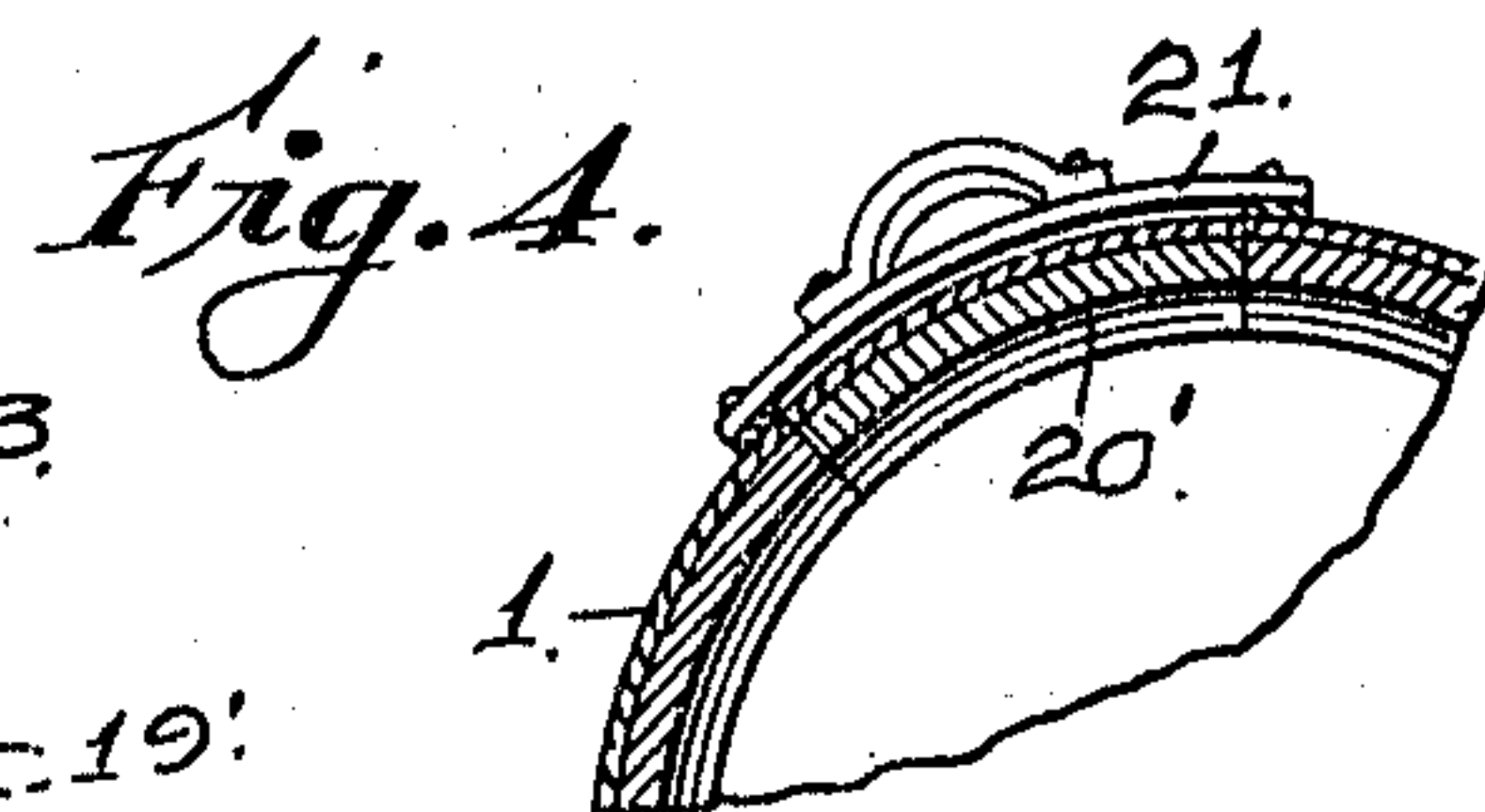
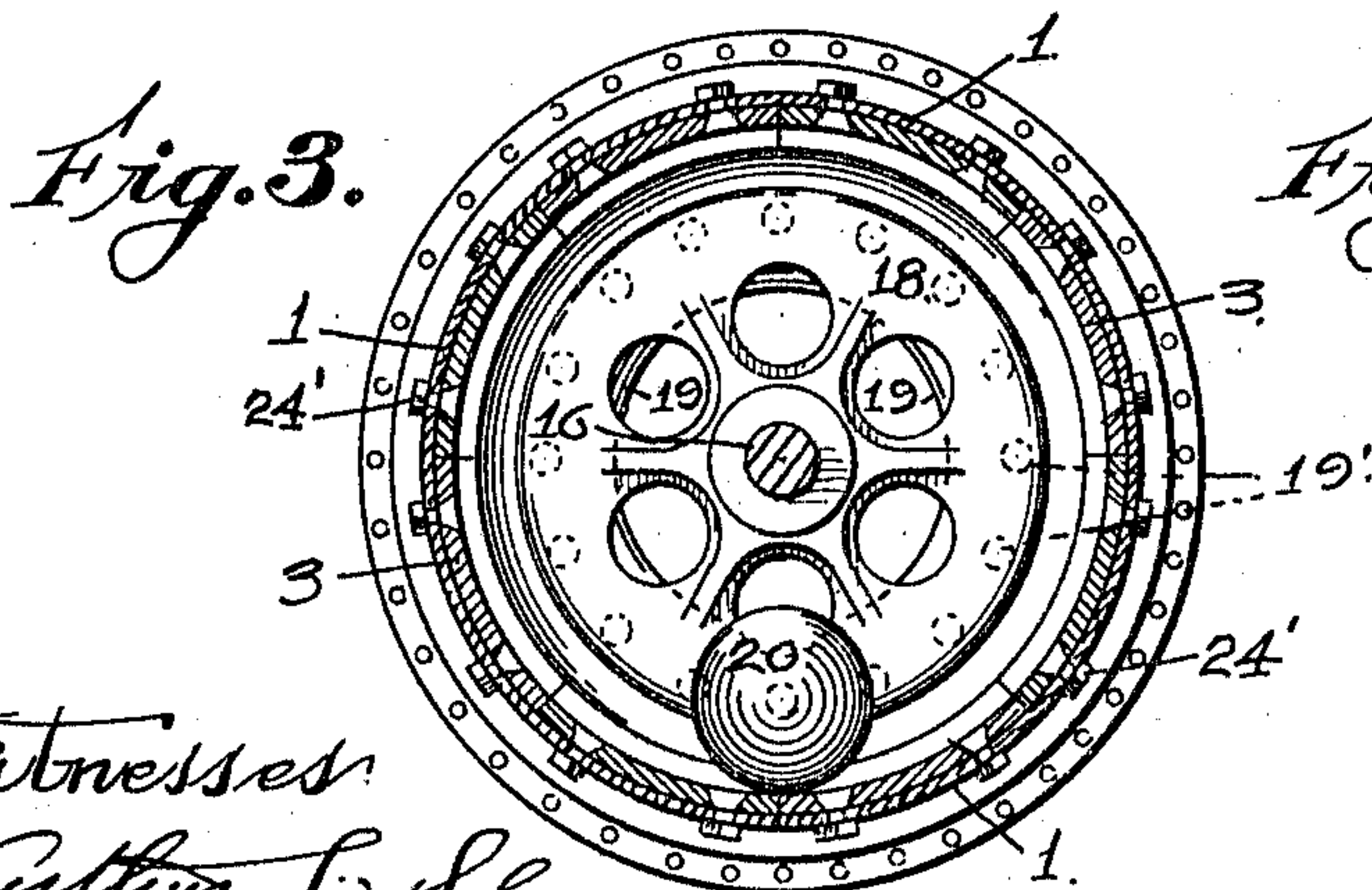
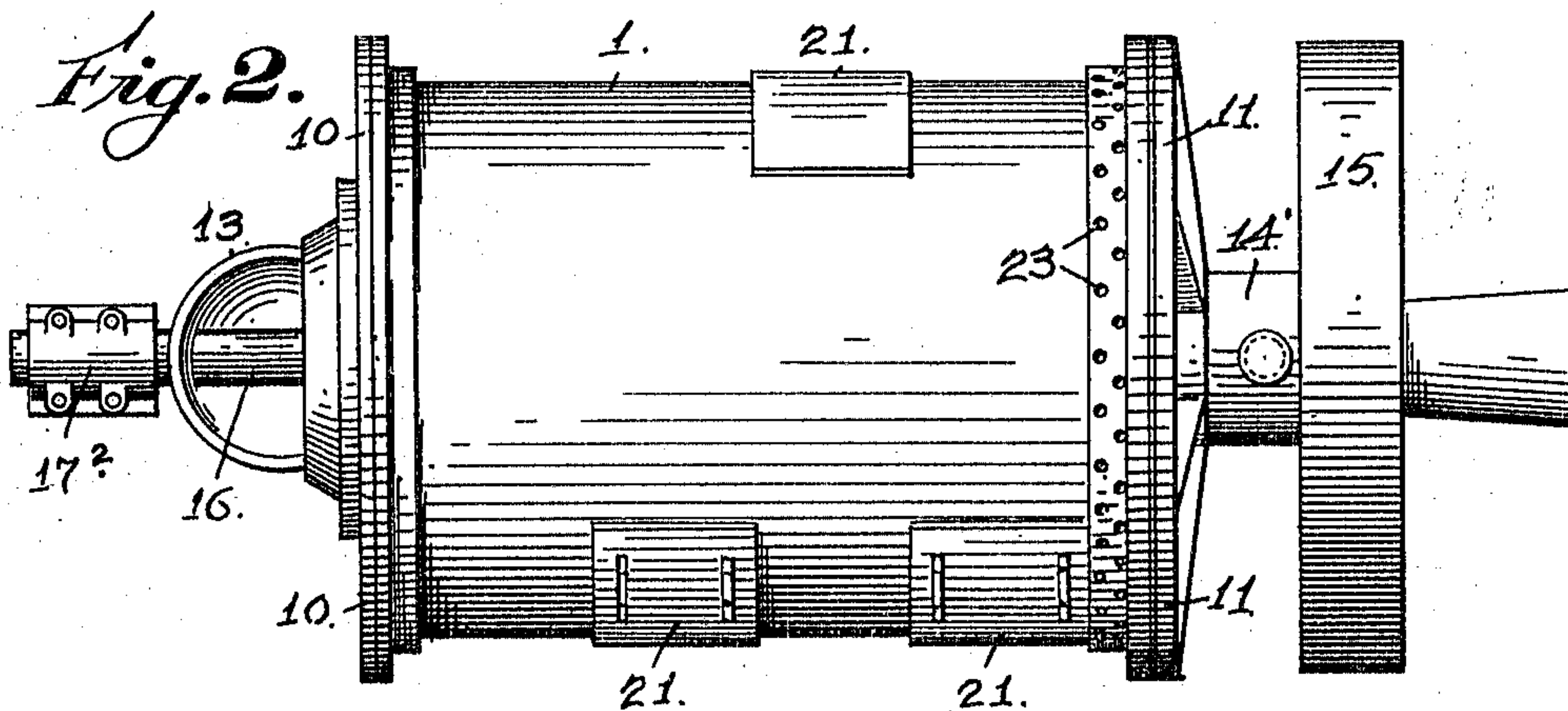
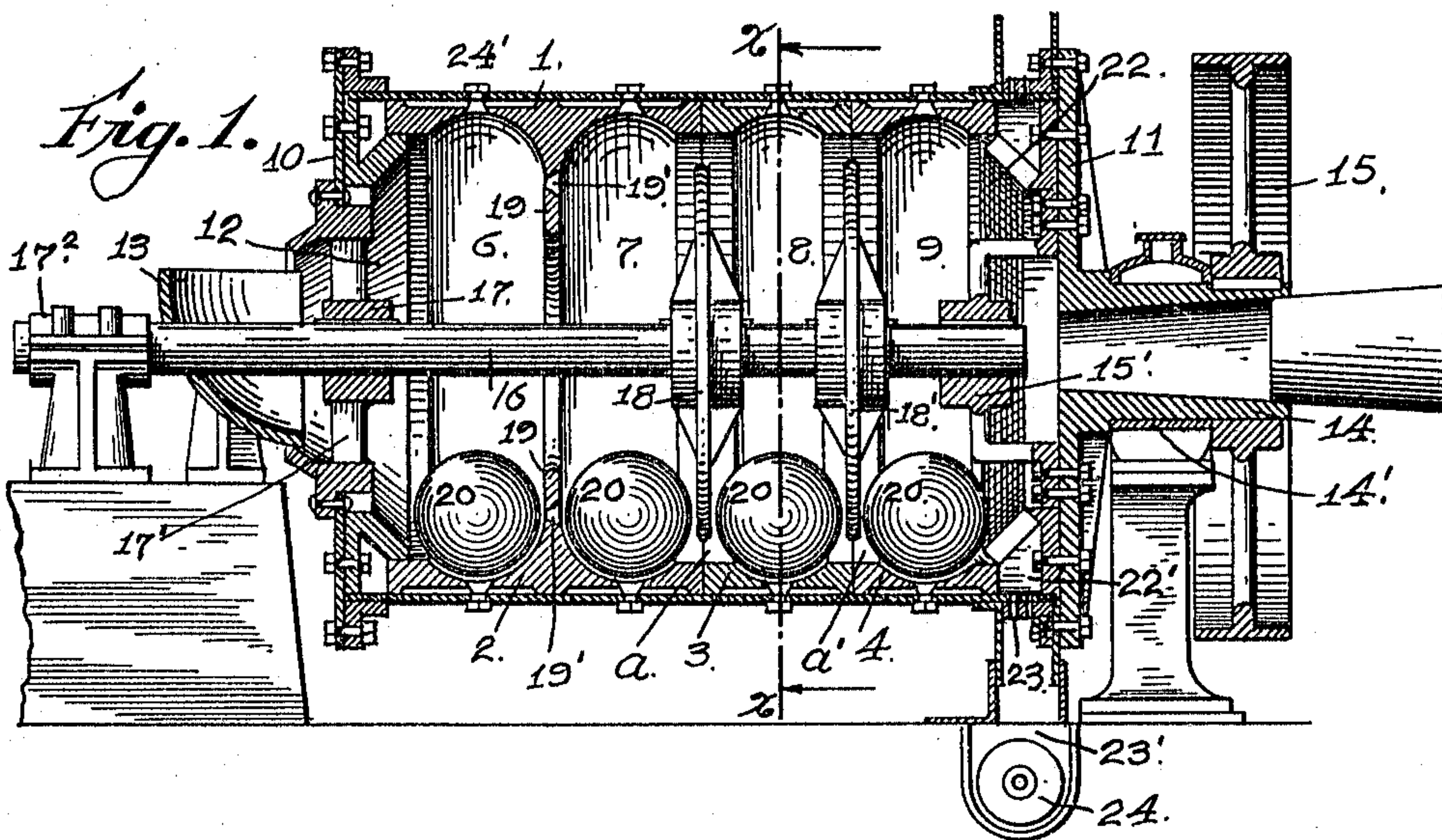


G. W. ROUVEL.  
PULVERIZING APPARATUS.  
APPLICATION FILED MAY 7, 1910.

990,167.

Patented Apr. 18, 1911.



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# UNITED STATES PATENT OFFICE.

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## PULVERIZING APPARATUS.

990,167.

Specification of Letters Patent.

Patented Apr. 18, 1911.

Application filed May 7, 1910. Serial No. 559,993.

*To all whom it may concern:*

Be it known that I, GEORGE W. ROUVEL, a citizen of the United States, residing at Napa, in the county of Napa and State of California, have invented certain new and useful Improvements in Pulverizing Apparatus, of which the following is a specification.

The hereinafter described invention relates to that type of pulverizers known as tube-mills, for use in the grinding and reducing of lime stone, shale, coal, and ore generally, although the present machine is designed for use in the grinding, reducing and pulverizing of material used in connection with the manufacture of cement, the object of the invention being to increase the efficiency and daily output of the pulverizer, to reduce the cost incident to the working of such machines and the maintenance thereof, to provide for a graduated pulverizing action, during the course of travel of the material acted on through the pulverizer, and to allow of access being readily had to the interior of the pulverizing cylinder for the removal of worn parts and the replacement thereof.

To comprehend the invention, reference should be had to the accompanying sheet of drawings, wherein—

Figure 1 is a longitudinal sectional view of the pulverizer. Fig. 2 is a front elevation thereof. Fig. 3 is a vertical sectional elevation taken on line  $x-x$ , Fig. 1 of the drawings. Fig. 4 is a broken detail sectional view of the rotatable cylinder disclosing one of the man-hole plates.

In the drawings, the numeral 1 is used to indicate an outer cylindrical metallic shell or casing, the interior of which is subdivided longitudinally by means of a series of metallic die rings 2, 3 and 4, into a plurality of grinding compartments or chambers 6, 7, 8 and 9, in which the material to be reduced is pulverized as conveyed through the rotating cylinder. The cylinder 1 is united to the drive heads 10 and 11, and into the forward end of the cylinder a feed hopper 13 extends through an annular opening 12 in the drive head 10, for supplying material to be crushed into the crushing chamber 6 of the series of said chambers.

The drive head 11 for the cylinder 1 is formed with an outwardly extended trunnion 14, which works in the bearing support 14' and has secured thereon a drive pulley

15, over which works a drive belt, not shown, for imparting rotation to the said cylinder 1. The said drive head 11 also carries an inwardly projected spider 15' for the inner end of the supporting shaft 16, which shaft extends through a hub 17 of the spider 17' carried by the drive head 10, and rests within a bearing 17<sup>2</sup> outside of the cylinder 1.

On the shaft 16 the spaced disks 18 and 18' are keyed, which disks form the partition walls between the chambers 7—8 and 8—9 respectively. These disks are slightly less in diameter than the interior diameter of the cylinder 1, so as to leave annular passage-ways  $a$  and  $a'$  between the said chambers 7 and 8 and 8 and 9. The chambers 6 and 7 are separated by the central dividing wall 19 of the die ring 2, which die ring provides a crushing surface for each of the chambers 6 and 7. This wall is projected a distance above the die rings 3 and 4, and the same is formed with a series of circumferentially disposed outlet openings 19', through which material escapes from within the chamber 6 into the chamber 7. The purpose of thus projecting inwardly the dividing wall 19 of the die ring 2, is to prevent the passage of material from the chamber 6 into the chamber 7 at too early a stage of pulverization, while by regulating the size of the circumferentially disposed openings 19', the material may be permitted to escape when reduced to a predetermined degree of fineness. In fact, the wall 19 may be treated as a circumferentially perforated diaphragm for controlling the feed of material into the chamber 7.

Into each chamber of the rotatable casing or cylinder 1 is loosely placed a crushing roll 20, the same being inserted through the man-holes 20', on the removal of the cover plates 21. These rolls travel within the grooved pathways of the die rings, and as rotated therein act against the material delivered within the mentioned chambers and by the crushing weight thereof gradually reduce the material to the proper degree of fineness.

The reduced and pulverized material escapes from the chamber 9 through the openings of the inclined screen ring 22, which is held between the die ring 4 and the inner face of the drive head 11, Fig. 1 of the drawings. As the pulverized material escapes through the screen-ring 22, the same falls into the chamber 22', from whence it



escapes through the outlets 23 into the discharge runway 23', where it is acted on by the screw conveyer 24, as usual in this class of machinery, for delivery at any suitable place of deposit.

Each die ring is composed of a series of sections, which sections are united to the inner wall of the cylinder 1 by means of the securing bolts 24', so that in case of excessive wear falling on any one section of a die ring, such worn section may be readily removed and replaced by a new die ring section.

During the operation of the pulverizing apparatus, rotation being imparted to the cylinder 1, the material to be pulverized is delivered by the hopper 13 into the primary reducing chamber 6, where it is acted on by the crushing roll 20 therein until the same has been reduced to such a size as to pass through the outlet openings 19' and escape into the chamber 7, in which chamber the partially reduced material is acted on by the crushing roll located therein, which crushing rolls are carried, partially raised and fall with crushing force during the rotary movement of the cylinder 1. The material delivered into the chamber 7 as reduced by the action of the crushing roll therein, gradually escapes or is forced through the annular outlet  $\alpha$  into the chamber 8, and in such chamber is further reduced by the action of the pulverizing roll located therein, and as reduced escapes therefrom through the annular outlet  $\alpha'$  into the chamber 9 for final pulverization. In this chamber the substantially pulverized material is subjected to the action of the crushing roll working therein until reduced to a powder-like condition or to such a degree of fineness as to permit of the same readily discharging from such chamber through the mesh of the screen 22, for escape into the discharge runway 24. The reducing of the material is treated successively in the respective chambers as conveyed

through the longitudinally disposed rotating cylinder, so that a graduated reduction or pulverization is the result. By this action, it is not required that the material remain in one chamber until reduced to the final degree of fineness, but the same is forced gradually from one chamber into a successive chamber the moment the reduction is sufficient to permit of its escape through the outlet thereof; hence the feed of material into the machine may be a continuous one, for danger of over feeding is reduced to a minimum.

Having thus described the invention what is claimed as new and desired to be protected by Letters Patent is—

An apparatus for the described purpose, the same comprising a longitudinally disposed cylinder, drive heads secured to the ends thereof, a shaft extended centrally through the cylinder and bearings of the drive heads, means for imparting rotation to the cylinder, a plurality of die rings within the cylinder dividing the interior thereof into a series of reducing chambers, each ring comprising a series of circumferentially disposed sections, a plurality of disks on the central shaft separating the last two of the reducing chambers, each of the said disks being of less diameter than that of the chambers to leave an annular outlet space for the travel of material from one chamber to the successive chamber, one of said die rings having a circumferentially disposed outlet for the escape of material from the primary reducing chamber to the second reducing chamber, and a crushing roll loosely situated in each reducing chamber.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

GEORGE W. ROUVEL.

Witnesses:

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