No. 868,346. PATENTED OCT. 15, 1907

W. KENNEDY.

CHARGE DISTRIBUTING APPARATUS FOR BLAST FURNACES.

APPLICATION FILED MAY 4, 1904. RENEWED JULY 6, 1905.

4 SHEETS—SHEET 1.

FIG. 1

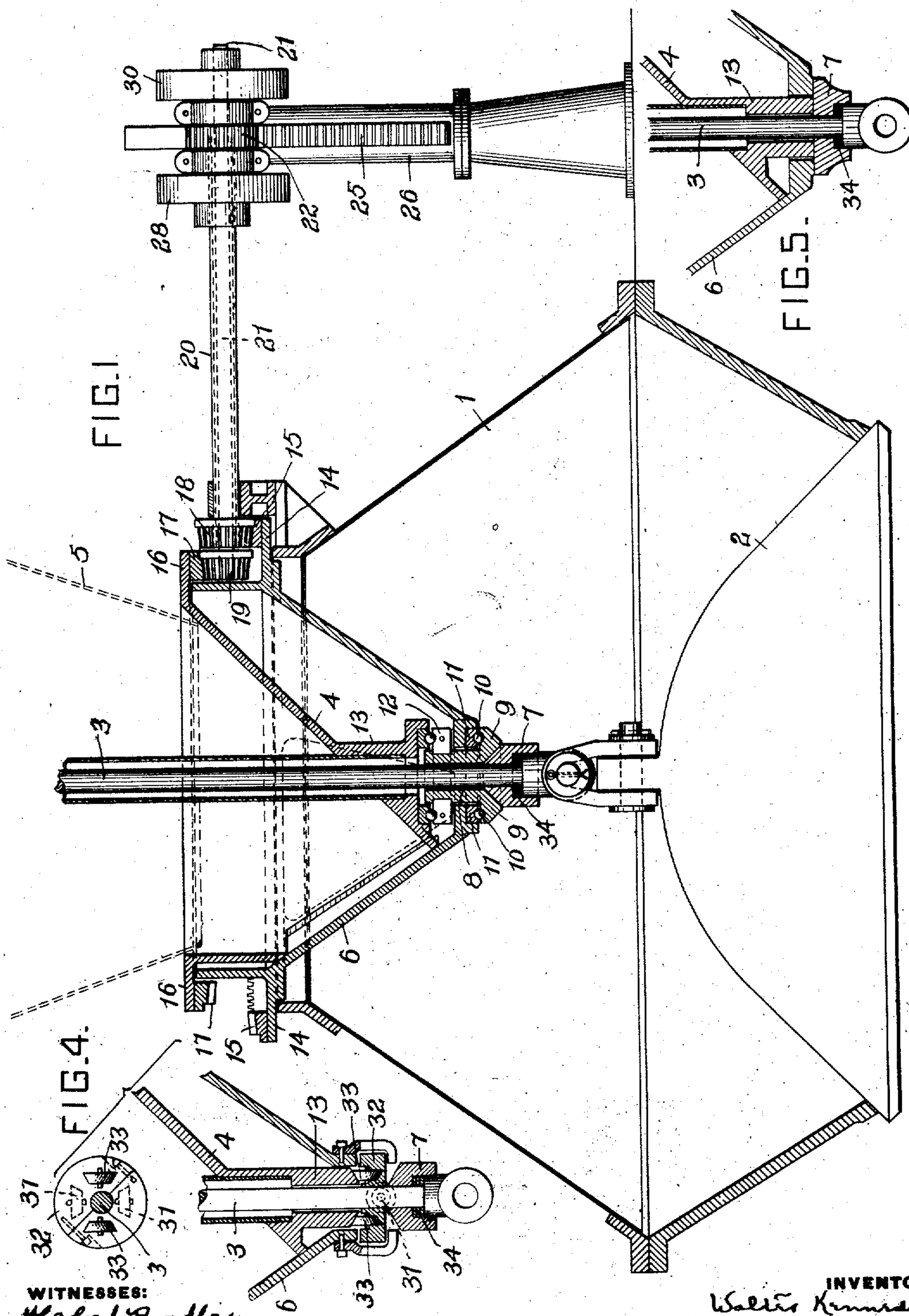

FIG. 5.

FIG. 4.

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by Christy & Christy, Atty's

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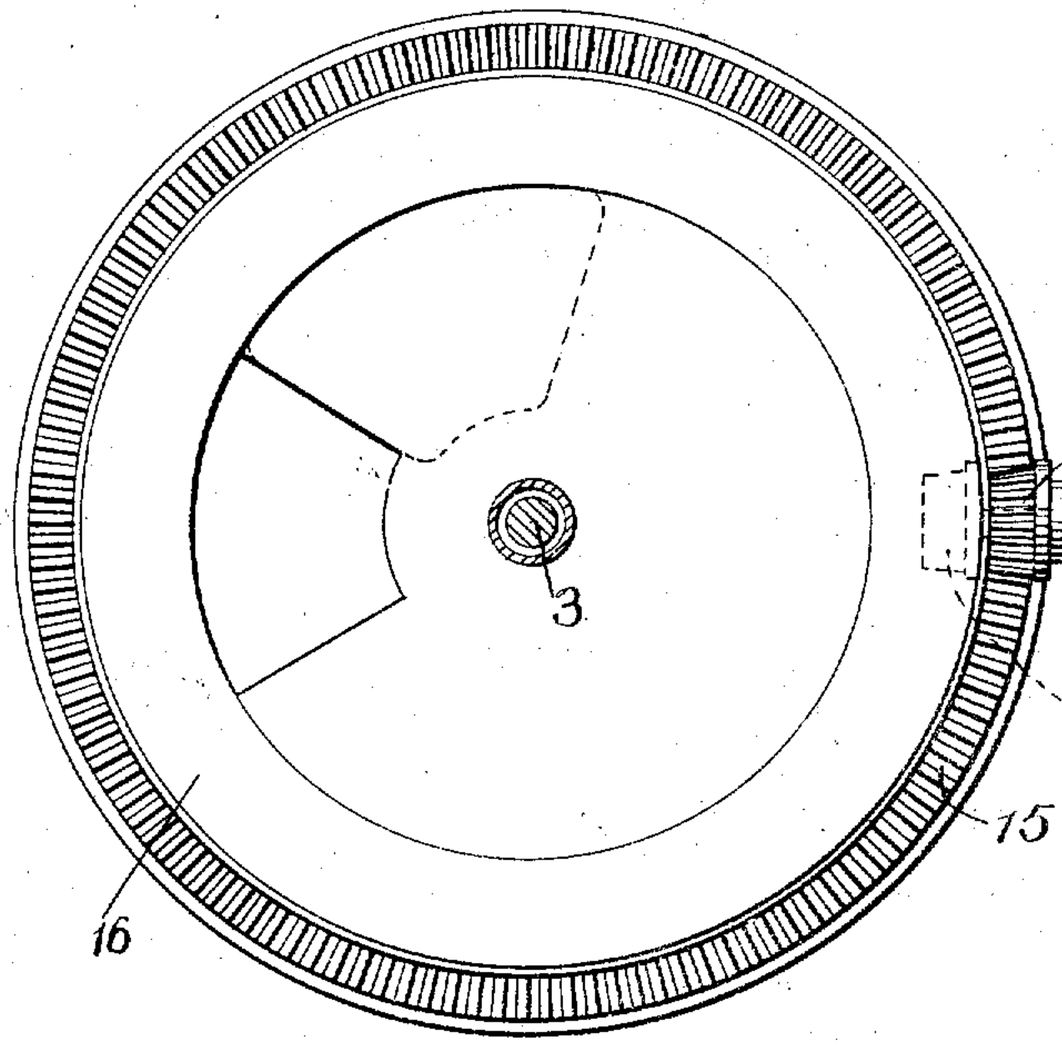
4 SHEETS—SHEET 2.

FIG. 2.



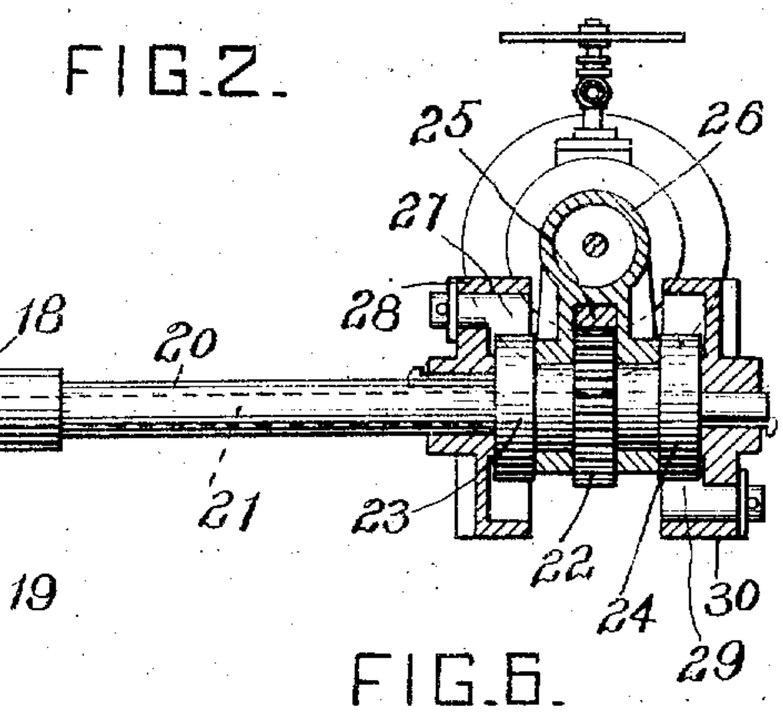


FIG. 6.

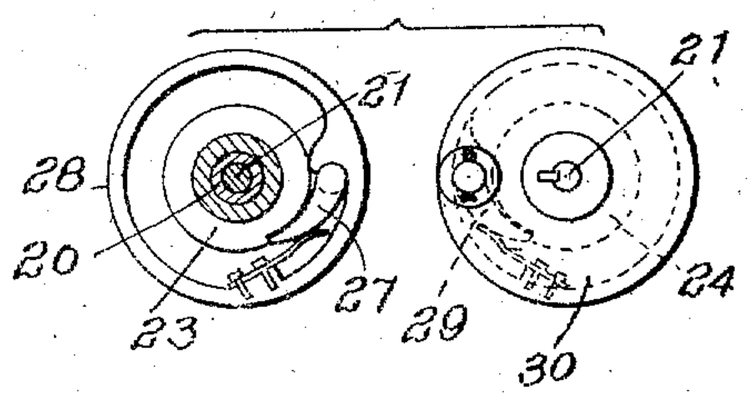
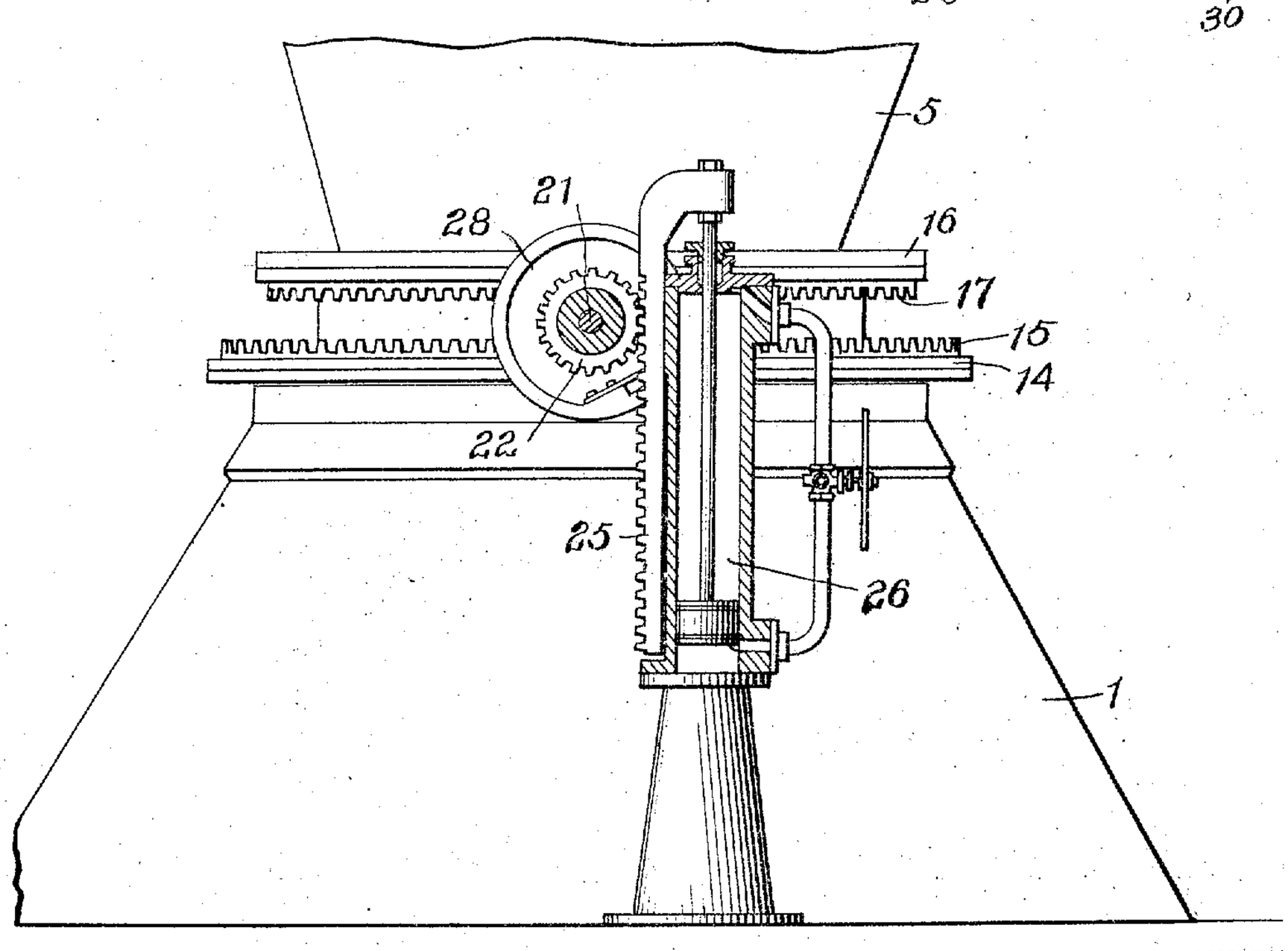


FIG. 3.



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4 SHEETS—SHEET 3.

FIG. 7.

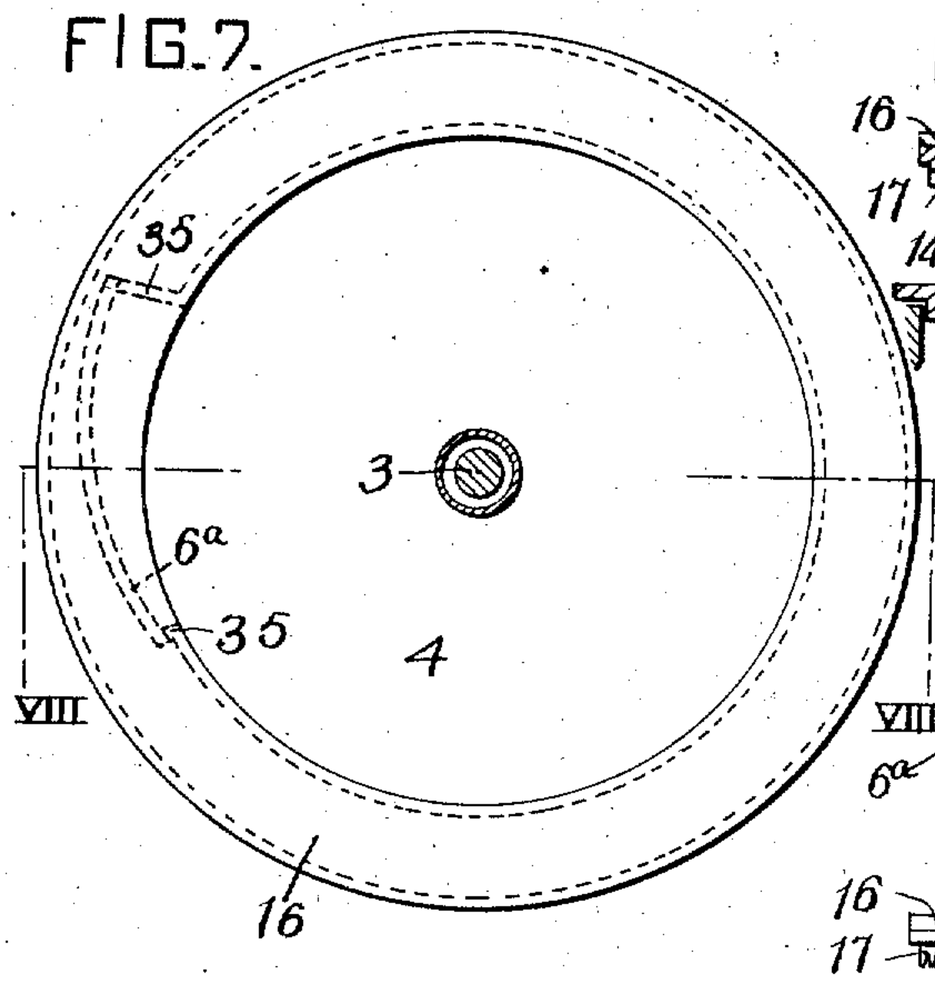


FIG. 8.

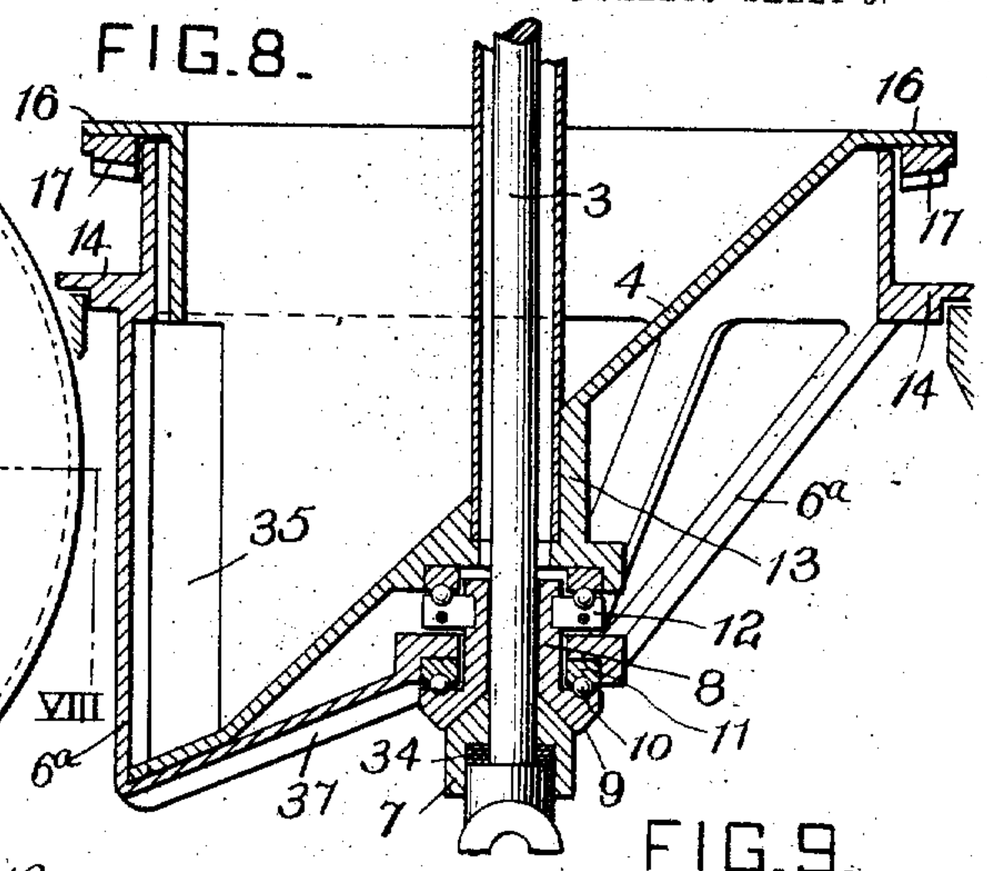


FIG. 9.

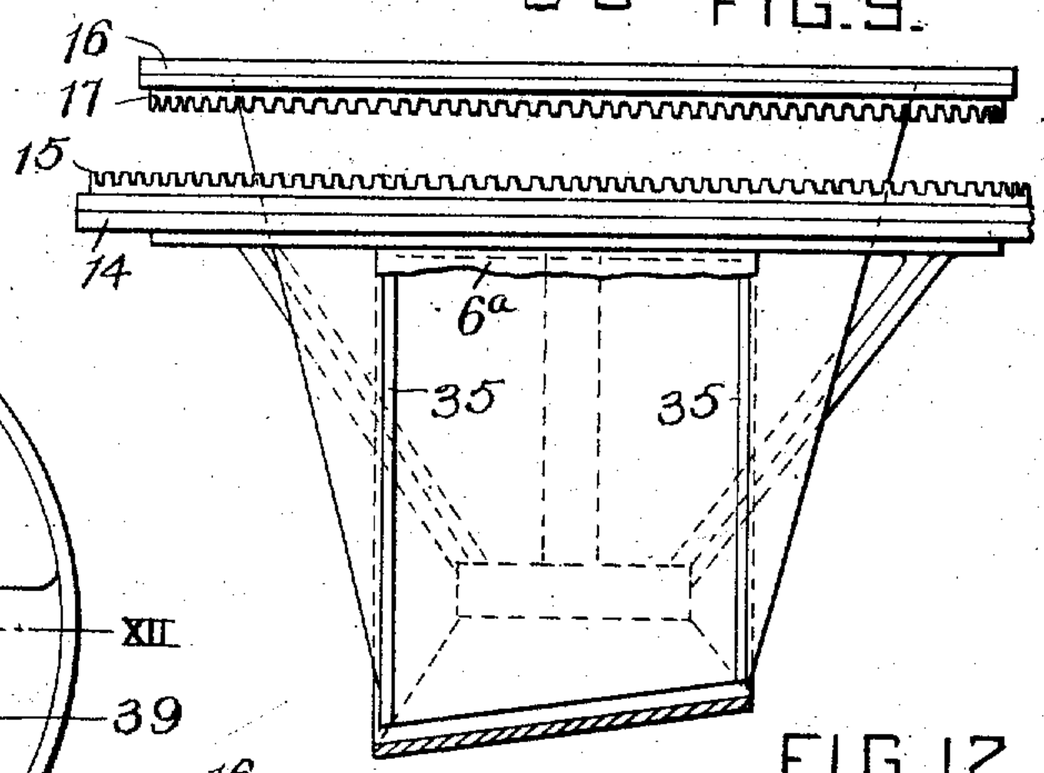


FIG. 10.

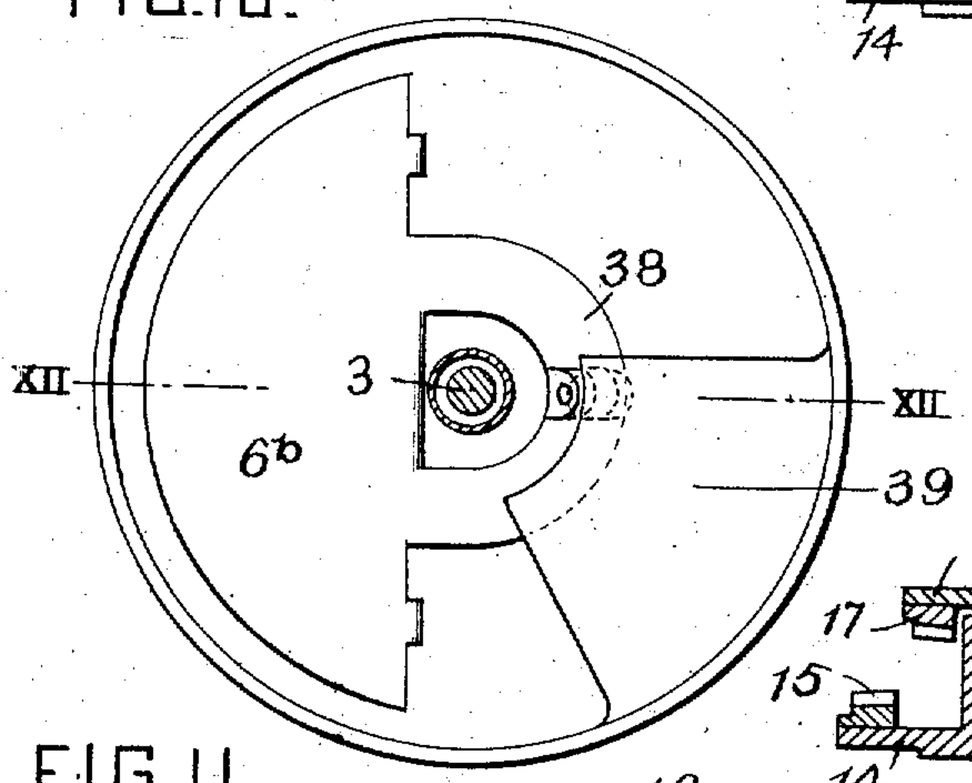


FIG. 11.

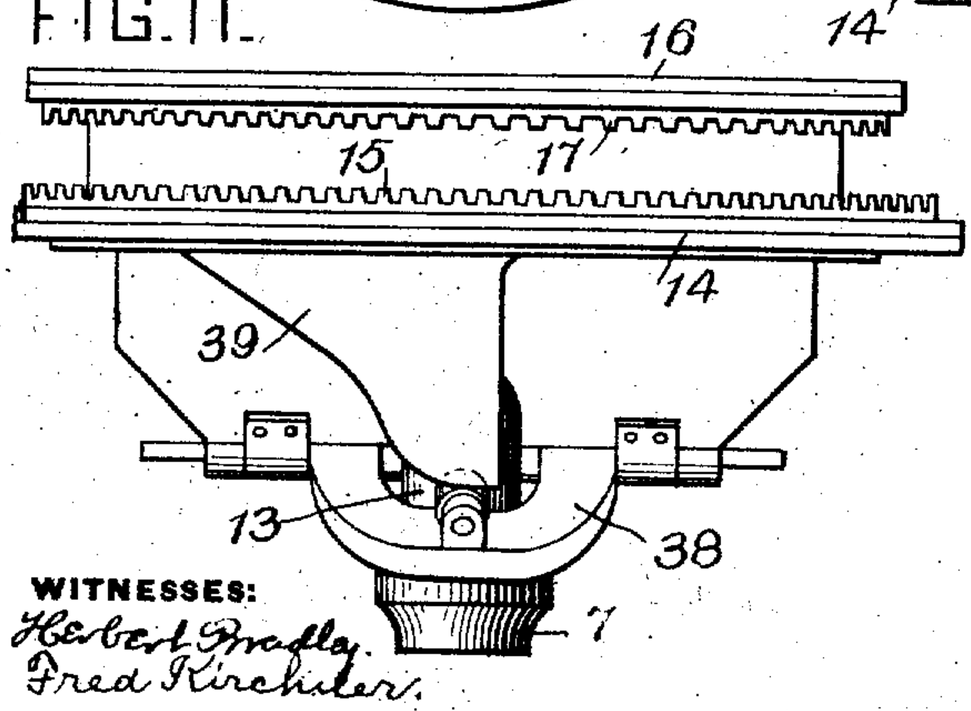
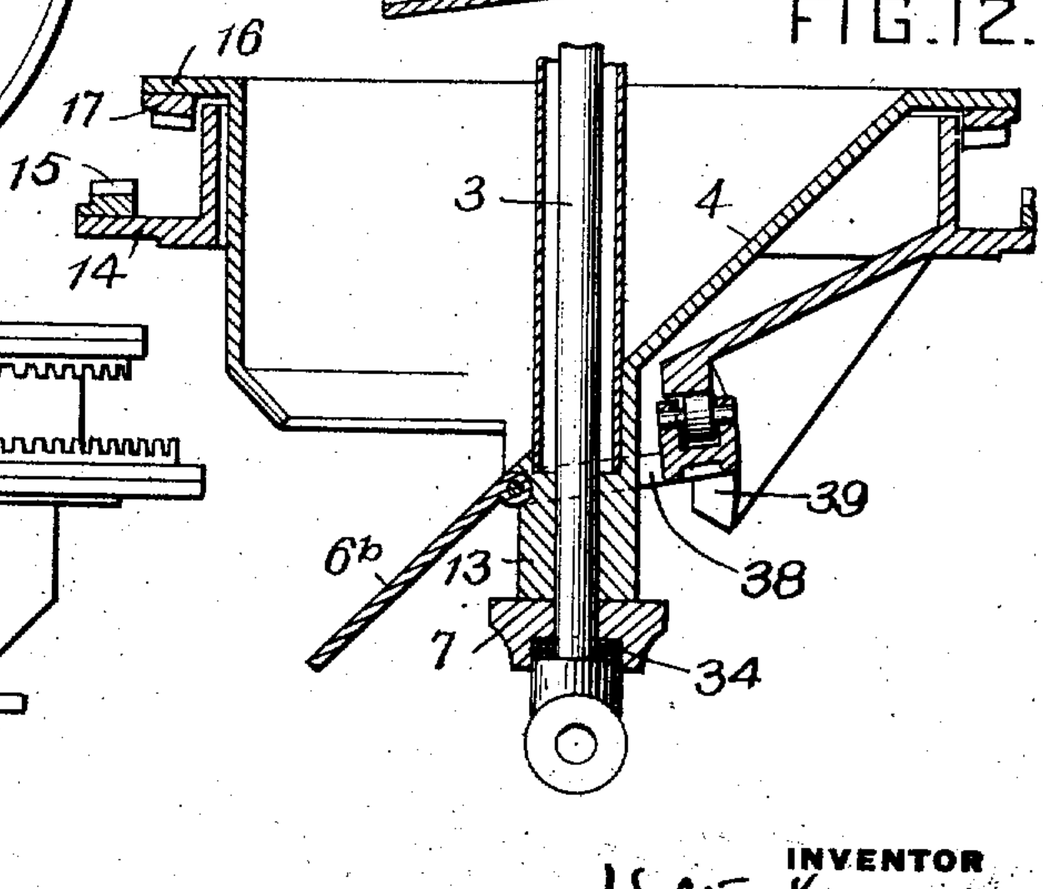


FIG. 12.



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4 SHEETS—SHEET 4.

FIG. 14.

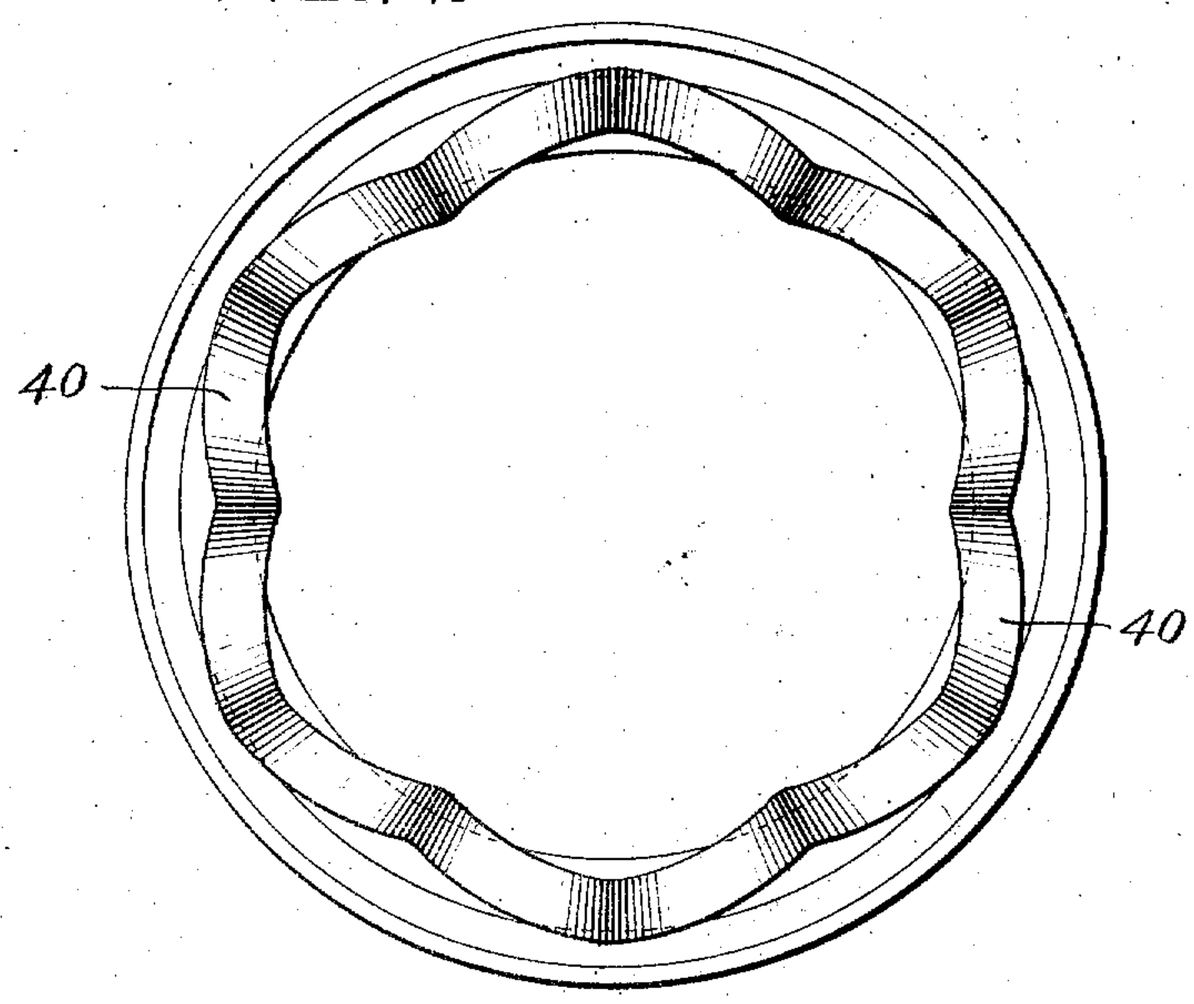
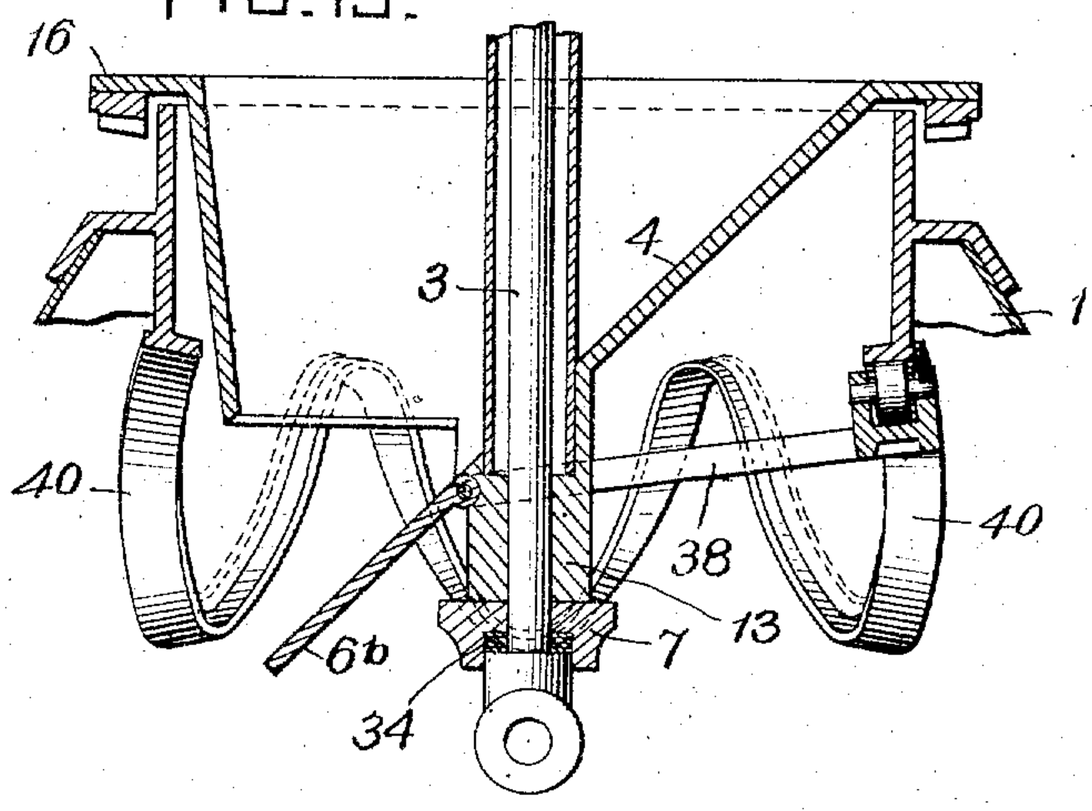


FIG. 13.



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UNITED STATES PATENT OFFICE.

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CHARGE-DISTRIBUTING APPARATUS FOR BLAST-FURNACES.

No. 868,346. Specification of Letters Patent. Patented Oct. 15, 1907.

Application filed May 4, 1904, Serial No. 206,397. Renewed July 6, 1905. Serial No. 268,558.

To all whom it may concern:

Be it known that I, WALTER KENNEDY, residing at Allegheny, in the county of Allegheny and State of Pennsylvania, a citizen of the United States, have invented or discovered certain new and useful Improvements in Charge-Distributing Apparatus for Blast-Furnaces, of which improvement the following is a specification.

The invention described herein relates to certain improvements in blast furnace charging mechanism, and has for its object a construction and arrangement of parts or elements whereby an even distribution of the ore, etc., onto the charging-bell may be effected so that the charge will on the lowering of the bell be regularly deposited within the furnace.

In most blast furnaces the cars carrying the material to the top of the furnace dump their contents into a hopper from one side of the same, and from this hopper the material passes into the main charging hopper where it is supported by the main bell. As the cars always dump from the same side or point, there will be a larger deposit of ore, etc., on one portion of the bell than at other parts, and as a consequence of this uneven distribution of the material on the bell, the material will pile up higher along one side of the furnace than the other, causing an uneven working of the latter. And further on account of the different momentum the lumps and finely divided ore received in passing from the car into the main hopper, there will be a separation of the lumps and finely divided ore, the latter being deposited on the side of the bell opposite that on which the lumps will drop. In order to overcome these difficulties in charging, a revolving trough has been employed, but it is found that when the trough is in the line of movement of the material from the car, the material then receives such impetus that it will pile up against the side of the hopper. But when the position of the trough is reversed so that the direction of movement of the material from the car is changed, the speed of movement is so reduced, that the material will pile up on the bell. It follows from this piling of the material partly against the side of the hopper and on the bell, that when the latter is lowered, the larger part of the charge will be deposited at one side of the furnace.

The invention described herein has for its object the deposition of the contents of each car at a different point upon the receiving bell without changing the point of discharge of the car.

The invention is hereinafter more fully described and claimed.

In the accompanying drawings forming a part of this specification Figure 1 is an elevation partly in section of the main hopper and charging-bell of the furnace having my improved distributing mechanism applied thereto; Fig. 2 is a view in top plan and section of my improved distributing mechanism; Fig. 3 is a view partly in elevation and partly in section of the distributing mechanism and its operating devices; Figs. 4 and 5 are detail views illustrating different constructions whereby the distributing mechanism may be raised and supported; Fig. 6 shows detail views of the pawl and ratchet mechanism forming parts of the mechanism for operating the distributer; Fig. 7 is a plan view illustrating a modification of the distributing mechanism; Fig. 8 is a sectional view of the construction shown in Fig. 7, the plane of section being indicated by the line VIII—VIII Fig. 7; Fig. 9 is a view in elevation of a portion of the construction shown in Figs. 7 and 8; Fig. 10 is a bottom plan view of a further modification of my improvement; Fig. 11 is a side elevation of the construction shown in Fig. 10; Fig. 12 is a sectional elevation on a plane indicated by the line XII—XII Fig. 10; Fig. 13 is an elevation partly in section of a further modification of my improvement and Fig. 14 is a bottom plan view of a portion of the construction shown in Fig. 13.

In the practice of my invention the main hopper 1 with its charging-bell 2 are constructed in the usual or any suitable manner, the bell being connected to an operating rod 3 extending up to a suitable lifting and lowering mechanism, as is customary.

A distributing hopper 4 is arranged within or directly in line with the mouth of the main hopper 1, said distributing hopper being provided with a sloping floor so that the material charged thereinto through the chute 5 [indicated in dotted lines] will flow or slide towards and through an opening formed in the side of the distributing hopper. This opening is designed to be closed by a door or shutter 6, which in the construction shown in Figs. 1 and 2, is made in the form of an inverted cone arranged below the distributing hopper, the latter being designed as hereinafter described to rotate within the shutter. The lower end of the shutter is supported by a block 7 carried by the lifting rod 3. In the construction shown in Fig. 1 this block or head on the lifting rod has a cone-shaped upper end and forms a bearing for a similarly shaped seat on a sleeve 8 surrounding the lifting rod. This sleeve is provided with a seat or shoulder 9 preferably having a groove therein for the reception of anti-friction rollers 10 on which a bearing-ring 11 in the lower end of the conical shutter is supported.

A divided disk 12 is secured around the sleeve 8, its inner periphery fitting within a groove in the sleeve. This disk serves as a support for the hub 13 formed on the distributer 4. As shown, it is preferred to provide an anti-friction bearing between the hub 13 and the disk 12 so that the distributing hopper can be easily rotated as hereinafter described. The upper end of the conical shutter is secured to or formed integral with a shifting ring 14 projecting over the edge

of the main hopper 1, and on this ring is secured a toothed rack 15.

The distributing hopper 4 is provided with a flange 16 projecting over the upper edge of the shutter and having secured thereto a toothed rack 17.

Pinions 18 and 19 secured respectively to shaft 20 and tube 21 engage respectively with the toothed racks 15 and 17.

A pinion 22 having disks 23 and 24 secured thereto is loosely mounted upon the shaft and sleeve, and is adapted to be rotated by a toothed rack 25 connected to the piston-rod of a fluid pressure cylinder 26.

As shown in Fig. 6 the disk 23 is provided with a notch adapted to engage a pawl 27 on a disk 28 keyed to the tubular shaft 20, while the disk 24 is provided with a notch adapted to engage the oppositely arranged pawl 29 on a disk 30 keyed to the shaft 21. By this construction an upward movement of the ratchet will rotate the tubular shaft 20, and with it the shutter 6 in one direction and the downward movement of the rack will rotate the shaft 21 in the opposite direction; but as the pinion 19 engages the rack on the distributing hopper on the under side of the same or the reverse of the arrangement of the pinion 18 and rack 14, the rotation of this distributing hopper will be in the same direction as the movement of the shutter.

When a charge of material is dumped into the chute 5 the opening in the distributing hopper will be closed by a solid portion of the shutter, and as soon as the charge has settled against this shutter, the rack 25 will be operated in such direction as to shift the shutter from in front of the opening in the hopper, thereby permitting the material to drop onto the bell. As soon as the material has passed from the distributing hopper, the rack 25 is operated in such direction as to shift the distributing hopper into the same direction as the previous movement of the shutter, thereby bringing the opening in the distributing hopper in line with the solid portion of the shutter, so that another charge of material can be dumped into the distributing hopper and then discharged onto the bell at a point distant from the point of deposition of the first charge, dependent upon the movement of the shutter and distributing hopper.

In Figs. 4 and 5 I have illustrated modifications of the manner of supporting the shutter and distributing hopper. In Fig. 4 the supporting block 7 is provided with anti-friction rollers 31 which support a carrying-block 32 provided with anti-friction rollers 33 supporting in turn the hub 13 on the distributing hopper.

In the construction shown in Figs. 1 and 4 the bearing block 7 will when raised by the lifting rod 3, carry the weight of the distributing hopper and its shutter, but when the bell is lowered the shutter will be supported by the main hopper, its flange resting upon the edge of such hopper and the distributing hopper will be supported by the upper edge of the shutter.

In order to compensate for wear on the bearing surfaces of the shutter and distributing hopper, liners 34 are interposed between the bearing block and the head of the lifting rod 3 so that when the bell is seated, the distributing hopper and shutter may be lifted out of contact with each other and supported solely by the anti-friction bearings.

In the construction shown in Fig. 5 the lower end of the shutter rests upon the bearing block 7 and the hub 13 is extended through an opening in the lower end of the shutter so as to rest upon the same block.

In order to avoid any difficulty which might arise in opening the shutter by reason of the load resting thereupon, I have provided a vertically arranged shutter as shown in Figs. 7, 8 and 9. As shown therein the distributing hopper is constructed with a vertical wall 35 in which is formed the discharge opening. This opening is adapted to be closed by a solid vertically arranged shutter 6^a. As clearly shown, this shutter is secured to or formed integral with the ring 14, and at its lower end is connected by a web 37 extending from the hub of the shutter. In order to strengthen these parts, a series of arms extend from the hub to the ring 14. As shown in Fig. 8 this shutter 6^a is made eccentric or with an outward curvature so that when it is shifted the pressure of the load against its inner face will tend to force it in the same direction, or in other words, the shutter moves away from the charge of material bearing against its inner surface.

In the construction shown in Figs. 10, 11 and 12, the shutter is made in the form of a hinged door 6^b pivotally connected to the hub 13 of the distributing hopper, and adapted to be shifted as hereinafter described so as to prevent the flow of material from the distributing hopper until the door is lowered. This door is provided with an arm 38 carrying at its end an anti-friction roller adapted to bear against a cam surface 39 carried by the ring 14. After the material has been charged into the distributing hopper, the cam is shifted to the left in Fig. 11, thereby permitting the door to drop, and the material to slide onto the bell. The distributing hopper is next shifted in the same direction, thereby causing the arm 38 to travel along the cam surface 29 and close the door so that the hopper may receive another charge.

In the construction shown in Figs. 13 and 14, the door 6^b is pivoted as before stated to the hub of the distributing hopper and the arm 38 with its anti-friction roller bears upon a continuous serpentine track 40. By this construction only the distributing hopper itself is shifted to open and close the door. When the arm 38 bears against one of the lower apices of the track the door will be closed so that a charge may be deposited in the distributing hopper, which is then shifted, thereby permitting the door to drop and discharge the load. By a further movement of the hopper the door will be again closed so that a new charge may be placed in the hopper.

I claim herein as my invention:

1. In an apparatus for charging blast furnaces the combination of a main or charging hopper, a distributing hopper, means for rotating the distributing hopper relative to the main or charging hopper whereby material contained therein may be discharged at different points in the main hopper, a shutter controlling the flow of material from the distributing hopper and means for shifting the shutter, substantially as set forth.

2. In an apparatus for charging blast furnaces, the combination of a main or charging hopper, a distributing hopper, means for rotating the distributing hopper relative to the main or charging hopper whereby material contained therein may be discharged at different points in the main hopper, a shutter and means for shifting the shutter independently of the distributing hopper, substantially as set forth.

3. In an apparatus for charging blast furnaces, the combination of a main or charging hopper, a distributing hopper having a discharge opening, means for rotating the distributing hopper relative to the main or charging hopper, whereby material contained therein may be discharged at different points in the main hopper, a shutter and means for shifting the shutter into alinement with the opening in the distributing hopper, substantially as set forth.

4. In an apparatus for charging blast furnaces, the combination of a main or charging hopper, a distributing hopper, means for rotating the distributing hopper relative to the main or charging hopper, whereby material contained therein may be discharged at different points in the main hopper a shutter, and means for shifting the shutter to operative position with relation to the distributing hopper, substantially as set forth.

5. In an apparatus for charging blast furnaces, the combination of a main or charging hopper, a bell controlling the flow of material from said hopper, a bell supporting rod, a distributing hopper and a shutter therefor rotatably mounted on said rod, and means for shifting the distributing hopper and shutter independently of each other, substantially as set forth.

6. In an apparatus for charging blast furnaces, the combination of a main or charging hopper, a distributing hopper, a shutter, a reciprocating mechanism and connections from the mechanism to the hopper and shutter, whereby said parts are shifted alternately in the same direction, substantially as set forth.

7. In an apparatus for charging blast furnaces the combination of a main or charging hopper, a distributing hopper, means for rotating the distributing hopper relative to the charging hopper whereby material contained in the distributing hopper may be discharged at different points in the main hopper, a shutter having the portion controlling the discharge from the distributing hopper inclined to the path of movement of the shutter and means for shifting the shutter independent of the hopper, substantially as set forth.

8. In combination with a furnace provided with a receiving chamber communicating with its interior, a closure for the bottom of said chamber, said closure being movable relatively to the chamber to open and closed positions, respectively, and adapted when open to direct the contents of the chamber to the side and means for shifting said closure relatively to the chamber on a vertical axis to vary the point of discharge.

9. The combination of a stationary main hopper, a bell for closing said hopper, a distributing hopper located above the main hopper, means for controlling the discharge from the distributing hopper into the main hopper and means for rotating the distributing hopper.

10. In a blast furnace charging apparatus, the combination of a main hopper and bell, a distributing hopper provided with means intermediate of the receiving and discharging points constructed to permit the passage of material beyond it at one point, means for varying the position of such point and means for controlling the discharge of material from the distributing hopper.

11. In a blast furnace charging apparatus, the combination of a main hopper and bell, a receiving hopper, charge-distributing means, movable horizontally relative to the receiving hopper and adapted to direct the material received from the receiving hopper to different points in the main hopper.

12. In a blast furnace charging apparatus, the combination of a main hopper and bell, a receiving hopper, means movable relative to the receiving hopper and adapted to direct the material in its passage from the receiving hopper, and mechanism for shifting such distributing means around the axis of the receiving hopper, whereby any desired distribution of the material in the main hopper may be effected.

13. In an apparatus for charging blast furnaces, the combination of a main hopper, a receiving hopper, having a discharge opening, and means interposed between said hoppers for controlling the flow of material from the receiving hopper and directing it to any point in the main hopper, whereby a substantially even distribution of the material in the main hopper may be had, substantially as set forth.

14. In an apparatus for charging blast furnaces the combination of a main hopper, a receiving hopper, a distributing hopper arranged between the main and receiving hoppers and having an eccentric discharge opening, means for regulating the discharge of material from the distributing hopper and means for so shifting the point of such discharge that the material may be deposited at several points successively into the main hopper, substantially as set forth.

15. In an apparatus for charging blast furnaces, the combination of a main hopper, a receiving hopper, a distributing hopper arranged between the main and receiving hoppers and having an eccentric discharge opening, a shutter controlling the movement of material from the distributing hopper and means for moving the shutter horizontally independently of the distributing hopper, substantially as set forth.

In testimony whereof, I have hereunto set my hand.

WALTER KENNEDY.

Witnesses:
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FRED KIRCHNER.