directed inward toward the center of the grinding chamber, and into or upon said chutes.

In the construction shown in Fig. 7, the screen, the fans or stirrers 19, the revolving inner end or propeller and chutes 27, together with other features of construction are omitted, the object in this case being only to show a method of sustaining and operating the rolls with one grinding chamber, instead of two, as hereinbefore described, and shown in Fig. 1.

In the construction shown in Figs. 5 and 6, the same parts are omitted as in Fig. 7, the object being only to show a method of connecting the grinding rolls and shafts with the main driving shaft and operating the same independent of the springs or arms 11. In this construction, the roll shafts are connected with the driving shaft by means of an arm 28, which is rigidly secured to the driving shaft in any desired manner, between the grinding chambers. To this arm are pivoted or hinged as shown at 29, journal boxes 30, through which pass and in which revolve the roll shafts 16, and in this case as in the construction hereinbefore described, it will be seen that the journal boxes and movable bearings are all between or outside of, and none of them within the grinding chambers.

In operation the material is fed into the grinding chamber from the hopper 25, and this may be automatically regulated, in any manner desired. On passing into the grinding chambers the material is received upon the revolving chutes 27, by which it is conducted to, or deposited upon the annular die

or dies 9, in front of the rapidly revolving rolls 10, by which it is reduced to a powder, or to any desired degree of fineness, after which it is discharged through the screen or screens 20, into the chamber or chambers 23, from which it passes into a receptacle or conveyor beneath the mill in the usual manner. The revolving inner end of the grinding chamber, preferably in the form of a propeller, forces a current of air through the grinding chamber and out through the screens carrying with it all the material sufficiently fine to pass therethrough, and the fans, vanes or stirrers at the ends of the rolls and also those attached to the driving shaft materially assist in this forcing the pulverized product through the screens, and also pick up the unpulverized material and throw it into the path of the rolls, or into the revolving chutes 27, which discharge it in front of the rolls by which it is again operated upon, and this process continues as long as the mill is in operation, only the pulverized product being discharged through the screens into the receiving chambers.

Among the many advantages secured by this invention, is the practical union of two mills in one, both being operated by the same mechanism and power appliances by which great capacity is secured at a minimum of structural cost and expense of operation.

It will be seen that in each form of construction shown the grinding rolls together with the shafts on which they are mounted, or to which they are secured are capable of radial movement and that when the mill is in operation, these rolls are held in contact with the dies by centrifugal force.

It is evident that many changes may be made in the construction, combination and arrangement of the various elements of the invention described herein without departing from the scope thereof, and I do not limit myself to the exact form shown, and it is also evident that a number of the elements of construction shown and described, such as the fans, vanes or stirrers attached to the rolls and roll shaft or either of them and other minor details may be omitted without destroying entirely the effectiveness of the mill.

Having fully described my invention, its construction and operation, I claim, and desire to receive by Letters Patent, the following:

1. In a pulverizing mill, the combination with a series of grinding chambers, of a series of rings or dies one of which is located in each chamber, and a series of rolls secured in pairs to shafts, operated by means of a journal bearing between the rolls in such manner that the rolls are revolved around, within and against the rings or dies, substantially as shown and described.

2. In a pulverizing mill, the combination with a series of rings or dies, of a series of rolls, secured in pairs to shafts, said shafts being provided with journal bearings between the rolls, the rolls and shafts being capable

of radial movement, and adapted to be carried around and within said ring or dies, substantially as shown and described.

3. In a pulverizing mill, the combination of an annular chamber for the reception of the material to be pulverized; an annular die located therein, the axis of which is a horizontal line; a driving shaft passing through said chamber and die, and having bearings at each end outside of the chamber; grinding rolls or pulverizers mounted on shafts connected with said driving shaft by arms as 11, and journal bearings connected therewith outside of said chamber, said rolls or pulverizers being counterbalanced and capable of radial movement and adapted to travel around said die and to be held in contact therewith by centrifugal force, substantially as shown and described.

4. In a pulverizing mill, the combination of a chamber for the reception of the material to be pulverized; an annular die located therein, the axis of which is a horizontal line; a driving shaft passing through the center of said chamber and die and having bearings at each end outside of said chamber; grinding rolls mounted upon shafts connected with said driving shaft outside of said chamber and operated by said driving shaft, said rolls being counterbalanced and capable of radial movement and adapted to travel around said die and to be held in contact therewith by centrifugal force; a separator or screens at one end of said chamber through which the pulverized material is discharged and means for feeding the material to be pulverized into the grinding chamber, substantially as shown and described.

5. In a pulverizing mill, the combination of a chamber for the reception of the material to be pulverized; an annular die located therein; a driving shaft passing through the center of said chamber and die and having bearings at each end outside of said chamber; grinding rolls or pulverizers mounted upon shafts connected with said driving shaft by means of arms 11, said rolls being counterbalanced and capable of radial movement and adapted to travel around said die and to be held in contact therewith by centrifugal force; a screen at one end of said chamber through which the pulverized material is discharged; a revolving head or casing at the other end of said chamber, and means for discharging the pulverized material through the screen, substantially as shown and described.

6. In a pulverizing mill, the combination of a chamber for the reception of the material to be pulverized; an annular die located therein, the axis of which is a horizontal line; a driving shaft passing through the center of said chamber and die and having bearings at each end outside of said chamber; pulverizers or rolls operated by said shaft and connected therewith outside of said chamber, by means of arms as 11, said rolls being counterbal-

anced and capable of radial movement and adapted to travel around said die and to be held in contact therewith by centrifugal force; a screen at one end of said chamber through  
5 which the pulverized material is discharged and a revolving head consisting of propelling fans at the other end of said chamber, substantially as shown and described.

7. In a pulverizing mill, the combination of  
10 a series of chambers for the reception of the material to be pulverized; an annular die or ring located in each of said chambers; a driving shaft passing through said chambers and said dies or rings, and having bearings out-  
15 side of said chambers; grinding rolls or pulverizers attached to shafts, which are connected with said driving shaft, by means of arms as 11, situated between said chambers, and operated thereby; said rolls being capable of  
20 radial movement and being adapted to travel around said dies; a separator or screen at one end of said chamber or chambers, and a revolving head or propeller at the other end, as and for the purposes set forth.

25 8. In a pulverizing mill, the combination of a series of chambers for the reception of the material to be pulverized; an annular die or ring located in each of said chambers; a driving shaft passing through said chambers, and  
30 said dies and having bearings outside of said chamber or chambers; grinding rolls attached

to the shafts, which are connected with said driving shaft by means of spring arms 11, and operated thereby; said rolls being capable of radial movement and adapted to travel around  
35 said dies; a screen at one end of said chamber or chambers, and means for agitating the material and discharging the pulverized product through said screen or screens, as and for the purposes set forth. 40

9. In a pulverizing mill, the combination of an annular chamber for the reception of the material to be pulverized; an annular die located therein, the axis of which is a horizontal line; a driving shaft passing through said  
45 chamber and die, and having bearings at each end outside of said chamber, said pulverizers and rolls being counterbalanced and capable of radial movement and adapted to travel around said die and to be held in contact  
50 therewith by centrifugal force; and fans or stirrers which revolve with said pulverizers or rolls, substantially as shown and described.

In testimony whereof I have signed my name to this specification, in the presence of  
55 two subscribing witnesses, on this 28th day of November, A. D. 1892.

EDWIN COLVER GRIFFIN.

Witnesses:

SAML. W. CRUCH, Jr.,  
STEPHEN GILMAN.