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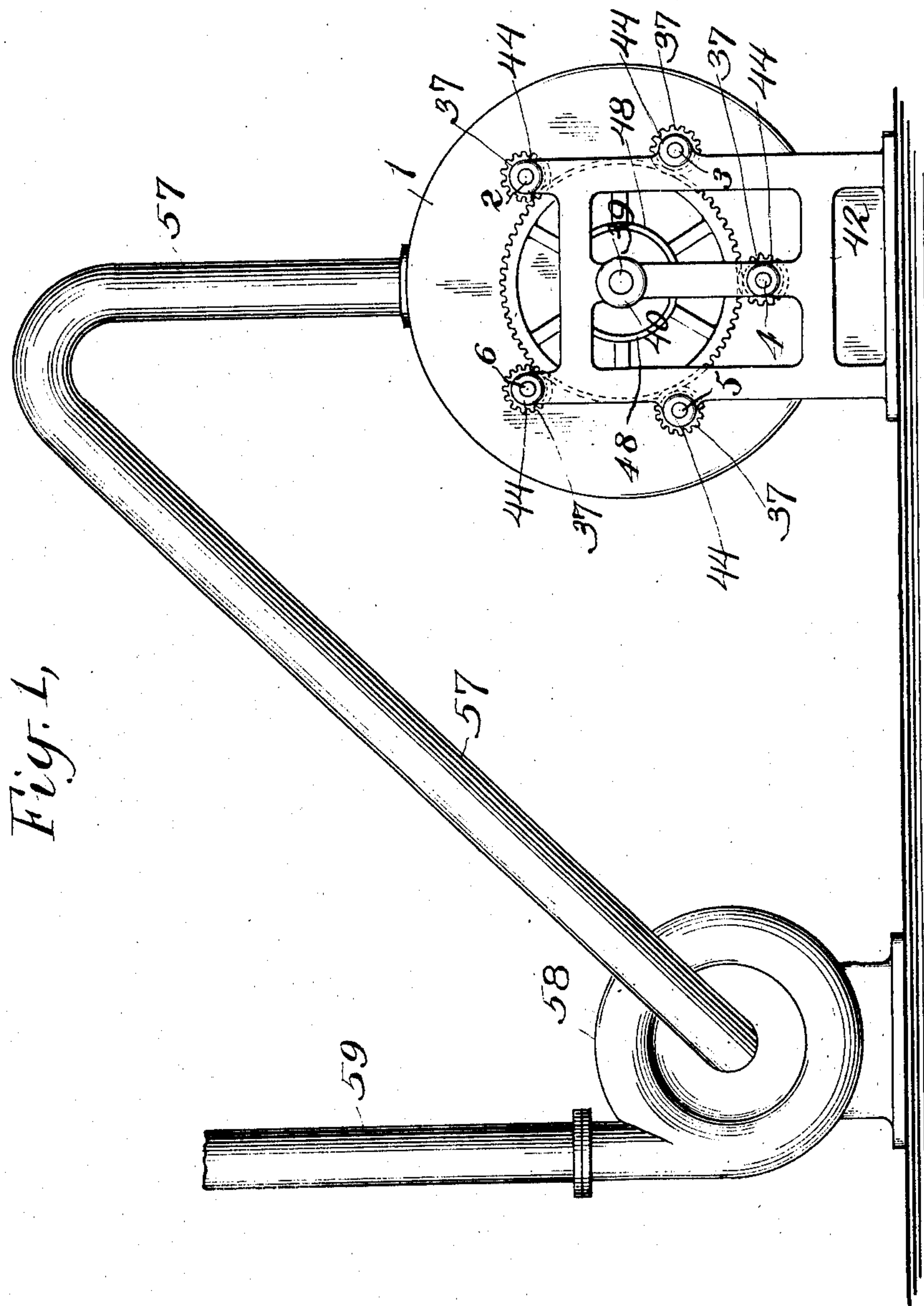
PATENTED AUG. 27, 1907.

J. W. BAILEY.

APPARATUS FOR PULVERIZING METALLIC LEAD.

APPLICATION FILED JUNE 26, 1902.

3 SHEETS—SHEET 1.



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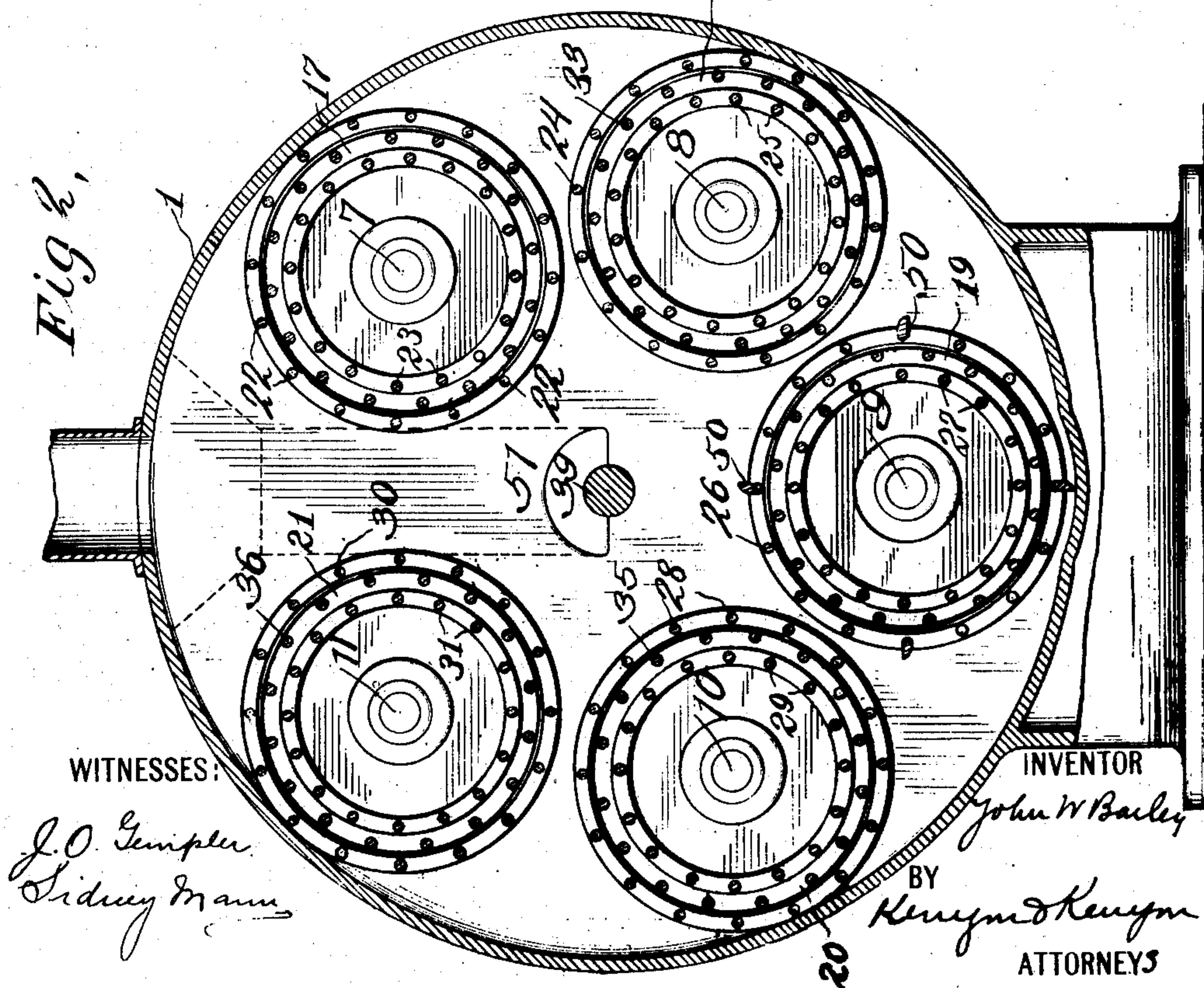
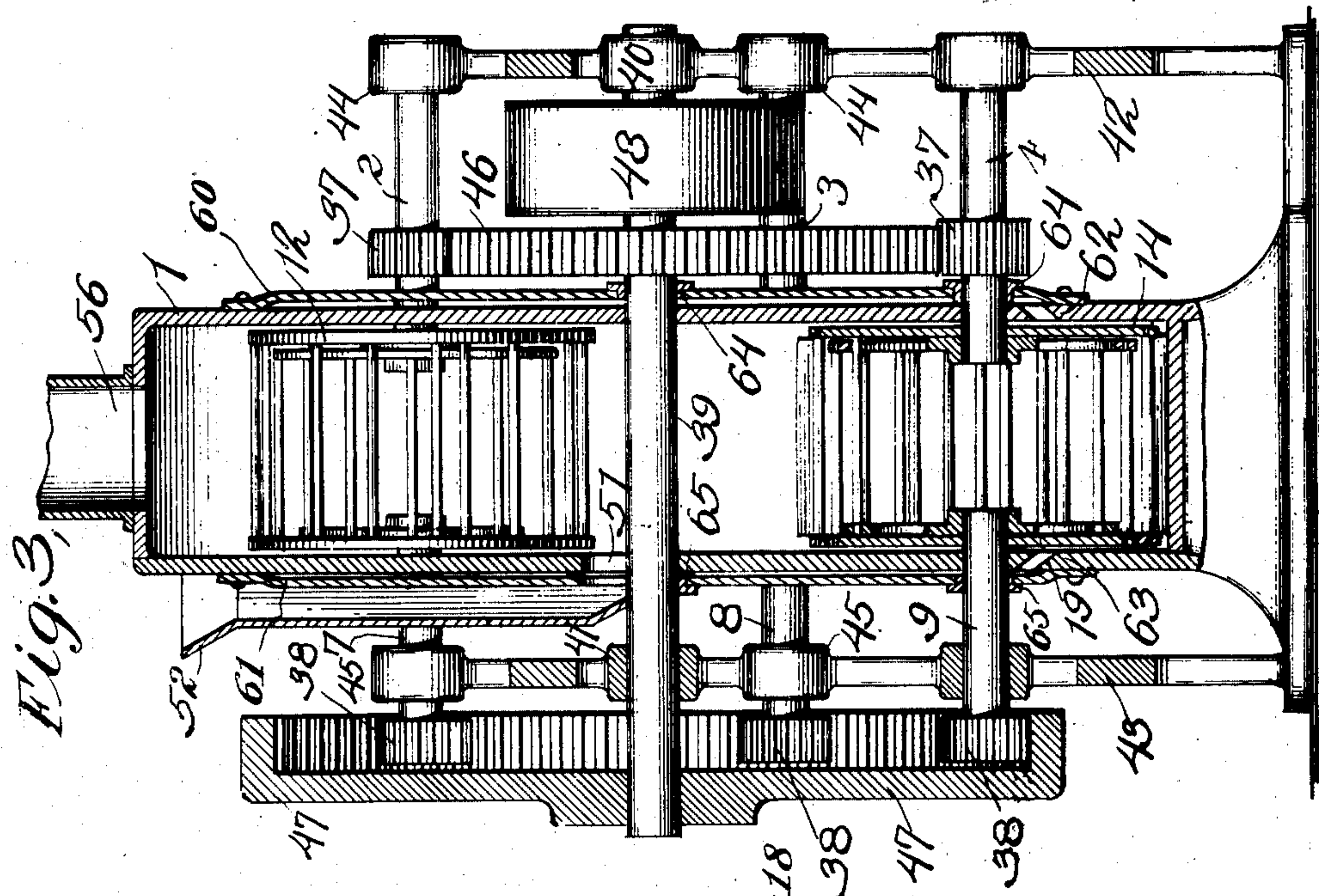
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3 SHEETS—SHEET 2.



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3 SHEETS—SHEET 3.

Fig. 5,

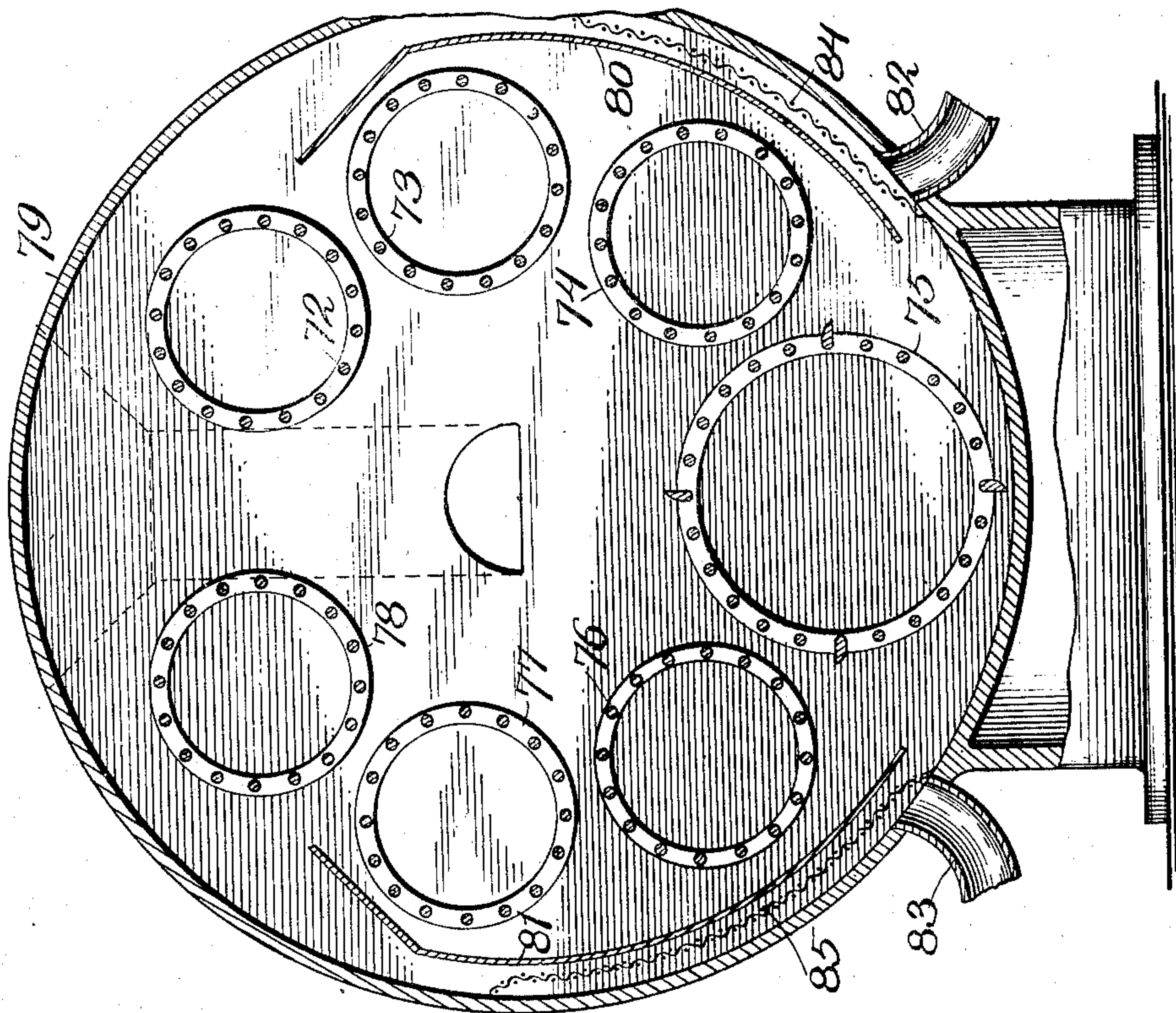
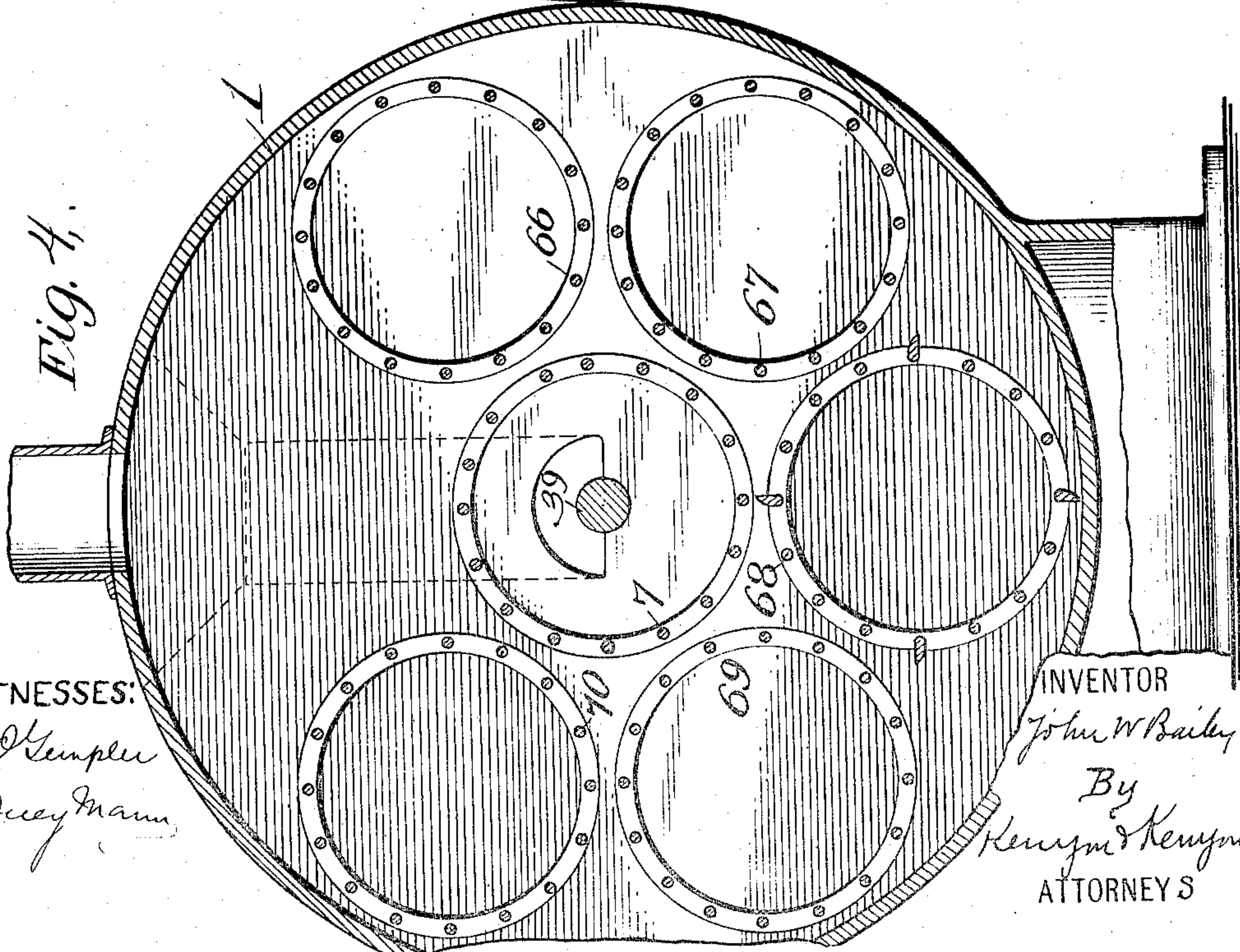


Fig. 4,



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UNITED STATES PATENT OFFICE.

JOHN W. BAILEY, OF NEW YORK, N. Y., ASSIGNOR, BY MESNE ASSIGNMENTS, TO UNITED LEAD COMPANY, A CORPORATION OF NEW JERSEY.

APPARATUS FOR PULVERIZING METALLIC LEAD.

No. 864,443.

Specification of Letters Patent.

Patented Aug. 27, 1907.

Application filed June 26, 1902. Serial No. 113,214.

To all whom it may concern:

Be it known that I, JOHN W. BAILEY, a citizen of the United States, and a resident of New York city, county and State of New York, have invented certain new and
5 useful Improvements in Apparatus for Pulverizing Metallic Lead, of which the following is a specification.

My invention relates to a pulverizing machine, and while the machine is well adapted for pulverizing or disintegrating substances which are more or less brittle,
10 such as ores, fuels, clay, etc., my invention is more particularly directed to the provision of a machine for pulverizing more tenacious materials, such as metals.

A special object of the invention is to provide a machine whereby metallic lead may be disintegrated or
15 reduced to an impalpable powder or dust.

Heretofore pulverizing machines have usually been constructed with two or more rotary beaters mounted concentrically with relation to each other and to the casing, the internal diameter of which is only slightly
20 greater than that of the outermost beater. I have found that with this construction, the material being pulverized, and especially a material which is so easily compacted as metallic lead when in a fine condition, has a tendency to gather in more or less compact masses
25 which acquire the rotary motion of the beaters, and by centrifugal force fly around in the space between the outermost beater and the interior of the casing, thus giving rise to a great loss of energy in friction and heat.

In accordance with my invention the beaters are so
30 arranged with relation to each other, and to a suitable inclosing case or housing, that it will be impossible for any part or particle of the material being pulverized to acquire a definite path of movement and maintain that path for an appreciable time without coming in contact
35 with a part of the casing, or with an oppositely moving beater or an oppositely moving particle of the material being pulverized. In carrying the invention into effect, the beaters are arranged side by side within a casing, and means are provided for rotating the beaters so
40 that as the particles fly off from the fingers or arms of one beater they will come in contact with the casing or with the fingers of an adjoining beater. The beaters are preferably arranged around the circumference of a substantially cylindrical casing, and they are preferably
45 rotated in the same direction, so that the adjacent parts of the beaters will move in opposite directions.

My invention consists in the novel parts, improvements and combinations herein shown and described.

The accompanying drawings, which are referred to
50 herein and form a part hereof, illustrate the best mode contemplated by me of carrying the invention into effect.

Of the drawings: Figure 1 is a side elevation of a complete machine constructed in accordance with my invention;
55 Fig. 2 is a vertical central section of the ma-

chine; Fig. 3 is a central transverse section of the same; and Figs. 4 and 5 are views similar to those shown in Fig. 2, illustrating modified forms of the machine.

Referring now to the drawings in detail, and at first to the form of the device illustrated in Figs. 1, 2 and 3, 1
60 represents a suitable casing forming a pulverizing chamber. So far as some features of the invention are concerned, this casing may be of any suitable form adapted to retain the material indefinitely in the field of action of the beaters. In accordance with one feature of the
65 invention, however, the casing is provided with a substantially circular inner wall and a closed bottom. Within the casing 1 are arranged side by side a plurality of rotary beaters. These beaters may be of any suitable form and construction, the essential being that each
beater is provided with a multiplicity of impact surfaces adapted, upon coming in contact with the material being pulverized, to break the same, thus disintegrating and reducing it to the form of a powder.

In accordance with the preferred construction, the
75 beaters are arranged in a plurality of sets, each set comprising two or more concentric rows of beater arms, and means are provided for rotating the adjacent rows of arms in opposite directions. In accordance with the construction shown in Figs. 1, 2, and 3, this is accomplished by providing two series of short shafts, the
80 shafts 2, 3, 4, 5 and 6 of one set being arranged to project through one side of the casing 1 and the shafts 7, 8, 9, 10 and 11 of the other set being arranged to project through the opposite side of the casing in alinement
85 with the corresponding shafts of the first set. On the adjacent ends of the two sets of shafts, are mounted the beater heads 12, 13, 14, 15 and 16, and 17, 18, 19, 20 and 21 respectively. Each of these beater heads is provided with one or more rows of concentrically arranged
90 beater arms, the heads 12, 13, 14, 15 and 16, as illustrated, are each provided with two rows of arms, 22 and 23, 24 and 25, 26 and 27, 28 and 29, 30 and 31 respectively. The heads 17, 18, 19, 20 and 21, as shown, are each provided with a single row of beater arms, 32, 33,
95 34, 35 and 36 respectively.

The sets of short shafts 2, 3, 4, 5 and 6, and 7, 8, 9, 10 and 11 may be driven by any suitable driving mechanism. The shafts of each set, however, are preferably
100 driven in the same direction, as in this way the adjacent portions of the side by side sets of beaters are caused to move in opposite directions, so that the material flying off from one set of beaters will come in contact with an oppositely moving set of beater arms or with oppositely
105 moving material thrown off therefrom. The two sets of shafts, however, and the sets of beaters carried thereby are preferably driven in opposite directions so that the adjacent concentric rows of beater arms will move in opposite directions. As shown, each of the shafts, 2 to 11, inclusive, is provided with a driving pinion,

the pinions on one side of the machine being represented by the number 37, and those on the opposite side of the machine by the number 38. The two sets of short shafts are, preferably and as shown, arranged on the circumference of a circle at the center of which is arranged a driving shaft 39. The driving shaft passes directly through the center of the machine, the same being supported in suitable bearings 40, 41 which are formed in the standards 42 and 43. These standards are also provided with bearings for the outer ends of the two sets of beater shafts, the bearings in the standard 42 for the shafts at one side of the machine being represented by the number 44, and those in the standard 43 for the shafts at the other side of the machine, by the number 45. Driving shaft 39 is provided at one side of the machine with an external driving gear 46 adapted to mesh with each of the pinions 37 and at the other side of the machine with an internal driving gear 47 adapted to mesh with each of the pinions 38. A suitable driving pulley is provided to drive the shaft 39.

One set of the beaters 14, 19 is preferably arranged at the bottom of the casing and the outermost row of beater arms 26 is preferably provided with one or more scrapers 50 adapted to move close to the bottom of the chamber so as to prevent the settling therein of any of the material being pulverized. The material is preferably supplied to the pulverizing chamber through an opening 51 arranged at or near the center of the casing, a suitable feed chute or hopper 52 being provided to facilitate the introduction of the material through said opening.

In order that none of the material may be discharged from the pulverizing chamber until it has reached a suitable degree of fineness, the discharge opening 56 is preferably arranged at or near the top of the casing, and said opening is connected by a pipe or passage 57 to the suction port of an exhaust fan or blower 58. The delivery passage 59 of the fan 58 may be connected to a suitable settling and collecting chamber in the ordinary manner. The pipe 57 is preferably extended vertically some distance above the casing 1, so that any heavy particles which may be thrown into the opening 56 will have to fall back into the pulverizing chamber by gravity before they reach the fan or a place of lodgment. The fineness of the material may be regulated to some extent by varying the height of the vertical part of the delivery pipe 57.

To prevent the escape of the material from the pulverizing chamber around the various shafts 2 to 11, and 39, auxiliary casings 60 and 61 are preferably provided at the opposite sides of the main casing 1. These auxiliary casings 60 and 61 form settling chambers for any material which may escape around the various shafts. Openings 62 and 63 are provided in the main casing 1 adjacent to the lower ends of the casings 60 and 61 to permit the material collected in the settling chambers to work back into the pulverizing chamber. Bushings 64 and 65 may be provided in the auxiliary casings around the various shafts to more effectually prevent the escape of the material. It follows from this construction that all of the material which is introduced into the casing 1 will be kept in a state of rapid motion and will be continually coming in contact with oppositely moving parts or particles so that it will be rapidly reduced to a state of powder; and that none

of the material will be delivered from the casing until it has been reduced to such a fine state that it may be conveyed by the current of air produced by the exhaust fan. By regulating the speed of the fan, therefore, and the consequent speed of the current of air, the degree of fineness of the delivered material may be nicely controlled. The speed of rotation of the beater heads will depend upon their size and upon the material being pulverized. When metallic lead is being pulverized it is first comminuted or reduced to a fine shotty or sand-like condition by directing a jet of superheated steam or compressed air through a stream of the molten metal in the ordinary manner. With this material I find that the best results can be produced by rotating beaters having a diameter of about 16 inches, at a speed of about 800 revolutions per minute.

Instead of providing sets of beaters as above described, a plurality of single beaters may be used as illustrated in Fig. 4, in which 66, 67, 68, 69 and 70 represent single rows of beater arms carried by suitable beater heads and beater shafts in a manner described in connection with the form of the device shown in Fig. 1, 2 and 3. If desired, a central row of beater arms, 71 may be mounted on a suitable head carried by shaft 39 as indicated in Fig. 4. It will be understood that this central head may be used in connection with the form of the machine shown in Figs. 1, 2, and 3, if desired.

In Fig. 5 is illustrated a form of the machine which is more particularly designed for pulverizing coarser and more brittle material, such as ores, fuels, etc. In accordance with the construction shown in this figure, a plurality of single rows of beater arms 72, 73, 74, 75, 76, 77 and 78 are arranged near the circumference of a casing 79 substantially in a manner previously described, except that in this form of the device, all of the beaters except the lower most one is separated from the walls of the casing by spaces sufficient to permit the introduction of the delivery chutes 80 and 81. These delivery chutes extend downwardly on the interior of each side of the casing to points near the bottom, so as to direct the material which is thrown into them at the top, into the discharge passages 82 and 83. Suitable screens 84 and 85 are provided to prevent the discharge of material until it has reached a suitable degree of fineness. Any coarser material which may be thrown into the chutes 80 and 81 will fall into the lower part of the casing where it will be picked up by the scrapers on the lowermost beater 75, the lower ends of the chutes being, to this end, left open.

In its broader aspects my invention is not limited to the particular constructions shown, nor to the particular constructions by which it may be carried into effect, as many changes may be made in the construction without deviating from the main principles of the invention, and without sacrificing its chief advantages. Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. A pulverizing machine including in combination, a casing having a substantially circular inner wall and a closed bottom, a series of three or more rotary beaters arranged one adjacent to another on separate axes within and adjacent to the inner circumference of said casing, and means whereby said beaters may be driven with adjacent portions moving in opposite directions, one of said

beaters being arranged near the bottom of the casing to prevent the material being pulverized from collecting therein.

2. A pulverizing machine including in combination, a casing having a substantially circular inner wall and a closed bottom, a series of three or more rotary beaters arranged one adjacent to another on separate axes within and adjacent to the inner circumference of said casing, means whereby said beaters may be driven with adjacent portions moving in opposite directions, one of said beaters being arranged near the bottom of the casing to prevent the material being pulverized from collecting therein, and means for maintaining a current of air through the casing whereby the material will be delivered from the casing when it has been reduced to such a fine condition that it may be conveyed by the current of air.
3. In a pulverizing machine, the combination of a casing having a closed bottom, a plurality of sets of rotary beaters arranged side by side in said casing in such a manner as to prevent the accumulation of material therein, each set of beaters comprising two or more concentric rows of beater arms, and means for rotating the adjacent rows of beater arms in each set of beaters in opposite directions.
4. In a pulverizing machine, the combination of a casing having a closed bottom, a plurality of sets of rotary beaters arranged side by side on substantially a horizontal axis in said casing, each set of beaters comprising two or more concentric rows of beater arms and means for rotating the adjacent beater arms in each set of beaters in opposite directions.
5. In a pulverizing machine, the combination of a suitable casing, a plurality of sets of rotary beaters arranged side by side on parallel axes in said casing, each set of beaters comprising two or more concentric rows of beater arms, and means for rotating the adjacent rows of beater arms in each set of beaters in opposite directions, said means being constructed to rotate the corresponding members of each set in the same direction.
6. In a pulverizing machine, the combination of a substantially cylindrical horizontal casing having a closed bottom, a plurality of sets of rotary beaters arranged side by side on parallel axes around the circumference of said casing, each set of beaters comprising two or more concentric rows of beater arms, and means for rotating the adjacent rows of beater arms in each set of beaters in opposite directions.
7. In a pulverizing machine, the combination of a substantially cylindrical casing, a plurality of sets of rotary beaters arranged side by side on parallel axes around the circumference of said casing, each set of beaters comprising two or more concentric rows of beater arms, and means for rotating the adjacent rows of beater arms in each set of beaters in opposite directions, the outermost beater of the set nearest the bottom of the casing having one or more scrapers to prevent the material being pulverized from collecting in the casing.
8. In a pulverizing machine, the combination of a suitable casing, a plurality of sets of rotary beaters arranged side by side in said casing, each set of beaters comprising two or more concentric rows of beater arms, and means for rotating the adjacent rows of beater arms in each set of beaters in opposite directions, said casing having near the top thereof a discharge passage for the pulverized material.
9. In a pulverizing machine, the combination of a suitable casing, a plurality of sets of rotary beaters arranged side by side in said casing, each set of beaters comprising two or more concentric rows of beater arms, means for rotating the adjacent rows of beater arms in each set of beaters in opposite directions, and means for maintaining

a current of air through the casing whereby the material will be delivered from the casing when it has been reduced to such a fine state that it may be conveyed by the current of air.

10. In a pulverizing machine, the combination of a suitable casing, a plurality of sets of rotary beaters arranged side by side in said casing, each set of beaters comprising two or more concentric rows of beater arms, means for rotating the adjacent rows of beater arms in each set of beaters in opposite directions, said casing having near the top thereof a discharge passage for the pulverized material and an exhaust fan connected to said discharge passage whereby the material will be delivered from the casing when it has been reduced to such a fine state that it may be conveyed by the current of air.

11. In a pulverizing machine, the combination of a substantially cylindrical casing, a plurality of sets of rotary beaters arranged side by side on parallel axes near the circumference of said casing, each set of beaters comprising two shafts arranged in alignment and extending in opposite directions through the sides of the casing, suitable beaters affixed to the adjacent ends of said shafts and means for rotating said shafts in opposite directions.

12. In a pulverizing machine, the combination of a suitable casing, a plurality of sets of rotary beaters arranged side by side on parallel axes in said casing, each set of beaters comprising two shafts arranged in alignment and extending in opposite directions through the sides of the casing, beater heads affixed to the adjacent ends of said shafts, one or more rows of beater arms carried by each head, and means for rotating said shafts in opposite directions.

13. In a pulverizing machine, the combination of a substantially cylindrical casing, a plurality of sets of rotary beaters arranged side by side on parallel axes near the circumference of said casing, each set of beaters comprising two shafts arranged in alignment and extending in opposite directions through the sides of the casing, suitable beaters affixed to the adjacent ends of said shafts, a driving shaft arranged concentrically with the sets of beaters, and driving connections between said driving shaft and said sets of beaters.

14. In a pulverizing machine, the combination of a substantially cylindrical casing, a plurality of sets of rotary beaters arranged side by side on parallel axes near the circumference of said casing, each set of beaters comprising two shafts arranged in alignment and extending in opposite directions through the sides of the casing, suitable beaters affixed to the adjacent ends of said shafts, a driving shaft arranged concentrically with the sets of beaters, a pinion carried by each of said beater shafts, and external and internal gears affixed to said driving shaft at opposite sides of said casing, and arranged to mesh with said pinions.

15. In a pulverizing machine the combination of a suitable casing, a plurality of beater shafts extending through the side of said casing, an auxiliary casing arranged at the side of the main casing and forming therewith a settling chamber for any material that may escape through the openings for said shafts, said auxiliary casing having a closely fitting bushing for each of said shafts, and a passage for the return of the material collected in the settling chamber to the chamber in the main casing.

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

JOHN W. BAILEY.

Witnesses:

EDWIN SEGER,

J. H. FREEMAN.