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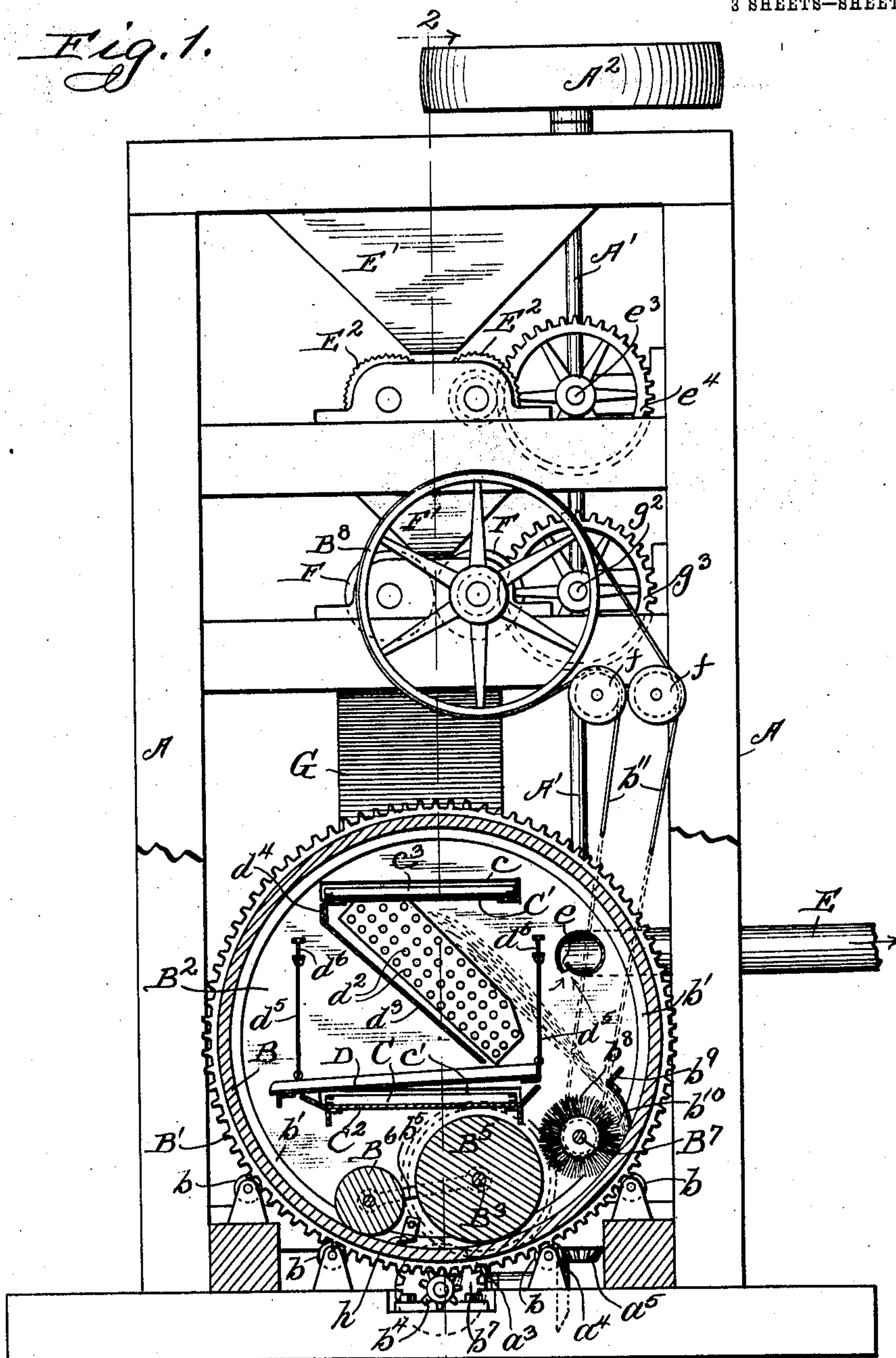
PATENTED AUG. 14, 1906.

C. C. SCOULLAR & E. E. HILL.  
PULVERIZER.

APPLICATION FILED FEB. 11, 1901.

3 SHEETS—SHEET 1.

*Fig. 1.*



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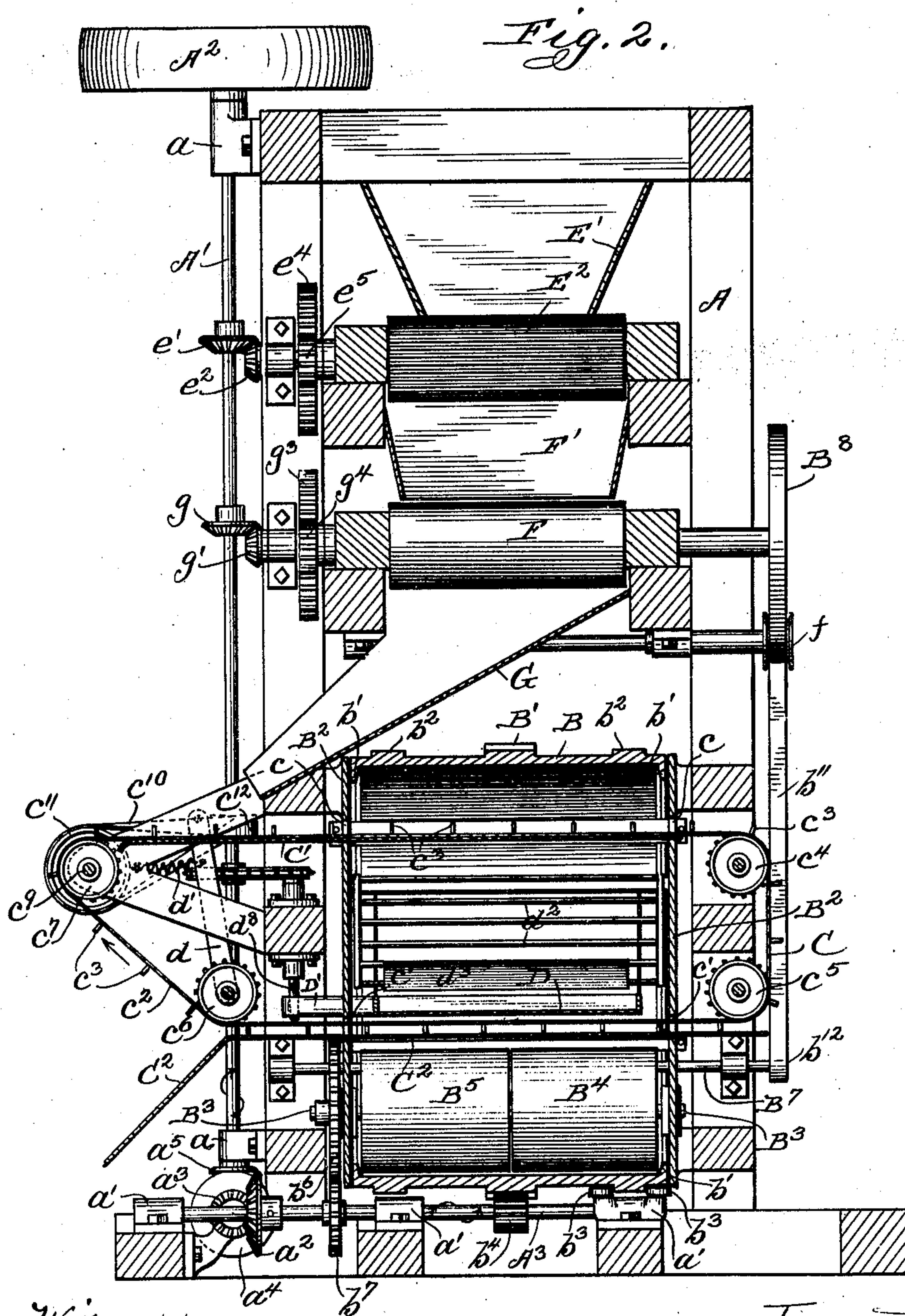
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3 SHEETS—SHEET 2.



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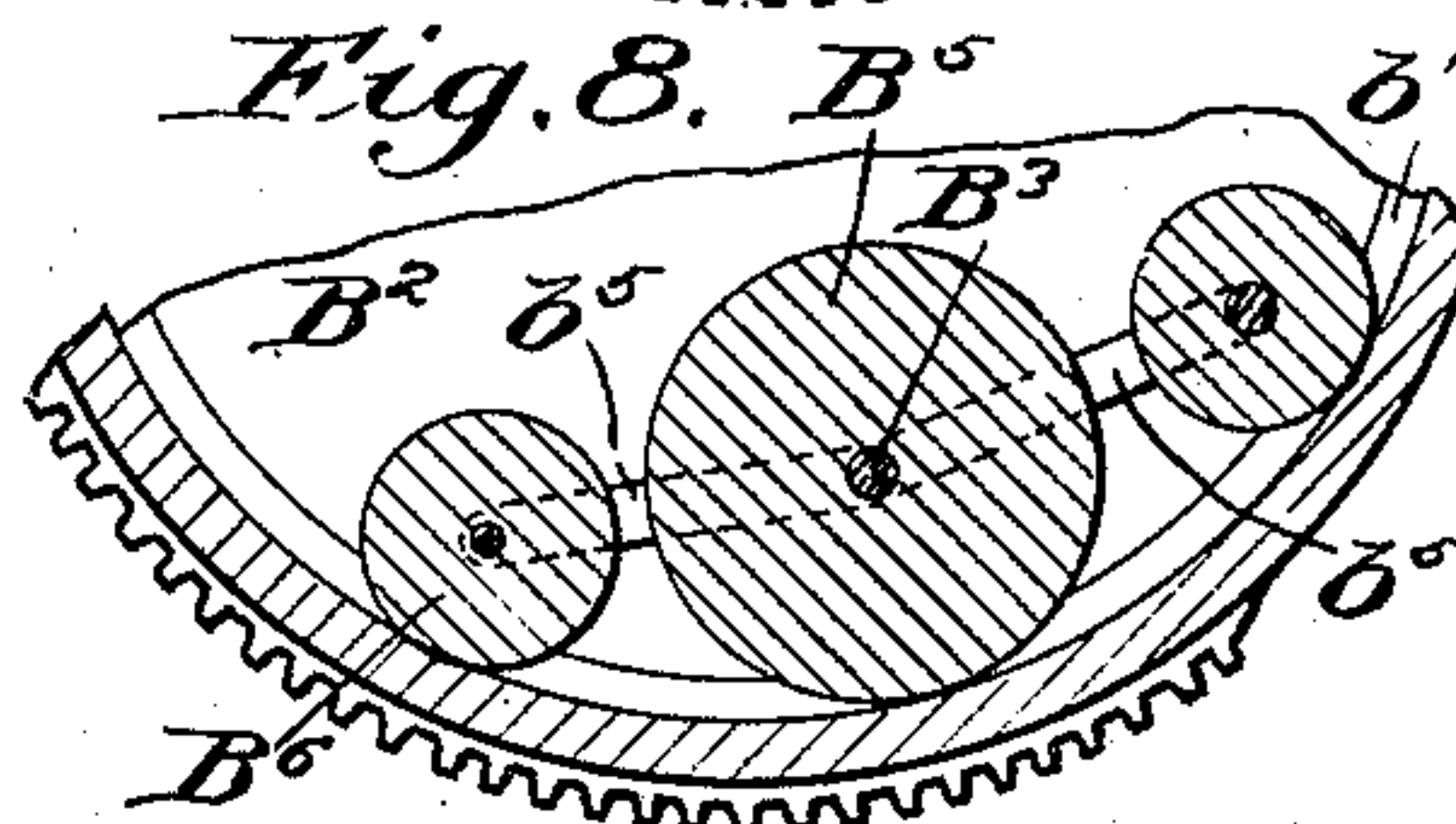
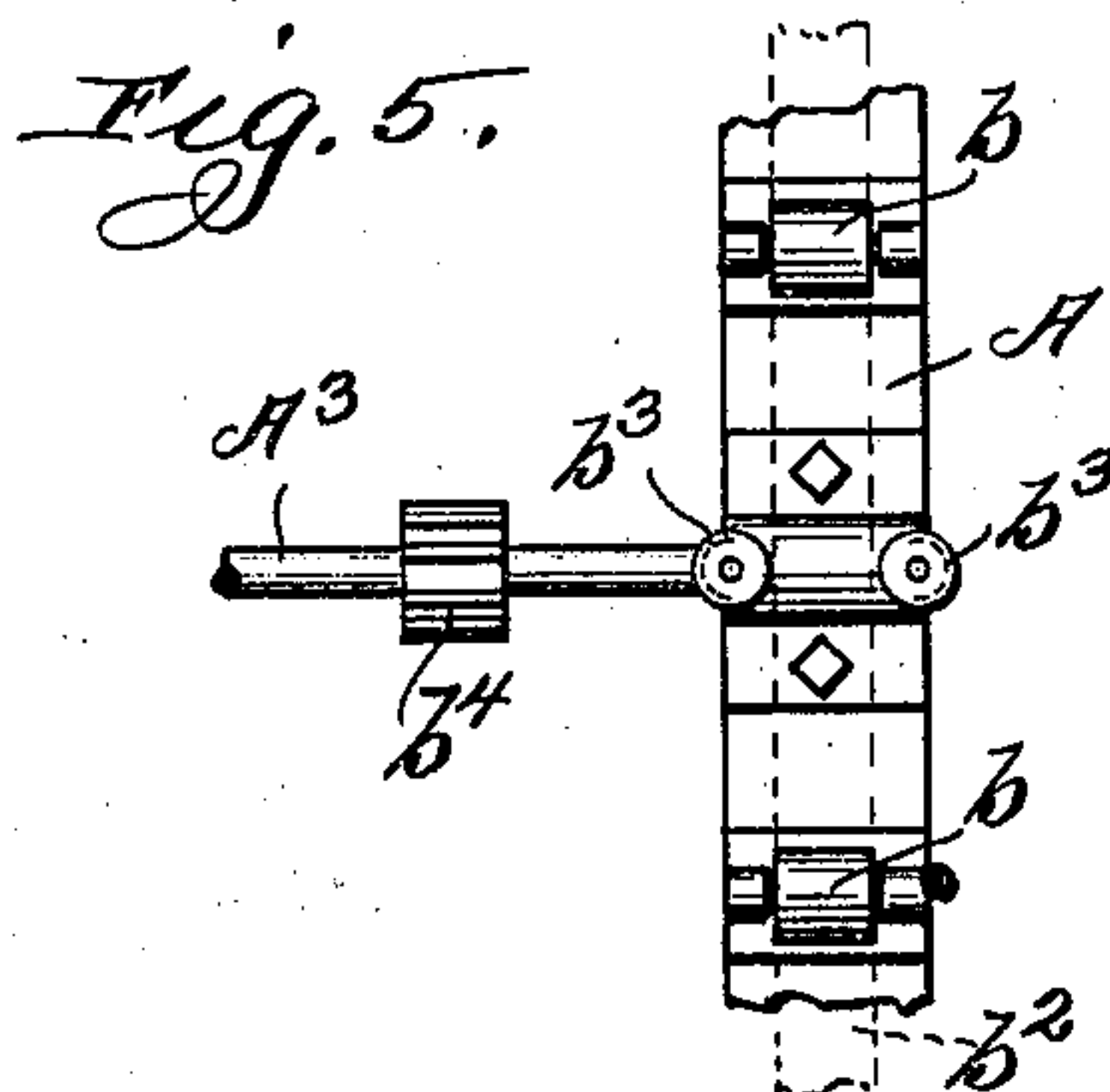
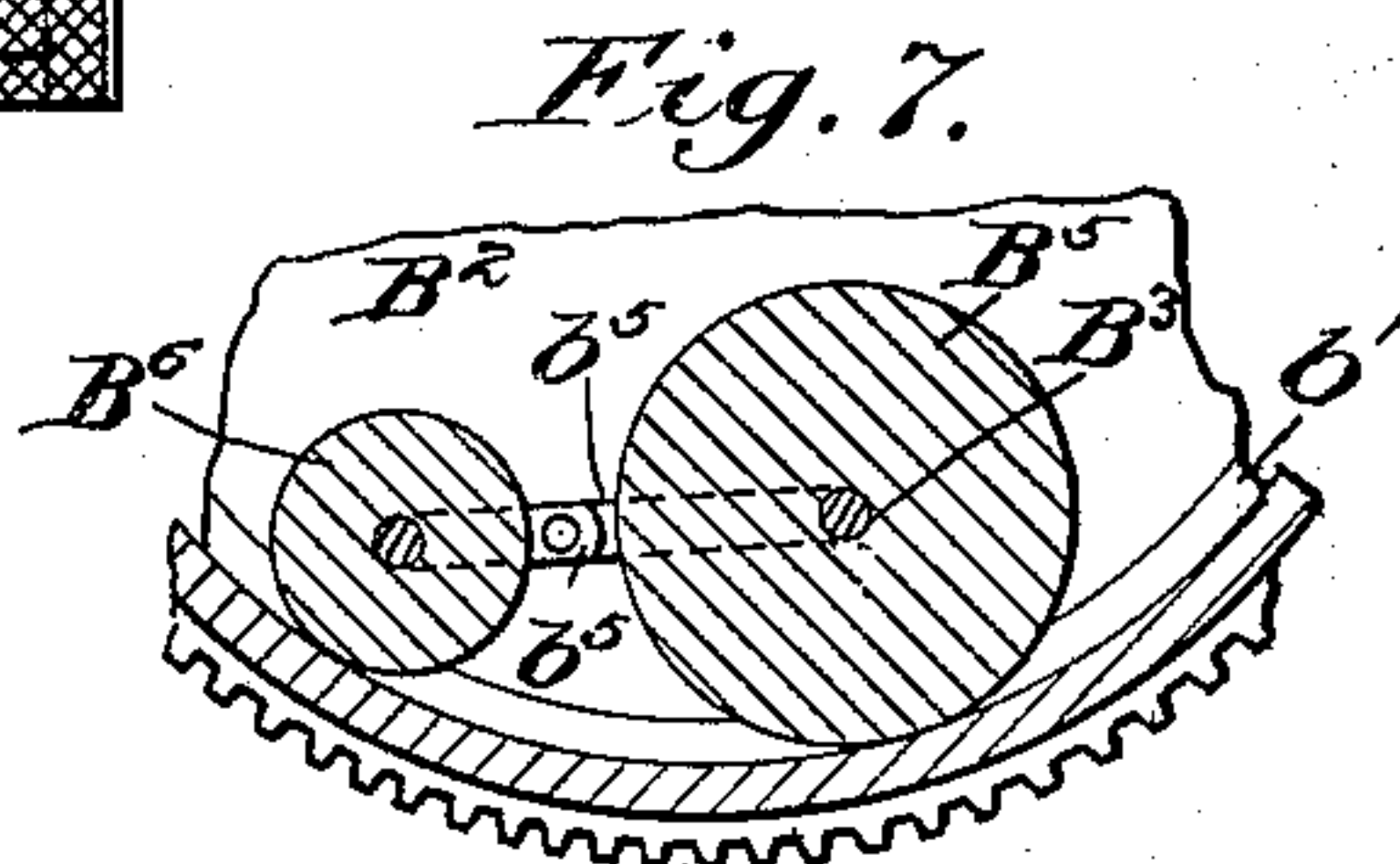
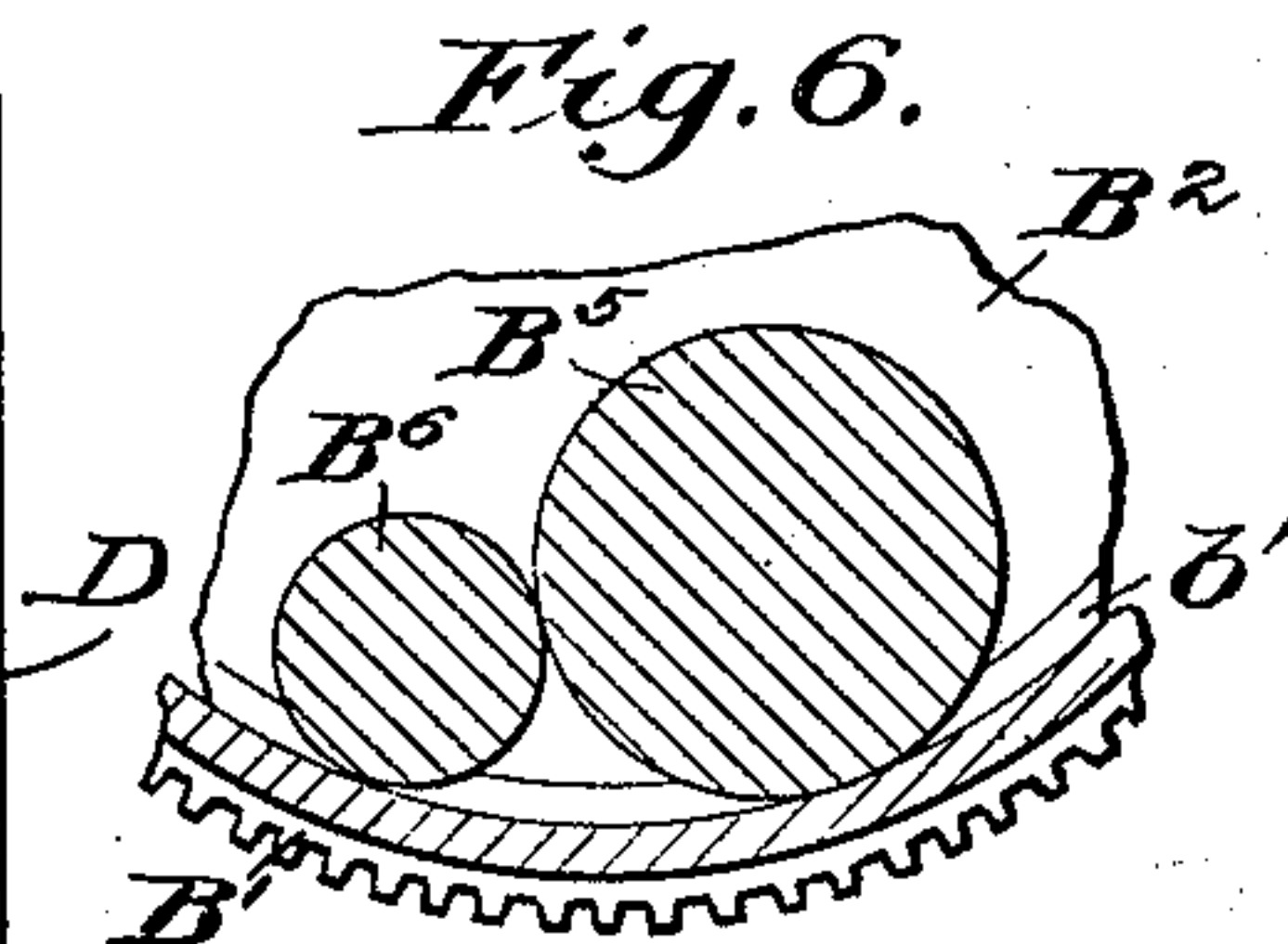
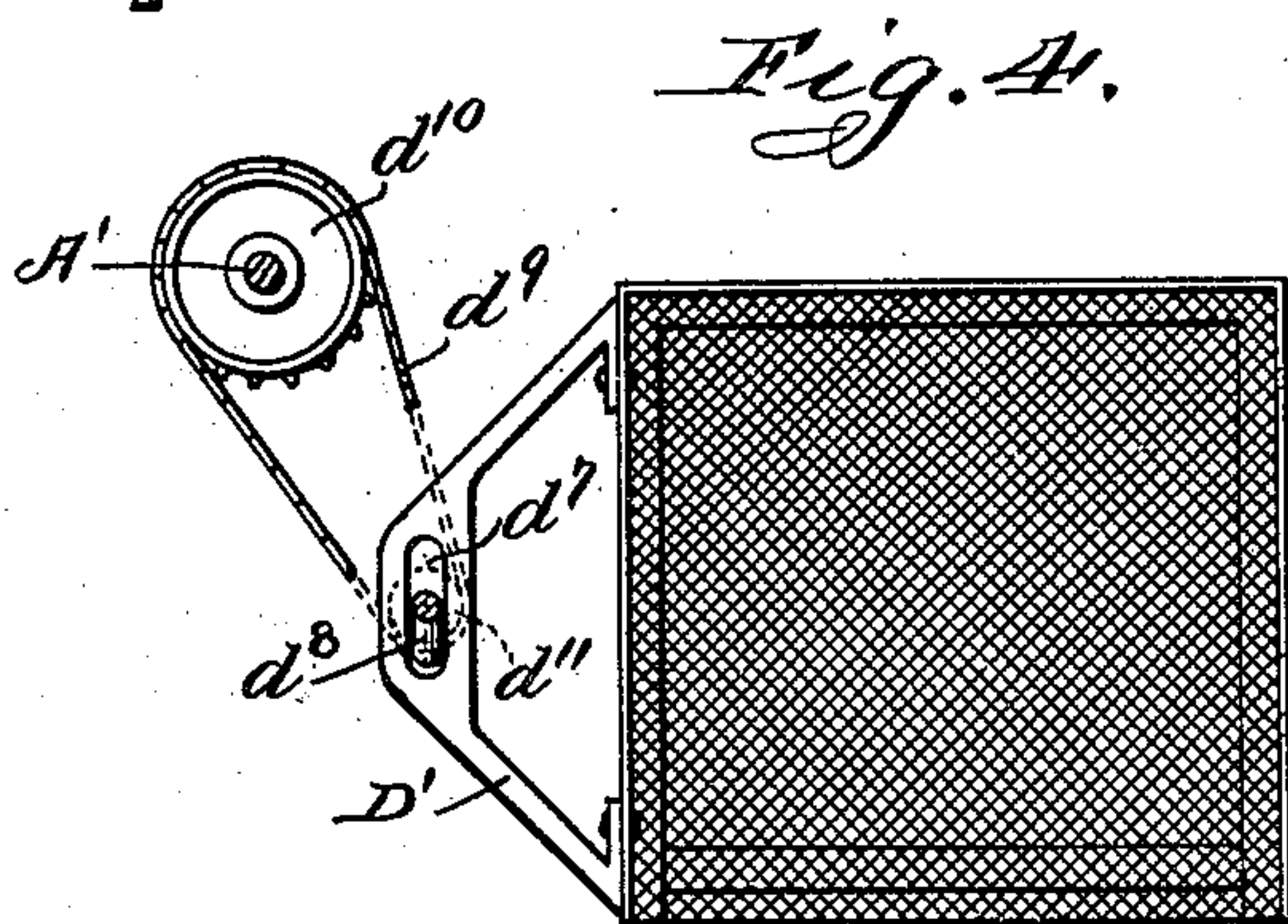
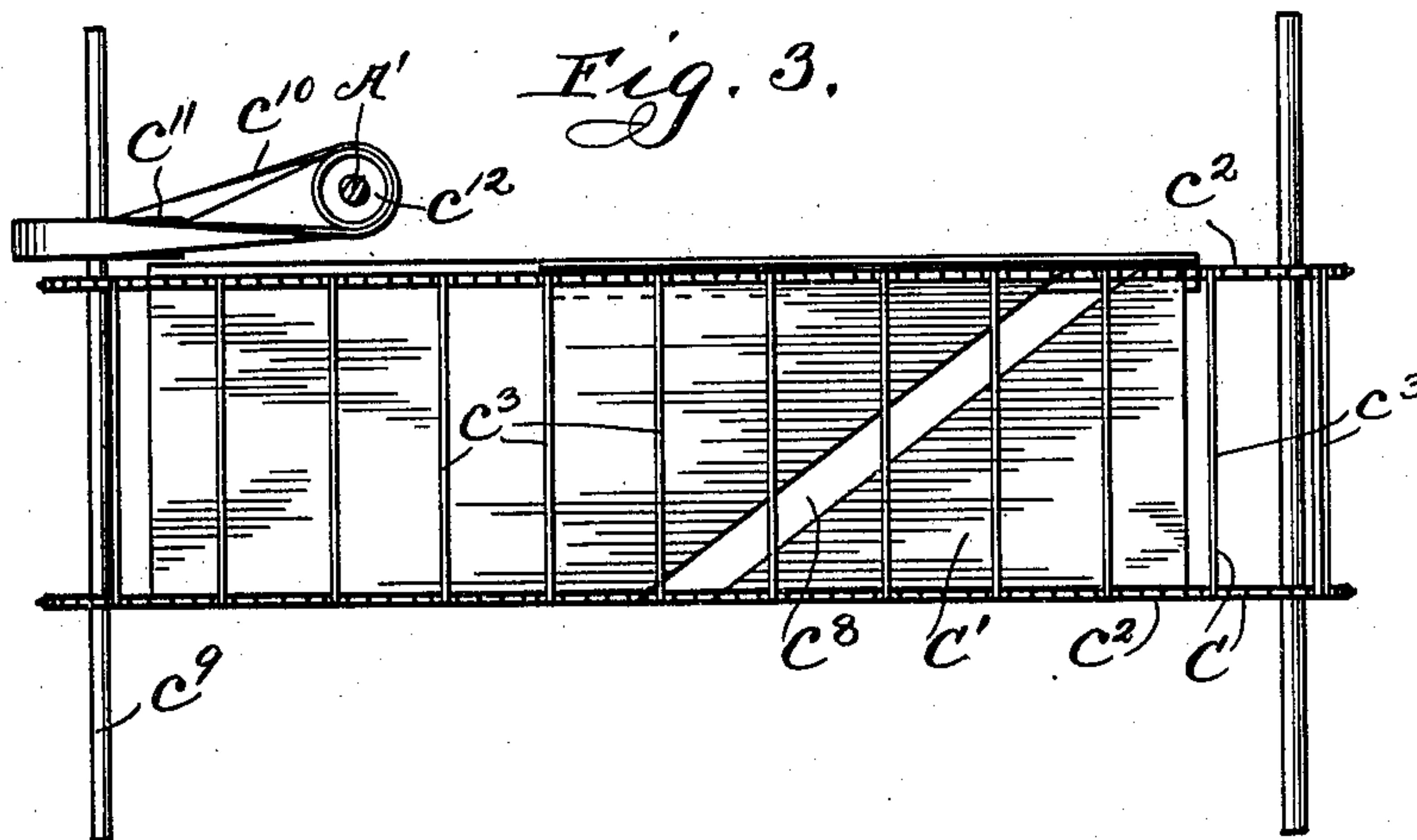
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3 SHEETS—SHEET 3.



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# UNITED STATES PATENT OFFICE.

CHARLES C. SCOULLAR AND EDWARD E. HILL, OF CHICAGO, ILLINOIS.

## PULVERIZER.

No. 828,517.

Specification of Letters Patent.

Patented Aug. 14, 1906.

Application filed February 11, 1901. Serial No. 46,900.

*To all whom it may concern:*

Be it known that we, CHARLES C. SCOULLAR and EDWARD E. HILL, citizens of the United States, residing at Chicago, in the county of Cook, and State of Illinois, have invented certain new and useful Improvements in Pulverizers, of which the following is a specification.

This invention relates to improvements in a crushing or pulverizing machine, and while it is more especially designed and intended to be used for reducing coal to fine or comminuted particles yet it is applicable for and may be used to comminute or grind to dust or flour ores or other products; and it consists in certain peculiarities of the construction, novel arrangement, and operation of the various parts thereof, as will be hereinafter more fully set forth and specifically claimed.

The object of our invention is to provide a pulverizer for reducing coal or other products to a fine powder or dust which shall be simple in construction, strong and durable, and efficient in operation.

In order to enable others skilled in the art to which our invention pertains to make and use the same, we will now proceed to describe it, referring to the accompanying drawings, in which—

Figure 1 is a view, partly in elevation and partly in section, of a pulverizer embodying our invention. Fig. 2 is a central vertical sectional view, partly in elevation, taken on line 2 2 of Fig. 1 looking in the direction indicated by the arrows. Fig. 3 is a detached plan view of the platform and conveyer employed for carrying the coal into and out of the rotatable cylinder or drum. Fig. 4 is a similar view of the sieve used for separating the finer particles from the coarser ones and illustrating the mechanism for shaking the same. Fig. 5 is a plan view of a portion of the supporting-frame, showing some of the antifriction-rollers on which the rotatable cylinder rests; and Figs. 6, 7, and 8 are cross-sectional views of a portion of the main cylinder and the crushing-rollers, showing modifications in the manner of mounting the latter.

Similar letters refer to like parts throughout the different views of the drawings.

A represents the main or supporting frame, which may be made of any suitable size, form, and material and has vertically journaled thereon in suitable bearings a driving-shaft A', which is provided at its upper end with a

pulley A<sup>2</sup>, to which power may be applied for operating the machine. Journaled in suitable bearings a' on the lower portion or base of the main frame is an auxiliary shaft A<sup>3</sup>, on which is mounted a beveled gear a<sup>2</sup>, which meshes with a smaller and beveled gear a<sup>3</sup>, which is mounted on the same shaft on which the beveled gear a<sup>4</sup> is mounted and which gear meshes with a beveled gear a<sup>5</sup> on the lower end of the driving-shaft. The lower portion of the main frame is provided with a series of antifriction-rollers b, which are located near the ends of the cylinder or drum B, which is provided at each of its ends with inwardly-extending annular flanges b' and preferably has on its periphery near each of its ends a circumferential rib or thickened portion b<sup>2</sup>, with which the rollers b impinge. As the cylinder B is not journaled on a shaft, but rotates on the bed formed by the rollers b, it may be necessary to provide means to prevent endwise movement of the cylinder, and to accomplish this we may provide the lower portion of the main frame with a series of rollers b<sup>3</sup>, journaled in pairs, as shown in Fig. 2 of the drawings, so as to impinge the sides of one of the ribs b<sup>2</sup> on the outer surface of the cylinder. Located on the periphery of the cylinder at about its middle is a circumferential rack B', which meshes with a pinion b<sup>4</sup> on the auxiliary shaft. Each end of the cylinder B is closed by means of a plate B<sup>2</sup>, which is fixed to the main frame and fits closely against the ends of the cylinder, yet in such a manner as to permit of its rotation. On a shaft B<sup>3</sup>, journaled in suitable bearings, usually in the head-plates B<sup>2</sup>, is a crushing roller or cylinder which may be made in two sections B<sup>4</sup> and B<sup>5</sup>, as shown in Fig. 2 of the drawings. This cylinder is of solid metal and is very heavy and rests directly on the inner surface of the cylinder or drum, within which is also located so as to contact with its inner surface an auxiliary crushing roller or cylinder B<sup>6</sup>, which is made of solid metal and is journaled on arms or bars b<sup>5</sup>, extending forwardly from the shaft B<sup>3</sup>, on which the larger crushing roller or cylinder is mounted. On one end of the shaft B<sup>3</sup> is mounted a gear b<sup>6</sup>, which meshes with a gear b<sup>7</sup> on the shaft A<sup>3</sup> and imparts rotary motion to the main crushing cylinder or roller.

Passing through the head-plates B<sup>2</sup> and suitably journaled in parallelism with the shaft B<sup>3</sup> and near the inner periphery of the drum or cylinder B is a shaft B<sup>7</sup>, on which is



mounted within said cylinder a cylindrical brush  $b^8$ , preferably composed of metallic bristles. Just above this brush and extending from one head-plate  $B^2$  to the other is a bar  $b^9$ , to which is secured a blade or scraper  $b^{10}$ , the free edge of which rests against the inner surface of the drum or cylinder and is for the purpose of scraping off any of the pulverized material which might adhere to the cylinder, as well as to form a guide for directing the course of the powder or pulverized material when thrown upwardly by the rapid revolution of the aforesaid brush, which is driven by means of a belt  $b^{11}$ , passing over a pulley  $b^{12}$  on one end of the shaft  $B^7$  and over a pulley  $B^8$ , journaled on the main frame.

The head-plates  $B^2$  are provided in their upper portions with horizontal openings  $c$  and below the same, but just above the crushing-rollers, with similar openings  $c'$  for the operation of the conveyer  $C$ , which comprises sprocket-chains  $c^2$ , united together by means of slats  $c^3$ , which chains pass over suitable idlers  $c^4$   $c^5$   $c^6$  and driving sprocket-wheels  $c^7$ , which are journaled on the main frame near the ends of the rotatable cylinder. In the lower part of the openings  $c$  in the head-plates is located a platform  $C'$ , which extends outwardly some distance through one of said head-plates and is provided within the cylinder  $B$  with a diagonal slot  $c^8$ , through which the crushed product may pass when being carried on the platform  $C'$  by means of the slats or scrapers  $c^3$  of the conveyer. The shaft  $c^9$ , on which the sprocket-wheels  $c^7$  are mounted, is driven by means of a crossed belt  $c^{10}$ , passing over a pulley  $c^{11}$  on said shaft and another pulley  $c^{12}$  on the driving-shaft.

The idlers  $c^6$  are journaled on suitable arms  $d$ , which are pivotally secured at their upper ends to a support on the main frame and are drawn outwardly by means of a spring  $d'$ , connected at one of its ends to said arms and at its other end to the said support, so as to keep the chains of the conveyer taut.

Located below the platform  $C'$  and within the rotatable cylinder  $B$  is a series of steam-pipes  $d^2$ , which are arranged in rows inclined toward the brush  $b^8$ , as is clearly shown in Fig. 1 of the drawings, and which may be supplied with steam from a suitable source. (Not shown.) Located beneath these pipes and in an inclined position is a platform  $d^3$ , which is secured at its upper end to a bar  $d^4$ , extending from one head-plate to the other. Suspended by means of rods  $d^5$ , pivotally secured at their upper ends to bars  $d^6$ , extending from one head-plate to the other or otherwise suspended, is a sieve  $D$ , which inclines from the brush  $b^8$ , as is clearly shown in Fig. 1 of the drawings. One side of the sieve  $D$  is provided with a projection  $D'$ , having a slot  $d^7$ , in which is located a crank  $d^8$ , journaled on the main frame and driven by means of a sprocket-chain  $d^9$ , passing around a sprocket-

wheel  $d^{10}$  on the driving-shaft and also around a wheel  $d^{11}$  on the crank-shaft, which arrangement will cause the aforesaid sieve to be shaken or agitated, so as to separate the finer particles from the coarser and allowing the former to fall on a platform  $C^2$ , which is located beneath the sieve and extends out through one of the openings  $c'$  in one of the head-plates. The coarser particles retained by the sieve will be shaken therefrom in front of the crushing-roller  $B^6$ , so as to be again operated on. Extending through one of the head-plates into the cylinder  $B$  is an exhaust-pipe  $E$ , which is provided with a longitudinal slot  $e$  for the admission of the flying dust, which may be drawn out of the cylinder through the pipe  $E$  to any desired point by means of a suction or exhaust fan attached thereto. (Not shown.)

The upper portion of the main frame is furnished with a hopper  $E'$  for the purpose of receiving and conducting the coal or other product to a pair of corrugated rollers  $E^2$ , which are journaled parallel with one another just below the hopper and are driven by means of a beveled gear  $e'$  on the main or driving shaft, which gear meshes with a beveled gear  $e^2$  on a shaft  $e^3$ , which carries a gear  $e^4$ , which meshes with a gear  $e^5$  on the shaft of one of the said rollers. Journaled parallel with one another on the main frame below the corrugated rollers  $E^2$  are two smooth-faced rollers  $F$ , which receive the crushed product from the corrugated rollers through a chute  $F'$ , located beneath the corrugated rollers. The rollers  $F$  are driven by means of a beveled gear  $g$  on the driving-shaft, which gear meshes with a beveled gear  $g'$  on a shaft  $g^2$ , which carries a gear  $g^3$ , which meshes with a gear  $g^4$  on one of the shafts of said rollers. On the opposite end of the shaft on which the gear  $g^4$  is mounted is a pulley  $B^8$ , over which the belt  $b^{11}$ , which operates the brush, passes and which belt also passes over idle pulleys  $f$ , journaled on the main frame at a suitable point. Connected at its ends to the head-plates  $B^2$  and located between the crushing-rollers  $B^5$  and  $B^6$ , so as to rest against the inner surface of the drum or cylinder  $B$ , is a scraper  $h$ , which is employed to remove or loosen any of the crushed material which might adhere to the said cylinder. Located beneath the rollers  $F$  in an inclined position is a chute  $G$ , which is used for conveying the material from said rollers, so as to deposit it on the platform  $C'$ , over which the conveyer travels.

It is apparent that the working gear for driving the several parts of the machine may be differently arranged or constructed; but the herein-disclosed arrangement is a convenient one for operating the entire machine from one driving-shaft; but we do not desire to be limited to the specific form and arrangement of the gearing mechanism, as we may



vary the same to suit circumstances and conditions without departing from the spirit of our invention.

While we have shown in Fig. 1 of the drawings the drum or cylinder B as being furnished with a large crushing-cylinder and an auxiliary crushing cylinder or roller operating in front thereof, yet we do not desire to be limited to any specific number of such crushing-rollers, as we may employ any desired number thereof, and we may sometimes locate another auxiliary crushing roller or cylinder to the rear of the larger one and pivotally connect it to the shaft B<sup>3</sup> by means of arms b<sup>5</sup> in a like manner as the roller or cylinder B<sup>6</sup> is connected, which is clearly shown in Fig. 8 of the drawings. We have shown the large crushing roller or cylinder as being made of two sections B<sup>4</sup> and B<sup>5</sup>, which may be done for the convenience of handling said roller when placing it in position; but it may be made of one piece or more, as is apparent.

In order to attain the best results in pulverizing the coal or other material, it should be as dry as possible when it reaches the pulverizing-cylinders within the drum or hollow cylinder, and for this reason the steam-pipes between which the product must pass are of great importance.

From the foregoing and by reference to the drawings it will be clearly seen and readily understood that by placing lump-coal, ore, or other material in the hopper E' it will be caused to pass between the corrugated rollers E<sup>2</sup>, which will crush it to a certain degree of fineness, from whence it will pass through the chute F' between the rollers F, by means of which it will be further crushed or comminuted, and from these rollers the product will pass down the inclined chute G to the platform C', on which it will be carried, by means of a conveyer C, into the rotatable drum or hollow cylinder. As the slats c<sup>3</sup> of the conveyer pass along the platform C' it is apparent that the crushed product will drop through the diagonal slot c<sup>5</sup>, so as to feed the material to the steam-pipes d<sup>2</sup> and sieve D gradually. The steam-pipes d<sup>2</sup> being arranged in rows inclined toward the raised end of the sieve will have a tendency to cause the product to move in said direction; but to carry all of the product toward the higher end of the sieve, so that the crushed material must pass over its entire surface, we locate under the steam-pipes in an inclined position the chute d<sup>3</sup>. In the agitation of the sieve, which is provided with very fine meshes, the finer particles of coal or other material are sifted therethrough and will fall on the platform C<sup>2</sup>, from which it will be carried out through one of the openings c' in the head-plates to a suitable receptacle, into which it will be deposited. The coarser particles will pass from the lower end of the

sieve in front of the auxiliary crushing-roller B<sup>6</sup> when the same is used and will be further pulverized by the action and weight of said roller. As the drum B rotates, the material over which the roller B<sup>6</sup> has just passed will be loosened from the surface of the drum or cylinder B by means of the scraper h, and the main crushing-roller B<sup>5</sup> will further crush and pulverize the material, after which it will be loosened from the surface of the drum by means of the scraper b<sup>10</sup> and will be thrown upward and on the steam-pipes by means of the brush, as is shown by dotted lines in Fig. 1 of the drawings, to again pass between said pipes and onto the screen, when the above-described operation will be repeated. As the scraper b<sup>10</sup> is slightly curved in cross-section, it is apparent that the material thrown upwardly by the brush will be deflected thereby toward the steam-pipes. The rollers B<sup>5</sup> and B<sup>6</sup> being of immense weight and rotating on the inner surface of the drum will grind or pulverize the material to dust or powder, and as it is loosened from the surface of the drum by the scraper b<sup>10</sup> and rapidly revolving brush it is apparent that it will be held for some time in suspension within the hollow cylinder, from whence it may be exhausted through the exhaust-pipe E to a suitable place of deposit.

While we have shown in Figs. 1 and 2 the main crushing-roller as being journaled in the head-plates and so as to be rotated by suitable gearing, yet we may place said roller, as well as others, in the hollow cylinder without journaling them (see Fig. 6) and allow them to be rotated by the revolution of the said cylinder. We may also pivotally secure the arms b<sup>5</sup> of the auxiliary roller or rollers to the head-plates, as is clearly shown in Fig. 7 of the drawings.

Having thus fully described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In a pulverizer, the combination with a rotatable hollow cylinder, of a fixed head at each of its ends having openings for the admission and discharge of the material to be pulverized; a crushing-roller located within the hollow cylinder, means to rotate said cylinder and roller, an endless conveyer to convey the material into and out of the cylinder, said conveyer adapted to pass through the openings in the fixed heads, and means to operate the conveyer longitudinally of the cylinder whereby the finer particles of the material after being crushed may be carried out and the coarser particles again subjected to the crushing-roller, substantially as described.

2. In a pulverizer, the combination with a rotatable hollow cylinder, of a fixed head at each of its ends having openings for the admission and discharge of the coal or other material, a main crushing-roller and an aux-



iliary crushing-roller both located so as to contact with the inner periphery of the cylinder, a scraper located within and against the surface of the cylinder, means to rotate the cylinder, an endless conveyer adapted to pass through the openings of the heads, and means to operate the conveyer, substantially as described.

3. In a pulverizer, the combination with a rotatable hollow cylinder, of a fixed head at each of its ends having openings for the admission and discharge of the coal or other material, a main crushing-roller and an auxiliary crushing-roller both located so as to contact with the inner periphery of the cylinder, a brush located within and against the inner surface of the cylinder, means to rotate the cylinder and brush, and a curved deflecting-plate located above said brush, substantially as described.

4. In a pulverizer, the combination with a rotatable hollow cylinder, of a fixed head at each of its ends having openings for the admission and discharge of the coal or other material, a main crushing-roller and an auxiliary crushing-roller, both journaled so as to contact with the inner periphery of the cylinder, means to rotate the cylinder and an endless slatted conveyer to convey the material into and out of the cylinder, and means to operate the conveyer, a mechanism to separate the coarser particles of the material from the finer and means to subject the coarser particles again to the crushing-rollers, substantially as described.

5. In a pulverizer, the combination with a rotatable hollow cylinder, of a fixed head at each of its ends having openings for the admission and discharge of the coal or other material, a conveyer passing through said openings, a platform under the upper openings and a platform under the lower openings, a main crushing-roller and an auxiliary crushing-roller, both journaled so as to contact with the inner periphery of the cylinder, and means to rotate the cylinder and main crushing-roller, and to operate the conveyer to convey the material into and out of the cylinder, substantially as described.

6. In a pulverizer, the combination with a rotatable hollow cylinder, of a fixed head at each of its ends having openings for the admission and discharge of the coal or other material, a downwardly-inclined chute located below the inlet-openings, a main crushing-roller journaled so as to contact with the inner periphery of the cylinder, an auxiliary crushing-roller pivotally connected to the shaft of the main roller and journaled so as to contact with the inner periphery of the cylinder, a brush located within and against the inner surface of the cylinder, and means to rotate the cylinder and brush whereby the material is projected back up to said chute, substantially as described.

7. In a pulverizer, the combination with a rotatable hollow cylinder, of a fixed head at each of its ends having openings for the admission and discharge of the coal or other material, a downwardly-inclined chute located below the inlet-openings, steam-pipes located in rows above said chute, a main crushing-roller journaled so as to contact with the inner periphery of the cylinder, an auxiliary crushing-roller pivotally connected to the shaft of the main roller and journaled so as to contact with the inner periphery of the cylinder, a brush and scraper located within and against the inner surface of the cylinder, and means to rotate the cylinder, main crushing-roller and brush, whereby the material is projected back up to the said steam-pipes and chute, substantially as described.

8. In a pulverizer, the combination with a rotatable hollow cylinder, of a fixed head at each of its ends having openings for the admission and discharge of the coal or other material, a main crushing-roller journaled so as to contact with the inner periphery of the cylinder, an auxiliary crushing-roller pivotally connected to the shaft of the main roller and journaled so as to contact with the inner periphery of the cylinder, and means to rotate the cylinder and main crushing-roller and an endless conveyer to convey the material into and out of the cylinder, substantially as described.

9. In a pulverizer, the combination with a rotatable hollow cylinder, of fixed heads at its ends each having an upper and lower opening, a platform located within the cylinder and below the upper openings and extending outside of one of the heads, a platform located within the cylinder, below the lower openings and extending outside of one of the heads, a conveyer traveling through said openings and on the upper surface of said platforms, means within the cylinder to pulverize the coal or other material, the steam-pipes located beneath the upper platform and within the cylinder, an inclined sieve located within the cylinder below the steam-pipes, and means to rotate the cylinder, to operate the conveyer, and to agitate the sieve, substantially as described.

10. In a pulverizer, the combination with a rotatable hollow cylinder, of a fixed head at each of its ends having openings for the admission and discharge of the coal or other material, means within the cylinder to pulverize or grind the material against the inner periphery thereof, a rotatable brush located within the cylinder so as to contact with the inner periphery thereof, steam-pipes located within the cylinder, a sieve suspended in an inclined position beneath the steam-pipes, and means to rotate the cylinder and brush and to agitate the sieve and to convey the material into and out of the cylinder, substantially as described.



11. In a pulverizer, the combination with a rotatable hollow cylinder, of a fixed head at each of its ends having openings for the admission and discharge of the coal or other material, a main crushing-roller journaled so as to contact with the inner periphery of the cylinder, a rotatable brush journaled so as to contact with the inner surface of the cylinder, a platform located under each of the openings in the cylinder, a conveyer traveling through said openings and on the platforms, steam-pipes located within the cylinder beneath the upper platform, and an inclined sieve located within the cylinder beneath the steam-pipes, substantially as described.

12. In a pulverizer, the combination with a rotatable hollow cylinder, of a fixed head at each of its ends having openings for the admission and discharge of the coal or other material, a main crushing-roller and an auxiliary crushing-roller both journaled so as to contact with the inner periphery of the cylinder, a platform located beneath the upper openings in the cylinder and having a diagonal slot, a platform located below the lower openings in the cylinder, steam-pipes located within the cylinder beneath the upper platform, a sieve suspended in an inclined position above the lower platform and beneath the steam-pipes, a rotatable brush located within the cylinder and journaled so as to contact with the inner periphery thereof, a scraper located near the brush and against the surface of the cylinder, an exhaust-pipe

opening into the cylinder, and a conveyer traveling through said openings and over said platforms, substantially as described.

13. In a pulverizer, the combination with a rotatable hollow cylinder, of a fixed head at each of its ends having openings for the admission and discharge of the material to be pulverized, a crushing-roller located within the cylinder, a brush and scraper located within and against the inner surface of the cylinder, and means to rotate the cylinder and brush, whereby the material is projected upwardly and deflected by the scraper over the crushing-roller, substantially as described.

14. In a pulverizer, the combination with a rotatable hollow cylinder, of a fixed head at each of its ends having openings for the admission and discharge of the material to be pulverized, a crushing-roller located within the hollow cylinder, a brush located within and against the inner surface of the cylinder, a curved scraper located within and against the inner surface of the cylinder above the brush, an exhaust-pipe opening into the cylinder, and means to rotate the cylinder and brush, whereby the material is projected over the roller by the curved scraper, substantially as described.

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