United States Patent [19]

Brown

[11] **3,881,663**

[45] **May 6, 1975**

[54] **ROLL MILL FOR FLAKING GRAIN AND THE LIKE**

[76] Inventor: **Andrew M. Brown,** 4535 E. 6th Ave., Denver, Colo. 80220

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[21] Appl. No.: **442,462**

[52] **U.S. Cl.** ..... **241/225;** 222/410; 241/227; 241/285 R

[51] **Int. Cl.** **B02c 11/04;** B02c 4/38

[58] **Field of Search** ..... 241/284, 285, 287, 230, 241/232, 285 R, 285 A; 222/410; 308/34

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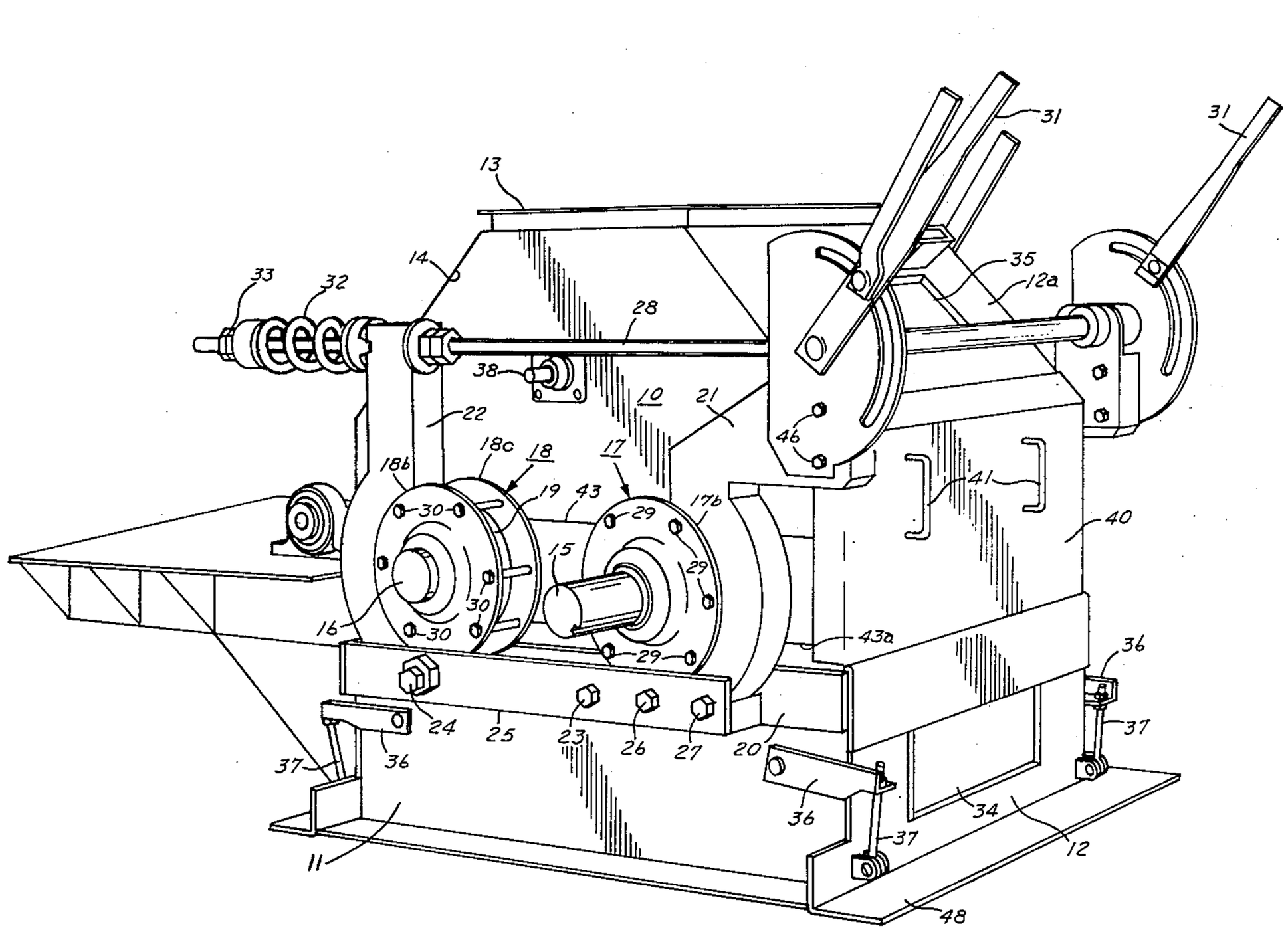
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Primary Examiner—Roy Lake
Assistant Examiner—Howard N. Goldberg
Attorney, Agent, or Firm—Wm. Griffith Edwards

[57] **ABSTRACT**

A heavy duty roller mill for flaking feed grain and the like comprises a housing for enclosing a pair of heavy rollers and auxiliary equipment such as a steaming chamber. A flexible curved plate grain flow controlling gate is mounted in the housing above the rolls. The plate is adjusted by bending effected by cam pressure. The housing is provided with a pair of horizontal slots in its side walls and a structural frame for carrying the rollers mounted in their bearing assemblies. The slots open toward one end of the mill and a removable door is provided to afford movement of the rolls into and out of position in the housing. During operation of the mill the slots are closed by removable closure plates. Readily released pivotal arms are provided for retaining the bearing assemblies in operative positions. Upon release of the bearing assembly retainers and removal of the door and the slot closure plates the rolls may roll outside the cabinet without disturbing the flow control, the steaming chamber or other equipment. A track extension is provided to support the rolls in position outside the housing.

8 Claims, 10 Drawing Figures



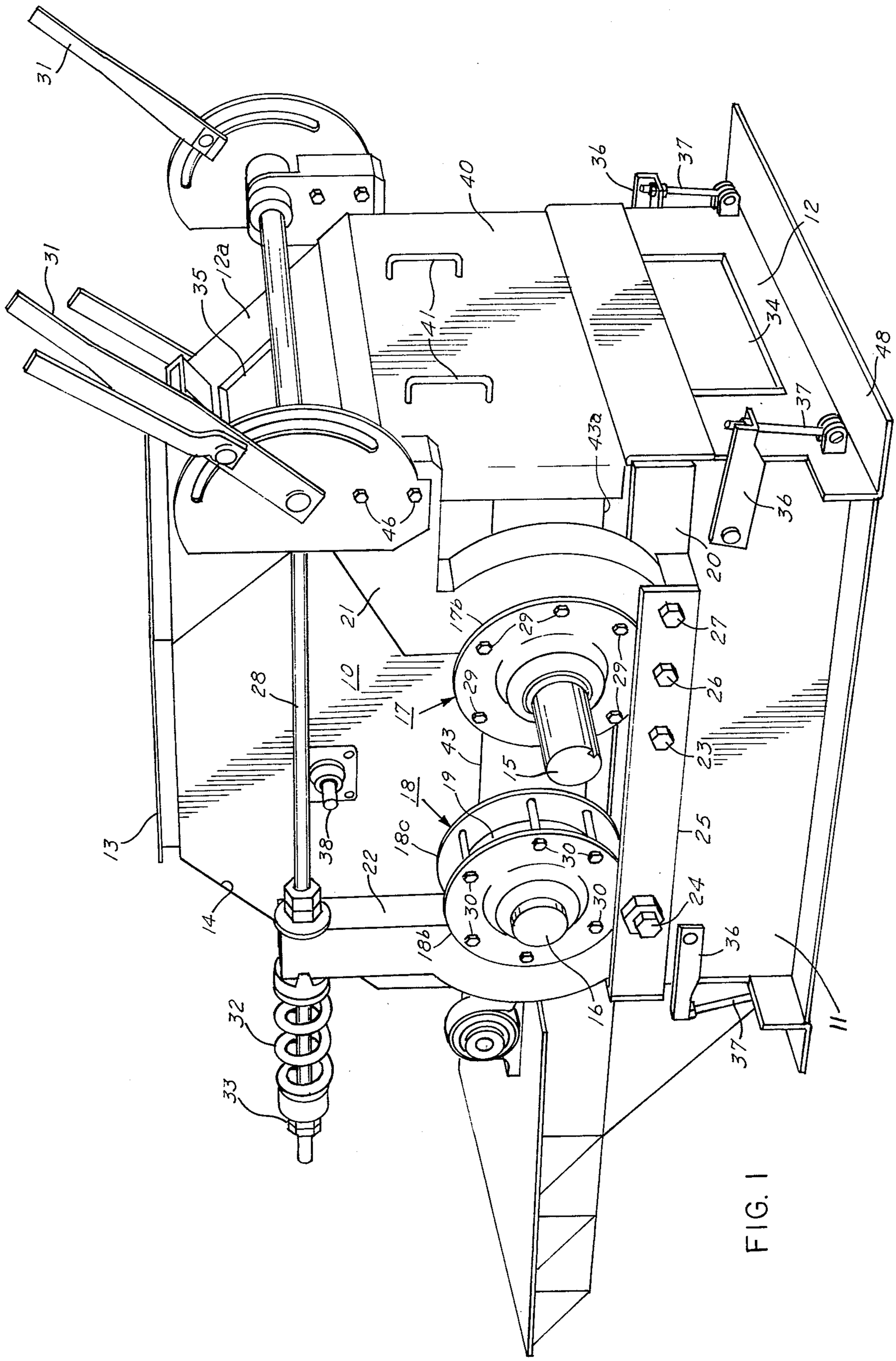

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FIG. 1

FIG. 2

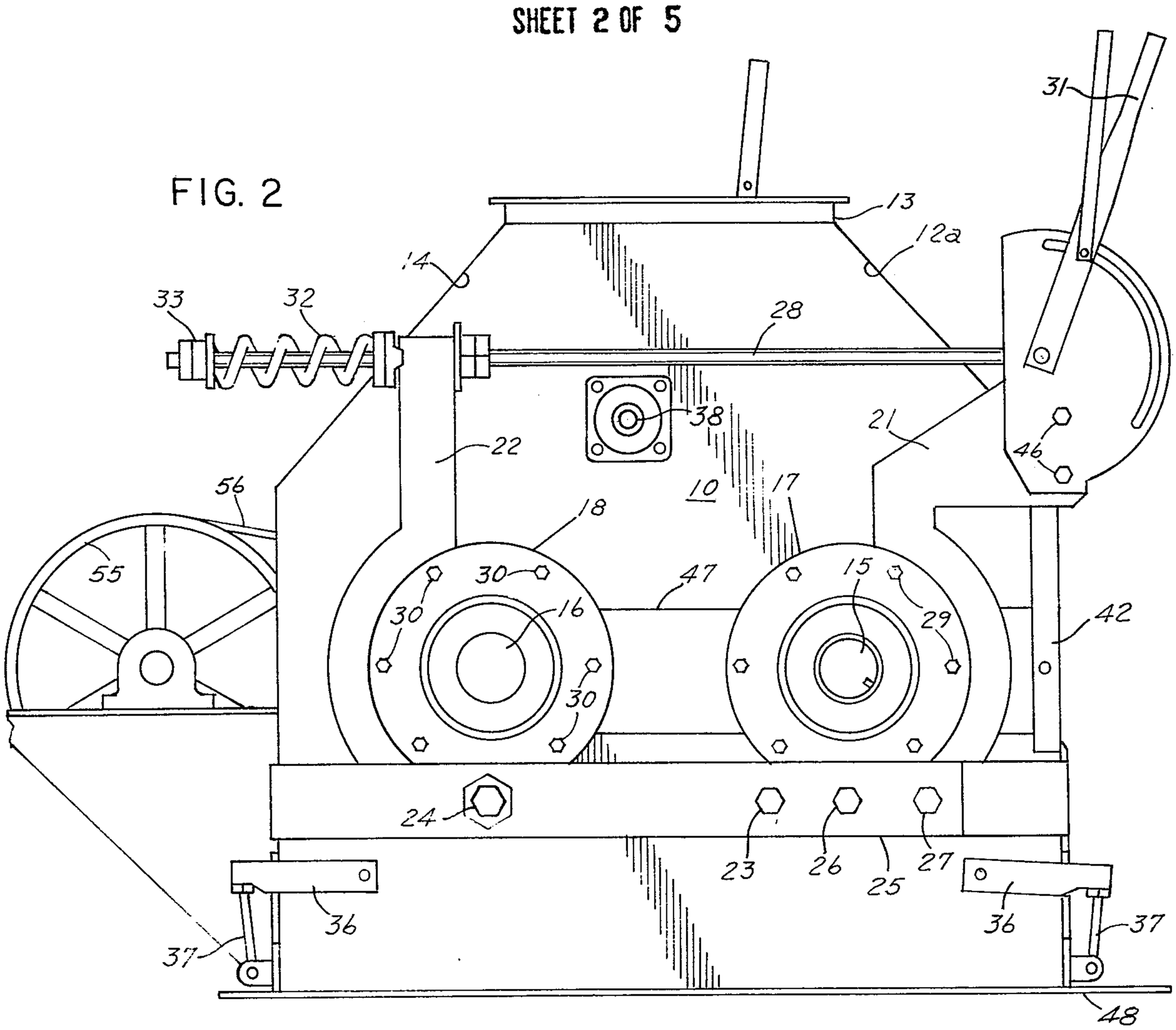
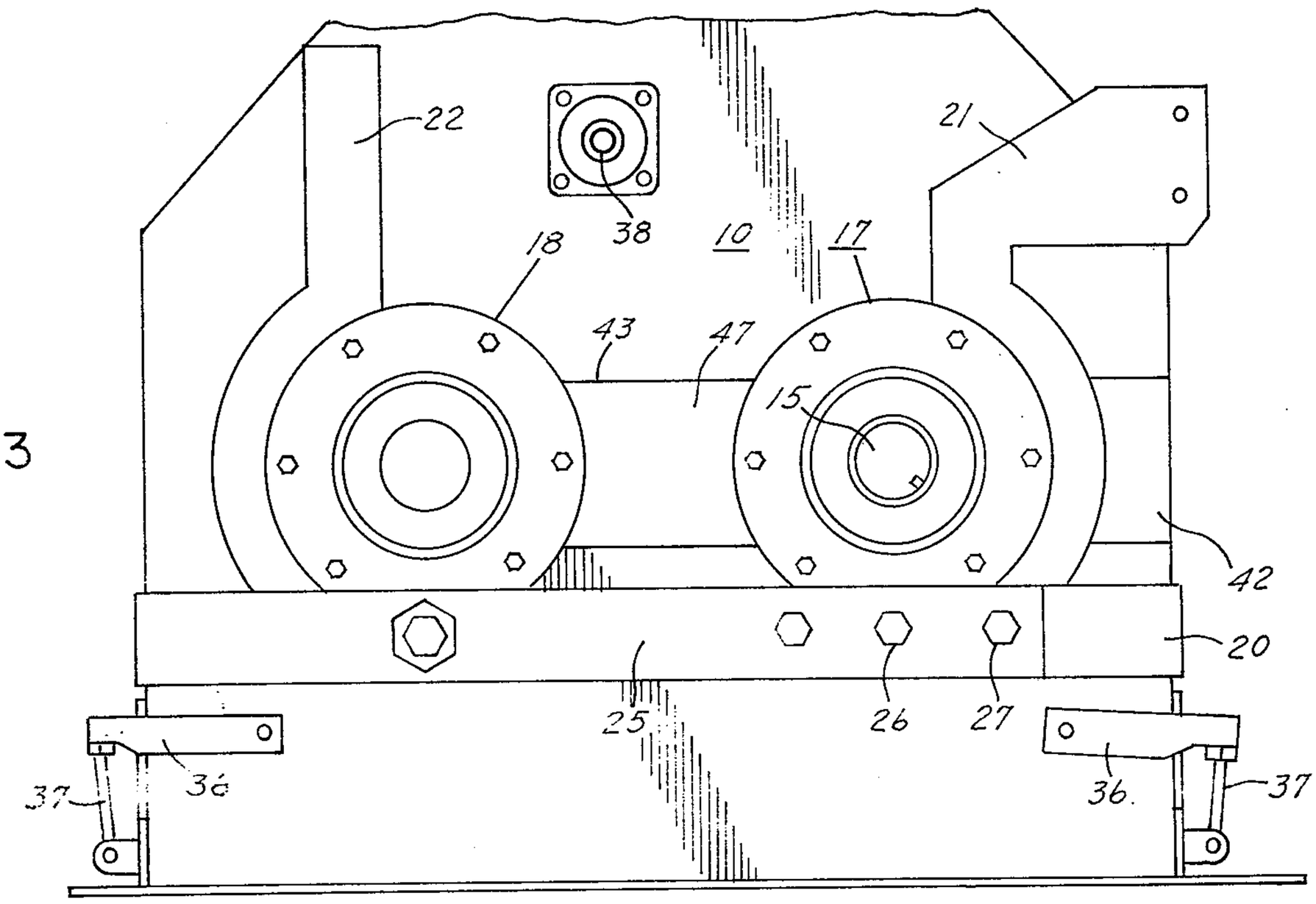

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FIG. 3


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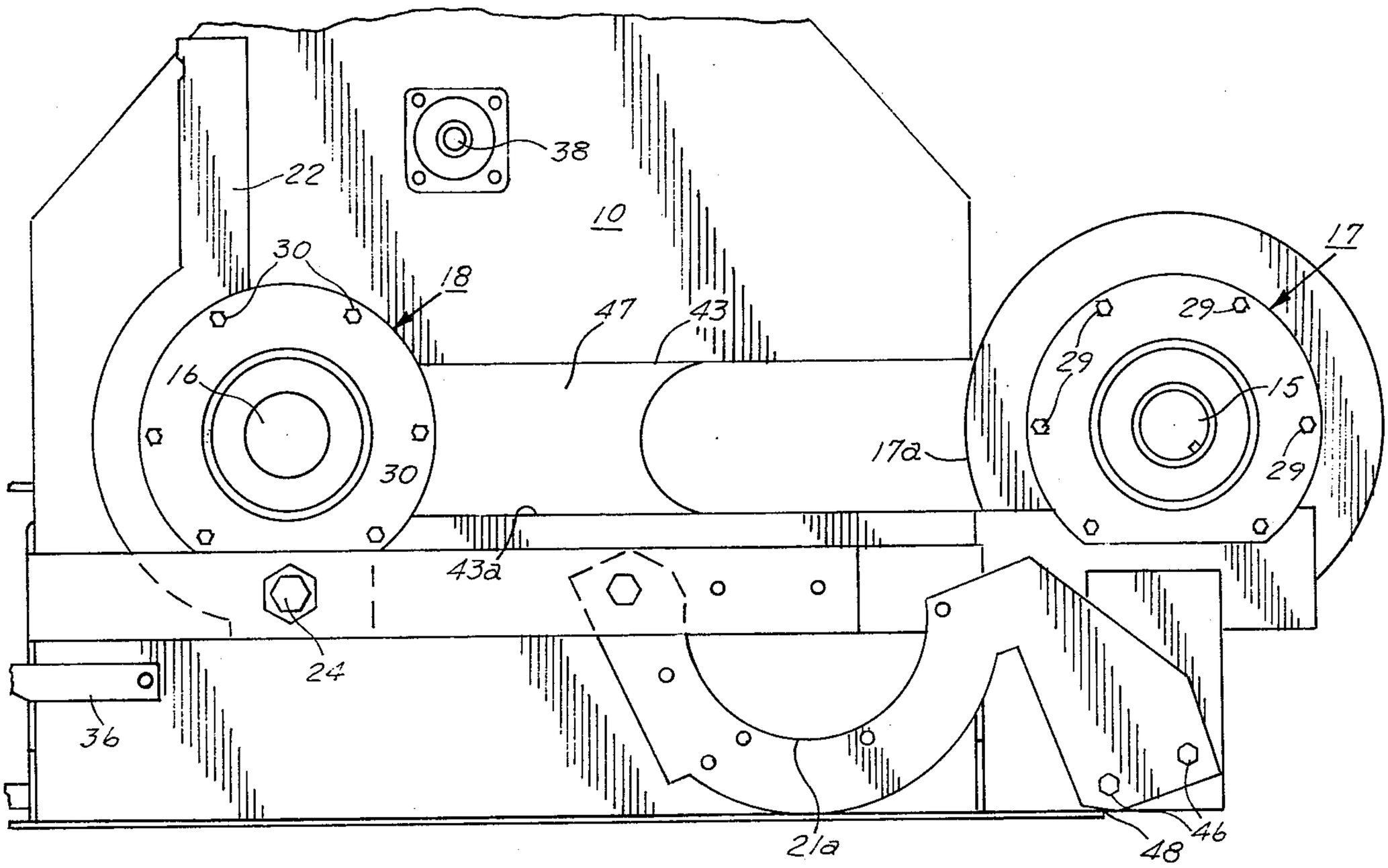

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FIG. 4

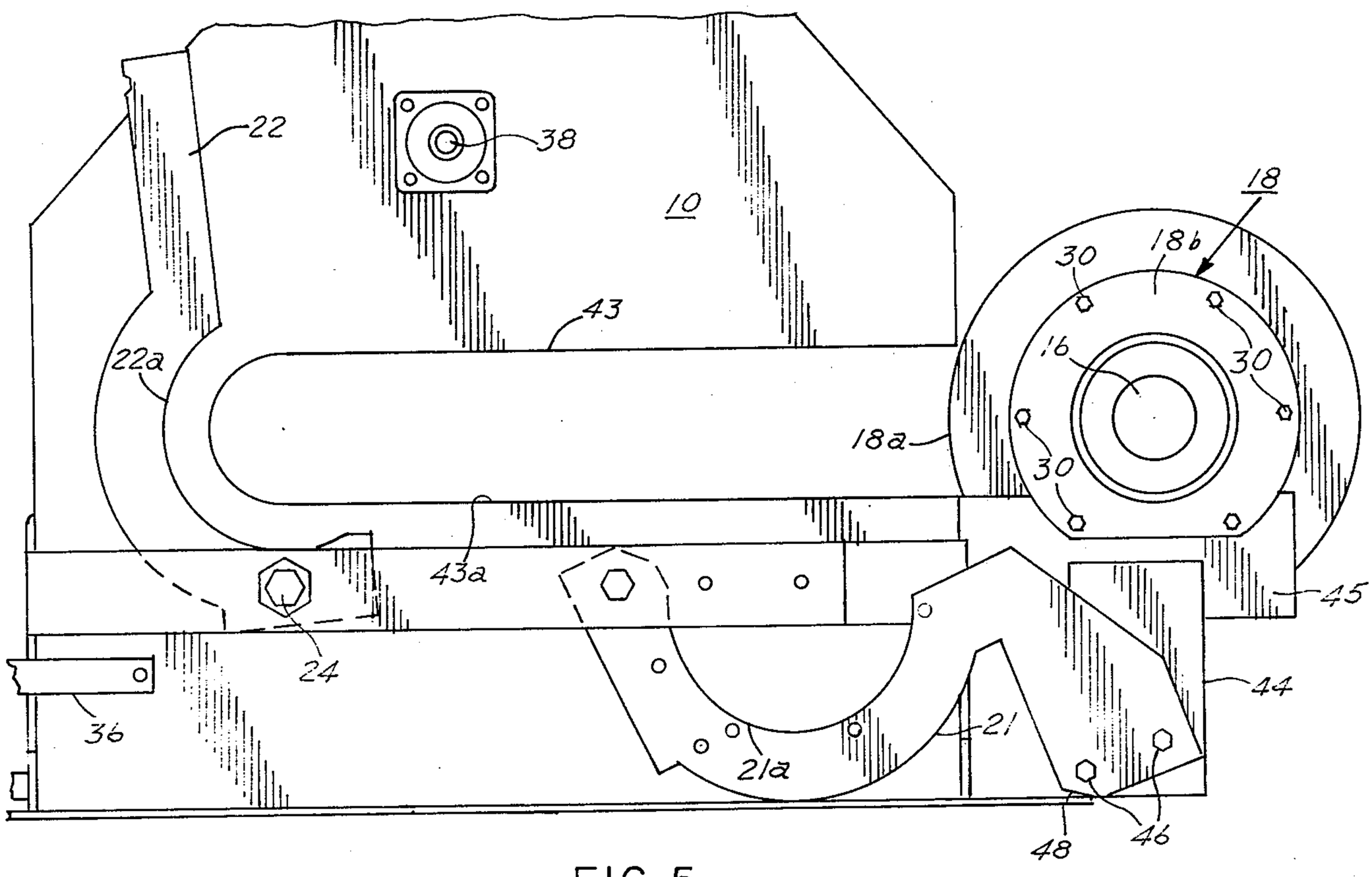

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FIG. 5

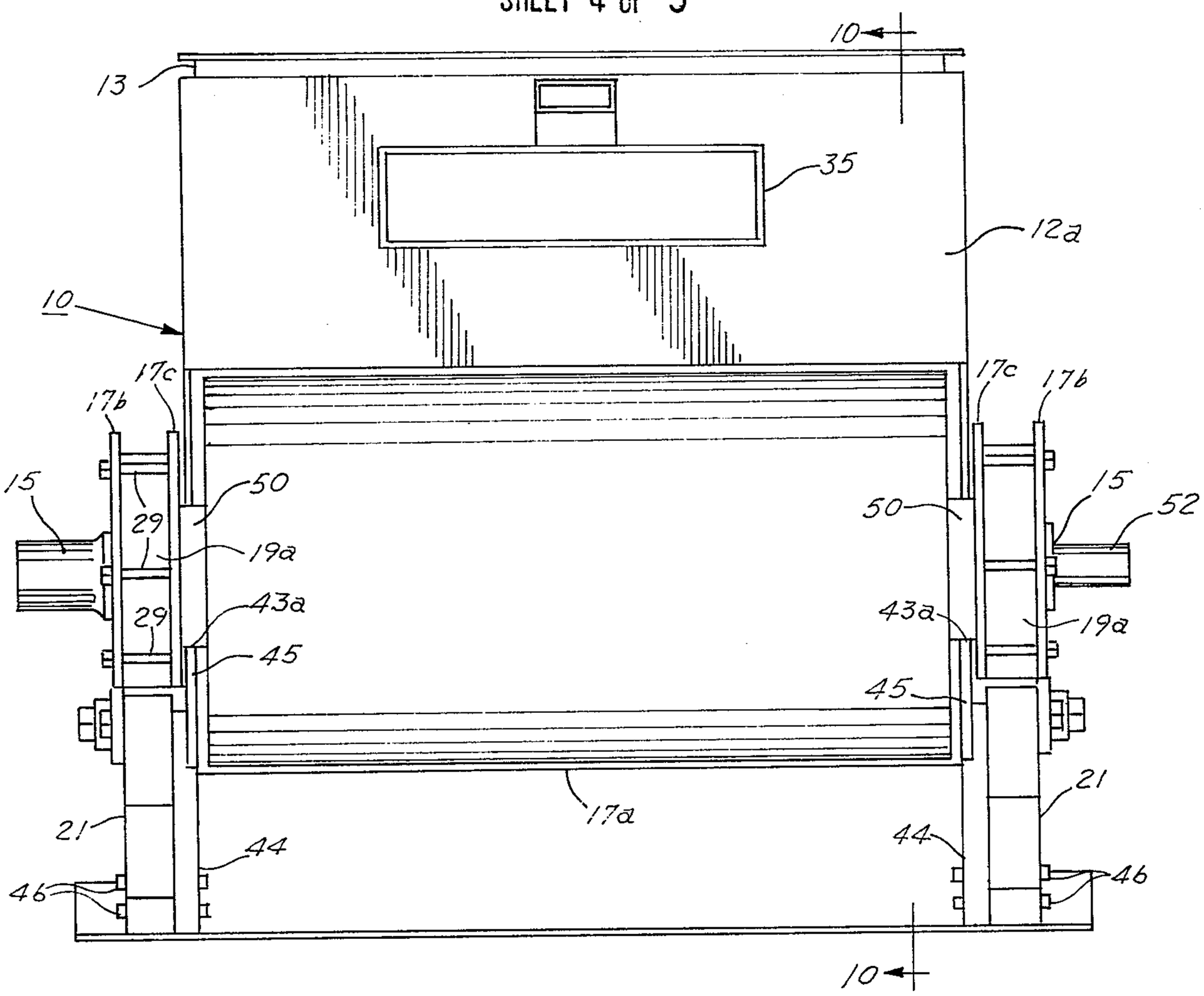


FIG. 6

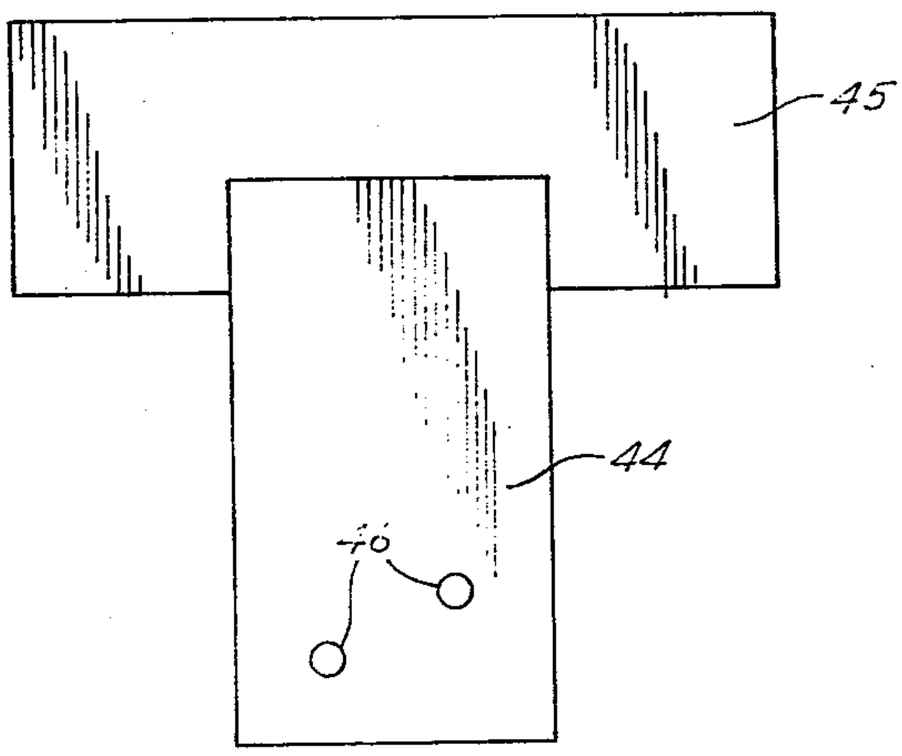


FIG. 7

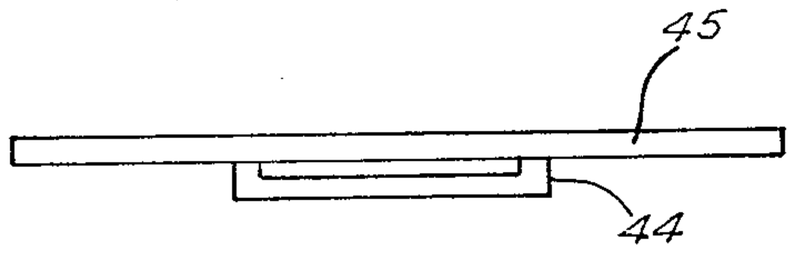


FIG. 8

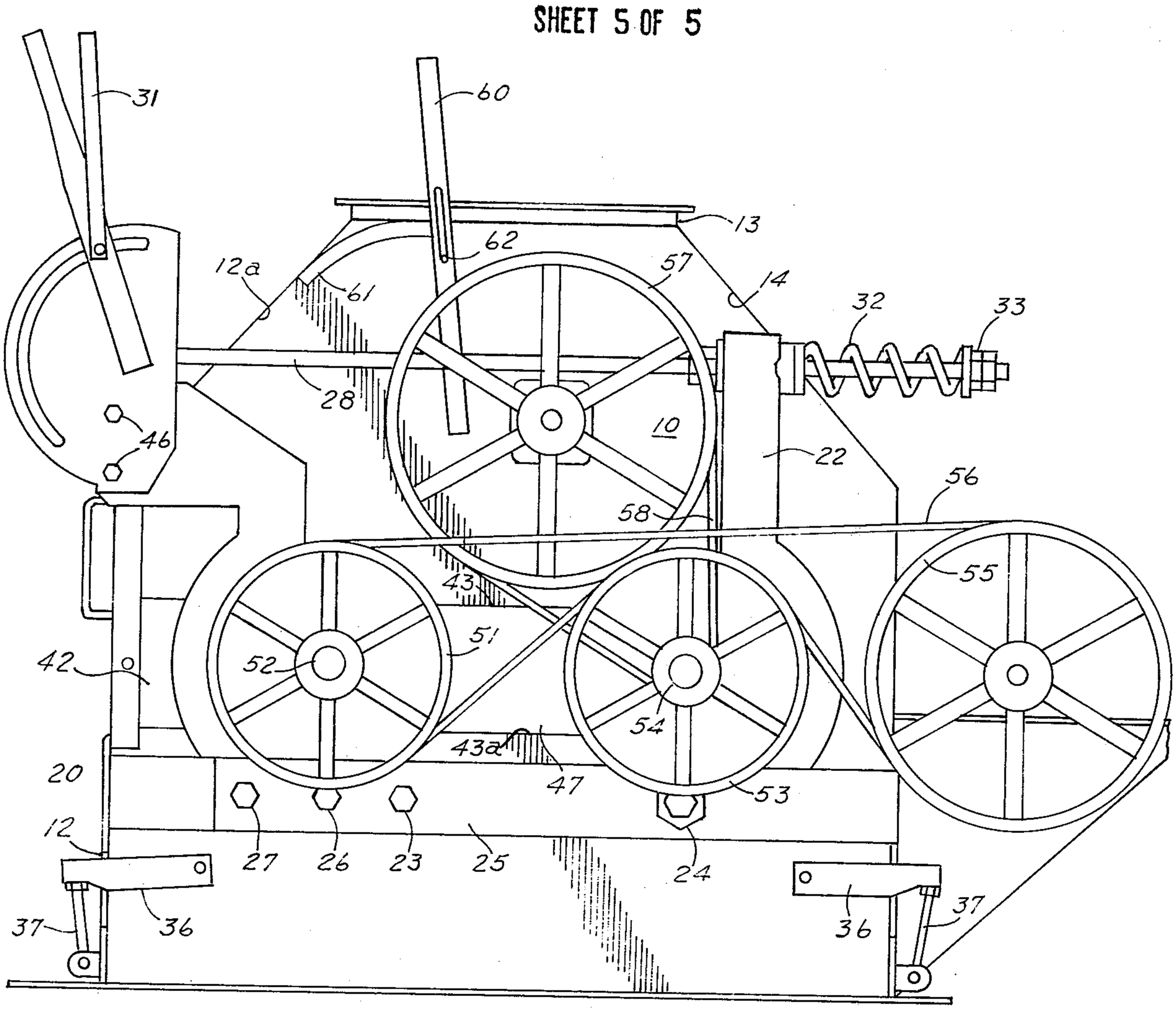
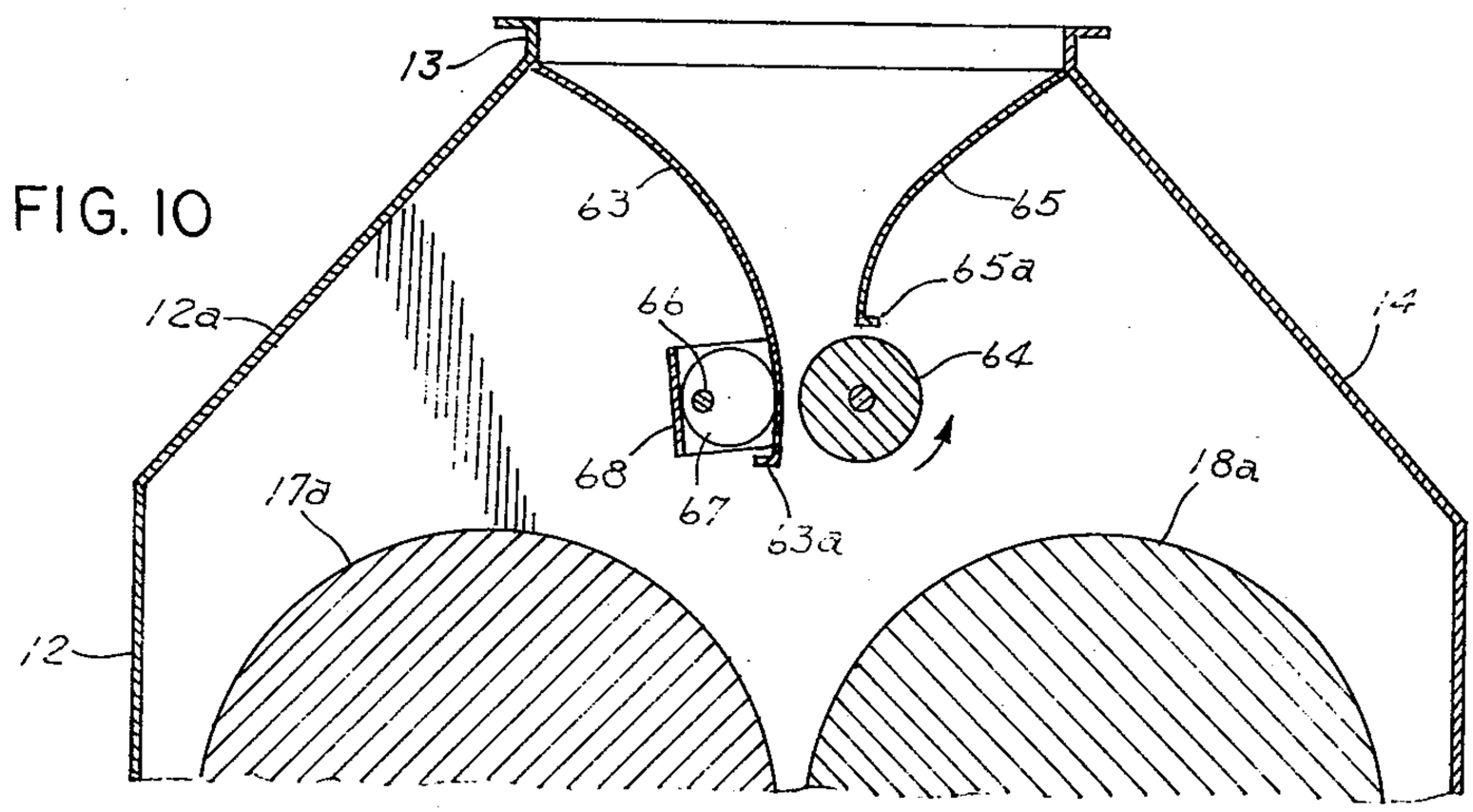

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FIG. 9

FIG. 10


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18a
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ROLL MILL FOR FLAKING GRAIN AND THE LIKE

My invention relates to heavy duty roller mills for flaking grain and the like and particularly to improved structural arrangements of the rolls and the grain feeding control.

Roll mills for flaking cattle feed grain and the like commonly comprise a pair of heavy mill rolls which may weigh around one ton each, together with grain supplying and steaming equipment. The removal of the rolls for servicing is necessary from time to time and requires that the mill be dismantled sufficiently to afford access for lifting the rolls and removing them. This requires removal of feed control equipment and steaming chamber and other auxiliary apparatus. Substantial lost operating time is thus required for each servicing of the rolls. Accordingly it is an object of my invention to provide a heavy duty roll mill or the like including an improved arrangement for removing the rolls for servicing, repair or replacement.

It is another object of my invention to provide a roll mill for flaking grains and the like including an improved arrangement for removing and re-installing the rolls.

It is another object of my invention to provide an improved grain feeding control of simple and rugged construction for roll mills and which affords lateral removal of the rolls without adjustment or removal of the control.

The features of my invention which I believe to be novel are set forth with particularity in the appended claims. My invention itself, however, both as to its organization and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawings in which:

FIG. **1** is a perspective view of a flaking mill embodying my invention;

FIG. **2** is a side elevation view of the mill of FIG. **1**;

FIG. **3** is a side elevation similar to FIG. **2** with the roll tensioning assembly removed;

FIG. **4** is a side elevation as in FIG. **3** with the front roll in position outside the mill housing;

FIG. **5** is a side elevation view similar to FIG. **4** with both rolls removed;

FIG. **6** is a front elevation of the mill in the position of FIG. **4**;

FIG. **7** is an enlarged side elevation of a part of the mill as shown in FIGS. **4** and **6**;

FIG. **8** is a top plan view of the part of FIG. **7**;

FIG. **9** is a side elevation of the mill on the side opposite that of FIG. **2**; and,

FIG. **10** is a partial sectional elevation view taken along the line **10—10** of FIG. **6**.

Referring now to the drawings, the roll mill illustrated in FIGS. **1** and **2** comprises a housing **10** of generally rectangular configuration and including side walls, one of which is indicated at **11** and front and rear walls, the front wall being indicated at **12.** The side walls extend upwardly to an attaching flange **13** and the front and rear walls are sloped toward the flange as indicated at **12***a* and **14.** When the mill as illustrated in FIGS. **1** and **2** is installed for operation the steaming chamber (not shown) for steaming the grain and facilitating the flaking thereof is mounted on top of the housing **10** in engagement with the flange **13.** The heavy duty dual roll mill comprises front and rear mill

rolls mounted on shafts **15** and **16,** respectively, the shafts being carried in front and rear bearing assemblies **17** and **18,** respectively. The rollers are carried on the walls of the housing and longitudinal structural members **20** are provided for facilitating the mounting of the bearing assemblies in position.

The bearing assemblies **17** and **18** are carried in bearing retainer arms **21** and **22** respectively, these arms being pivotally mounted on the housing on bolts or pins **23** and **24** which are securely mounted in the supporting structure including the member **20** and a longitudinal reinforcing member **25** which is suitably secured to the housing wall by welding or bolting or otherwise. The bearing assembly **17** is held rigidly in position by additional bolts **26** and **27** secured in a longitudinal members **20** and **25** after the retainer arm **21** is in position in engagement with the assembly **17.**

The bearing assemblies **17** and **18** have cylindrical body portions, this portion of the assembly **18** is indicated at **19** in FIG. **1.** These assemblies include inner plates **17***b* and **18***b*, respectively and outer plates **17***c* and **18***c*, respectively. The inner and outer plates of the assembly **17** and **18** are secured together against the respective cylindrical body portions by sets of six bolts **29** and **30,** respectively. The cylindrical portions fit in circular or cylindrical seats in the arms **17** and **18**; these seats are shown at **21***a* and **22***a* in FIG. **5.** When installed on the retainer arms three of the bolts of each set pass through the arm to secure the bearing assemblies rigidly in position on their respective arms. These three bolts are removed when the mill rolls are to be moved out of the housing for servicing and the bearing assemblies must be released from the retainer arms.

When securing the retainer arms **21** and **22** in position to hold the rolls in operating relationship, the arms **21** are first moved into their upright positions and bolted therein and the bearing assemblies are bolted to the arms. The front and rear arms **21** and **22** are then clamped in position by the tension bars **28,** one on either side of the housing, and which are attached to the retainer arms **21** and **22** at their upper ends. The arms are drawn together by operation of handle **31** which apply tension to the rods **28** against the pressure of compression springs **32** mounted on the far side of the retaining arm **22** and of the retainer **21** and which may be adjusted by nuts **33.** Inspection doors are provided in the front wall **12** in the lower portion of the front wall indicated at **34** and another in an inclined portion **12***a* in the front wall indicated at **35.**

Scraper bars (not shown) are provided within the housing **10** below the rolls for clearing the product from the rolls. These bars may be adjusted by pivoted arms **36** by moving the positions of these arms with respect to pivoted or swinging posts **37.** A suitable feed roll and flow control described below is provided in the path of the grain supplied to the rollers and is driven by a feed roll drive shaft **38.** The drive shaft **38** and the shafts **15** and **16** are connected to be driven by suitable motor or engine (not shown) through the shaft **15** which extends outwardly a substantial distance and has a keyway for securing a drive pulley or coupling (not shown). A suitable reversing drive such as a serpentine double V-Belt or reversing sheave drive as described below is provided on the opposite side for driving the rolls in opposite directions of rotation.

During the operation of the mill when roll replacement repair or servicing is required it has heretofore

been necessary to dismantle the mill structure in order to gain access to the rolls so that they may be lifted out of their positions therein. In order to avoid long shut-down periods during servicing, repair or replacement, the present invention provides an improved arrangement whereby the rolls may be moved out from the housing without dismantling the grain feed control, the steaming chamber or other equipment mounted on the housing and without dismantling the housing. For this purpose the housing frame members including the members **20** have been constructed and arranged so that the rolls may be moved outwardly along side wall portions as tracks and may be removed through a front door or panel **40** which is detachable and removable. The door **40** is provided with handles or hooks **41** by which the door may be lifted and moved aside. When it is desired to remove the rolls, the tension rigging including the tension bars **28** and the mounting assemblies for the handle **31** are removed whereupon the mill appears as shown in FIG. **3.** Bolts **26** and **27** are then removed and the bearing retainer arm **21** is rotated clockwise downwardly to a position as shown in FIG. **4.** An enclosure plate **42** mounted in the front portion of a slot **43** extending longitudinally of the housing and opening toward the front is removed and a track extension member comprising an upright column **44** and a transverse member **45** is attached to the outer end of the arm **21** by bolts **46** which extend through holes also used for attaching the assembly for the handle **31.** The horizontal member **45** when positioned with the arm **21** in its bottom position lies with its top edge constituting a continuation of the horizontal structural member or track **20** and this provides an extended track along which the front roll, indicated at **17***a*, may be rolled out with the bearing assemblies remaining in place thereon at both ends. It will be understood that the arms **21** and **22** have counterparts on the opposite side of the housing for retaining the bearing assemblies on the opposite side of the housing and that the reinforcing plates **20** and slot **43** are also duplicated on the opposite wall of the housing. The bearing assemblies and their positions on the housing also can be seen in FIG. **6** which is a front view of the housing with the door **40** removed as shown in FIG. **4.** The closure plates **42** are securely attached in any suitable manner to the housing wall and provide an opening adjacent the bearing assemblies when in position which is somewhat elongated and affords slight movement of the rolls therein. However, the bearing assembly also closes the opening adjacent the assembly so that the housing is effectively closed when the plate is in position. A second plate **47** is provided between the two bearing assemblies and closes the central portion of the slot **43.** After this plate has been detached from its position in the slot **43,** the second roll, indicated at **18***a*, may be rolled out along the tracks indicated at **43***a* and which are provided by the bottom edges of the slot **43,** and then along the extension **45.** As shown in FIGS. **4** and **5,** when the retainer arm is in its down position its end rests against a flange **48** of the base of the housing and when in this position locates the track **45** in alignment with the horizontal slot track **43***a*.

During normal operation of the rolls the shaft and bearing assemblies are out of contact with the track **20,** a slight lifting of the assemblies from the track being effected by rotating or arcuate movement of the arms **21** and **22** into their upright positions. The rolls are lowered into engagement with the tracks upon release of the tension rods **28** which allows the arms **21** and **22** to rotate out of their upright positions. The front roll on the shaft **15** may be removed from the track **46** and the second roll moved forward along the track **43***a* to the track **46** for similar removal. It will thus be seen that heavy rollers which may have weights of the order of 2,000 pounds each may thus be moved out from the mill housing without disturbing any of the structure above the rollers, and dismantling of the mill is therefore not necessary for roll servicing purposes.

When the rolls **17***a* and **18***a* are to be returned to their operating positions, the rear roll **18***a* is first placed upon the extended track **40** and is rolled back into position, the arms **22** being brought up to receive the bearing assemblies **18** which are then bolted to the assemblies by three of the bolts **30.** Plates **47** are then returned to their positions in the slot **43** and are secured to the housing wall, and the front roller **17***a* is placed on the tracks **45** and rolled back into position along the horizontal slot tracks **43***a*. The track extension members **44** are then removed from the arms **21** and the arms are rotated upwardly into position about the bearing assemblies and are pressed to their upright positions thus lifting the roll **17***a*. Bolts **26** and **27** as well as the three bolts **29** are secured to firmly attach the retaining arms **21** to the bearing assemblies and in their operating positions. The tension assembly is then re-installed and the arms are drawn together to bring the bearing assemblies **18** also into their required slightly raised operating positions wherein the roll **18** is free from enagagement with the horizontal slot track **43***a*.

The end view, FIG. **6,** shows the roller **17***a* in the same position on the end supports **45** as shown in FIG. **4.** The shaft **15** includes the left hand extension for coupling to the driving motor and carries the bearing assembly **17** in position adjacent the housing **10.** The shaft **15** has enlarged portions **50** which rest on the tracks formed by the edge of the housing adjacent the horizontal slots **43.** It is this portion **50** which rides on the housing track **43***a* and then moves out onto the track extension **45** on which the roll is resting in FIG. **6.** The tension riggings including the bars **28** and the driving mechanism for rotating the rolls in opposite directions do not appear in FIG. **6** because these parts of the mill have been removed for the purpose of removing the rolls.

The mechanism for rotating the two rolls **17***a* and **18***a* in opposite directions and for driving the feed roll is shown in FIG. **9.** The so-called "serpintine drive" for effecting opposite rotation of the two rolls includes a V-belt drive pulley wheel **51** mounted on a reduced shaft portion **52** which is an extension of the shaft **15.** A second pulley of the same size is indicated at **53** which is secured on an extended shaft portion **54** of the shaft **16** and an idler pulley **55** is mounted on a support shelf at the back of the mill. A double V-belt **56** extends around the pulleys **51** and **55** on their top sides and then is reversed over the pulley **53** so that this pulley is driven in the opposite direction from pulleys **51** and **55.** The direction of rotation of the pulley **51** and hence the roll **17***a* is clockwise as viewed in FIG. **9** and that of the pulley **53** counterclockwise.

A feed roll not shown in FIG. **9** is utilized to facilitate the movement of the grain or other material toward the feed zone between the rollers **17***a* and **18***a* and is driven by a pulley **57,** which in turn is driven by a belt **58** ex-

tending about the pulley **57** and about a small drive pulley (not shown) on the shaft **54.** The pulley **57** is thus driven in a counterclockwise direction as viewed in FIG. **9.** Within the sloping upper portion of the housing **10** there is arranged an adjustable feed control which cooperates with the feed roller to determine the rate of feed to the rolls. This control is actuated by a lever **60** movable along a curved guide **62** to effect a change in the cross section of the supply passage for the grain. A suitable lock indicated at **62** is slidable into position to lock the lever **60** in any selected position along the guide **61.**

The adjustable control for regulating the rate of feed to the rolls is illustrated in FIG. **10.** This control includes a flexible resilient metal sheet or baffle **63** which is of generally cylindrical configuration with its convex side upward toward the top of the housing. The lower portion of the sheet **63** is arranged to move toward and away from the feed roll indicated at **64** which, preferably is grooved or fluted longitudinally and may be spiraled. The grain supply chute is completed by the side walls of the housing and a baffle **65** rigidly secured to the housing and extending from the upper right hand corner of the housing at the top downwardly to a position adjacent the roll **64** it being slightly spaced from the roll to prevent frictional engagement. This baffle is also of generally cylindrical curvature with its convex side up. The baffles **63** and **65** have reinforcing flanges, **63***a* and **65***a*, respectively, along their lower edges.

The flexible sheet **63** is securely anchored to the upper left hand corner of the housing as viewed in FIG. **10** where it is welded or otherwise suitably attached rigidly to the housing structure. The main portion of the sheet is free to flex and is held in a position such that it is biased by its own resilience toward the roller **64.** The lever **60** is connected to a shaft **66** on which are eccentrically mounted a plurality of cylinders **67** at spaced intervals along the shaft **66.** A rectangular guide box or frame **68** is attached to the flexible sheet **63** adjacent each cylinder and has an internal passage of the same width as the diameter of the cylinder **67,** so that when the cylinder is turned the sheet **63** is flexed either toward or away from the roll **64** and changes the spacing between the sheet **63** and the roll **64,** thereby changing the opening through which the grain is supplied and controlling the rate of flow of grain. It will be observed that the sheet **63** may move slightly with respect to the cylinder **67** because the guide **68** does not restrain the sheet in the vertical direction. The sheet **63** positioned as shown provides a substantially vertical lower portion adjacent the roll **64** so that the passage through which the grain flows to reach the rolls is substantially vertical where the grain moves through the opening between the sheet **63** and the roller **64** from which the grain falls vertically to the line of engagement of the rolls, this zone being called the "knip" or "bite".

During the operation of the feed control, the passage of the grain induced by gravity and by the rotation of the feed roller and the resulting driving effect on the grain a downward force is transmitted to sheet **63.** This downward force produces a slight vertical up or down movement of the flexing sheet and facilitates the passage of grain through the opening between the feed roll and the sheet and results in a more uniform rate of feed of the grain. It has also been observed that the feed passage along the roll **64** tends to clear itself of any "bridging" of the grain between the roll **64** and the sheet **63.** The curvature of the sheets **63** and **65** working in conjunction with the movement of the feed roll appear to enhance this effect.

The sheet **63** provides a simple and very effective arrangement for controlling the flow of feed and makes it possible to use a relatively small area of the housing for the flow control mechanism. Furthermore, particularly in view of the manner in which the flow is directed toward the "knip" or zone of entrance or contact of the rolls, the feed control may easily be positioned above the top plane of the rolls so that the rolls are free to move out of the housing without interference with the control mechanism which thus can remain in place during servicing of the rolls. This construction requires a minimum of moving parts, the flexible sheet **63** making it possible to eliminate hinged gates or similar valving arrangements. Improved operation and ease of control by manipulation of the lever **60** is thus effected.

While the invention has been described in connection with a specific form of flaker mill, other applications and embodiments will occur to those skilled in the art. I therefore intend by the appended claims to cover all modifications which fall within the spirit and the scope of the invention.

I claim:

1. A dual roll mill for flaking grain or the like comprising:

a housing having front, rear and side walls;

the side walls of said housing having horizontal slots opening toward the front wall thereof;

a pair of mill rolls having shafts extending from the ends thereof;

roll supporting structure adjacent said slots;

means for mounting said rolls in said housing with the shafts thereof extending through said slots, said means including bearing assemblies for said shafts and releasable means for locking said bearing assemblies in position on said supporting structure;

detachable means for closing said slots;

removable closure means at one end of said housing for affording when removed an open passage for said rolls; and,

means providing tracks adjacent the lower sides of said slots for affording rolling movement of said roll shafts whereby upon removal of said locking means and said slot closing means and said front wall closure means said rolls may be rolled forward and out through said front wall.

2. A dual roll mill for flaking grain or the like as set forth in claim **1** wherein said housing includes a base structure and said releasable bearing locking means includes structural members rotatably mounted adjacent the front ends of said side walls and movable from positions engaging the bearings of the front one of said rollers to positions engaging said base structure whereby the rolls may be rolled freely out of said slots.

3. A dual roll mill for flaking grain or the like as set forth in claim **2** including detachable means on said structural member for providing an extension of said tracks for supporting either of said rolls during movement out of said housing after removal of said front wall closure.

4. A dual roll mill for flaking grain or the like as set forth in claim **1** including front and rear bearing supports pivotally mounted on said frame on each side thereof for holding said shafts out of engagement with

said tracks in one position and rotatable away from one another for lowering said shafts to said tracks upon rotation from said one position, and means for urging the front and rear bearing support toward one another.

5. A dual roll mill for flaking grain or the like as set forth in claim **4** wherein said shafts engaging said tracks between respective ends of said rolls and said bearing assemblies.

6. A dual roll mill for flaking grain and the like as set forth in claim **1** including a grain feed control assembly mounted in said housing directly above the adjacent faces of said rolls, said assembly comprising:

a grain chute, one wall of which is a cylindrical flexible metal sheet extending across said housing and having its upper face convex;

said sheet being rigidly secured to said housing along its upper edge and curving downwardly toward the lower end of said chute;

said chute terminating above said rolls a sufficient distance to afford clearing said rolls when they are rolled from said housing; and,

feed adjusting means comprising a camming mechanism for flexing said sheet from a position of maximum feed to a position of minimum feed, said sheet being biased toward said maximum feed position.

7. A dual roll mill for flaking grain and the like as set forth in claim **6** wherein said chute includes a feeder roll mounted along the lower edge of said sheet for moving the grain downwardly toward the bite of said mill rolls.

8. A dual roll mill for flaking grain and the like as set forth in claim **7** wherein the lower curved portion of said sheet presents a substantially vertical wall throughout the range of adjustment of the positions of said sheet.

* * * * *