

No. 678,897.

Patented July 23, 1901.

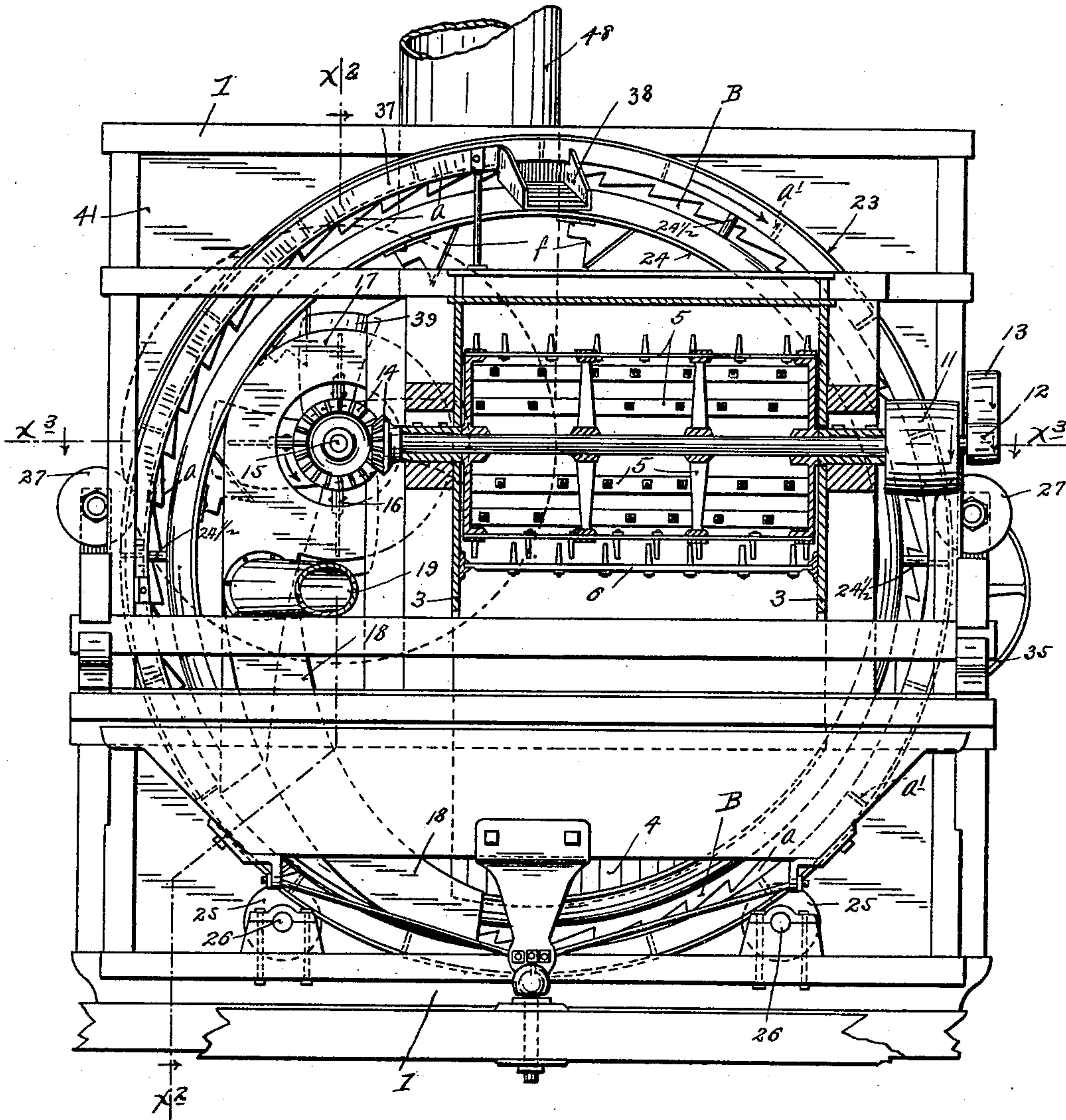
F. E. McNALL.  
THRESHER AND SEPARATOR.

(Application filed Mar. 2, 1900.)

(No Model.)

5 Sheets—Sheet 1.

*Fig. 1.*



*Witnesses,*  
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*Inventor,*  
*Frank E. McNall,*  
*By his Attorney,*  
*Geo. F. Williams*

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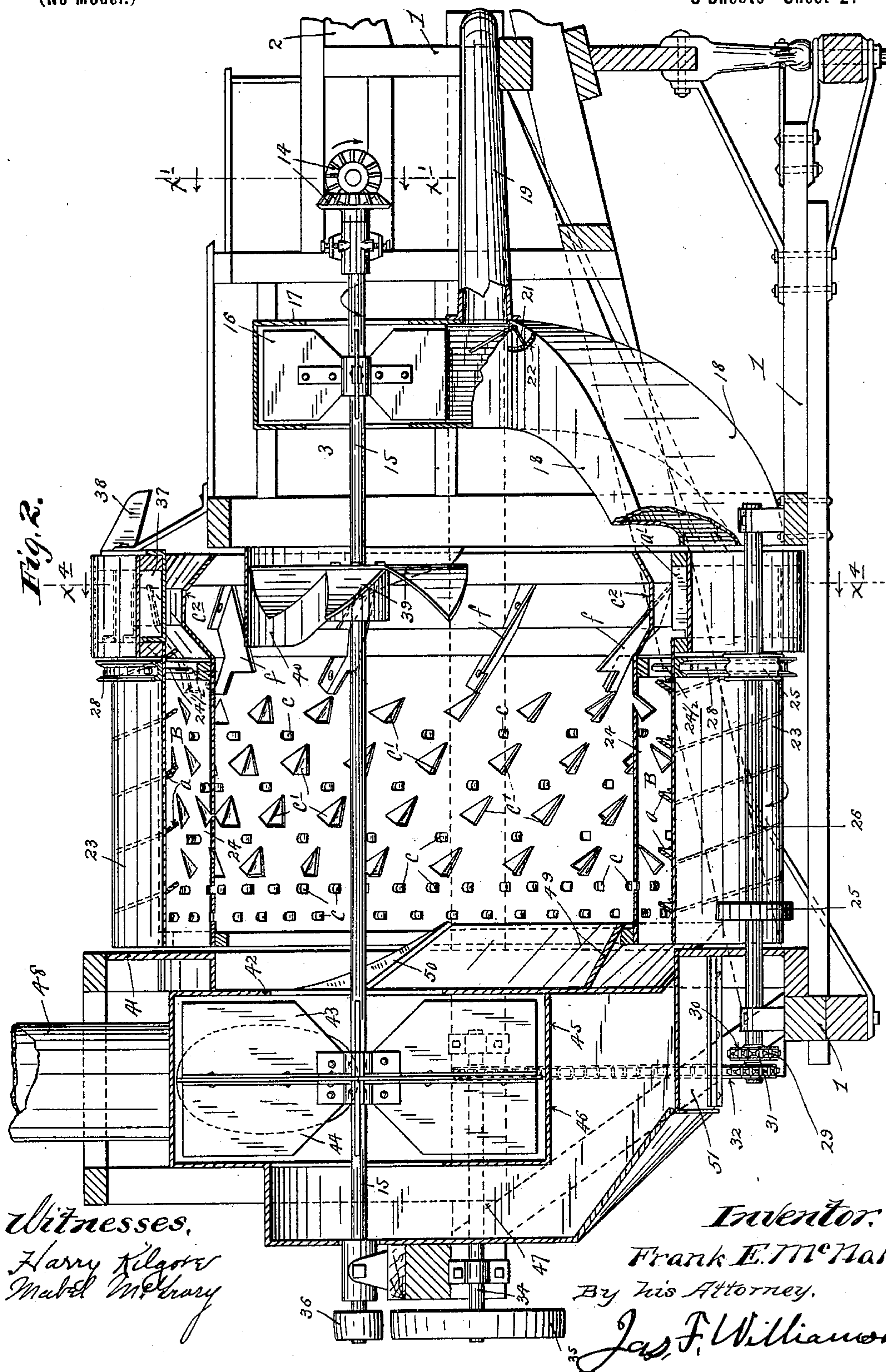
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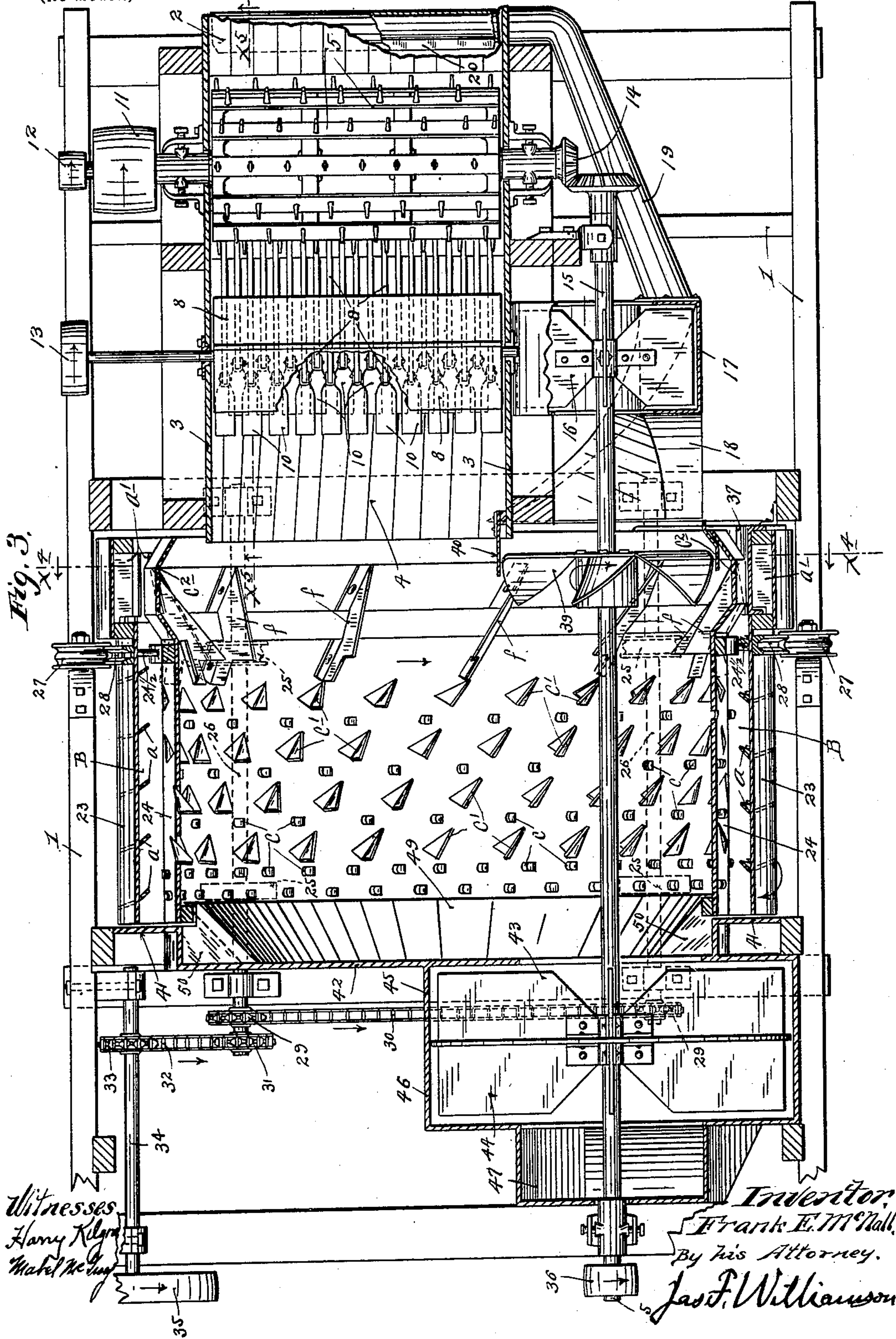


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5 Sheets—Sheet 3.

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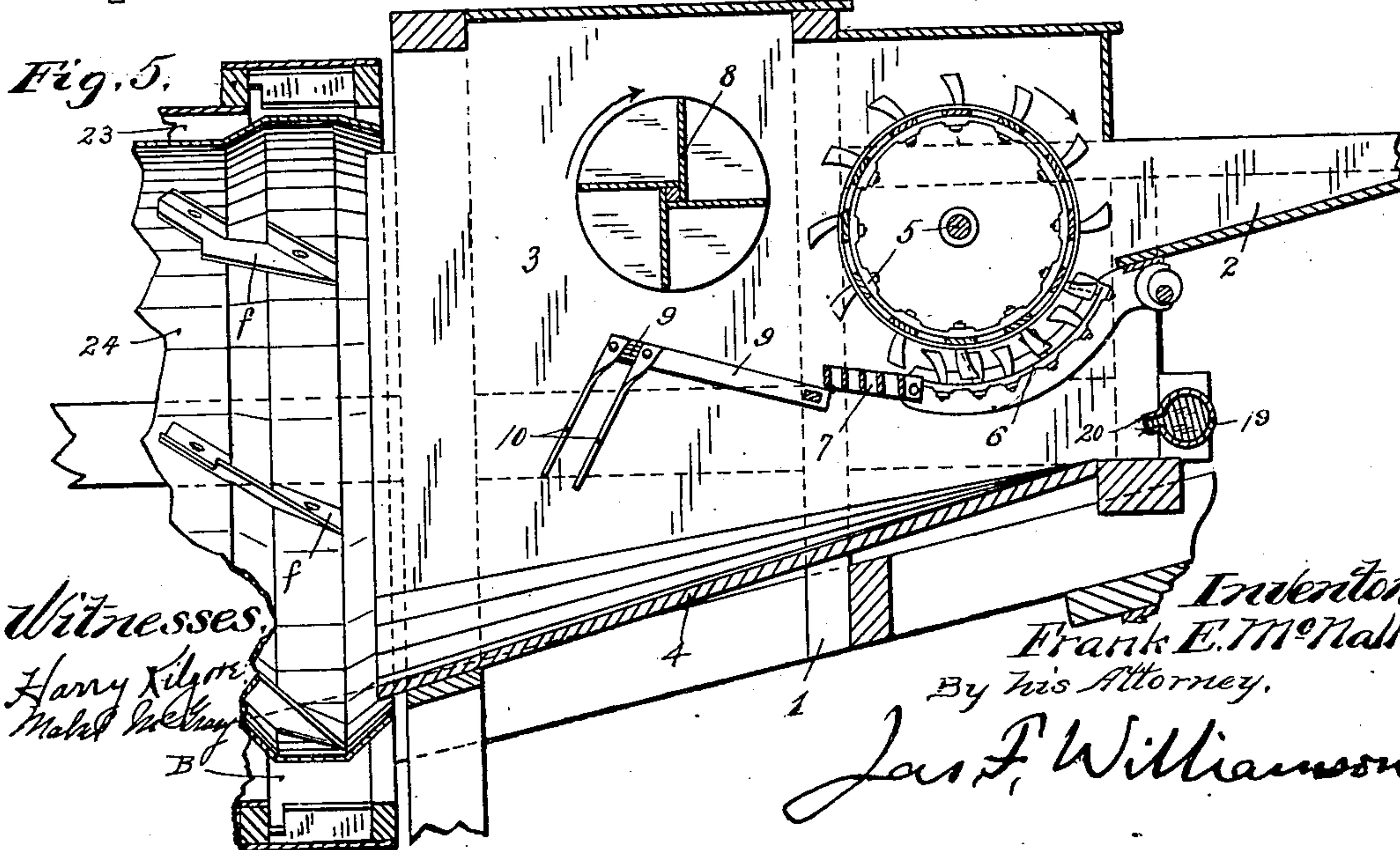
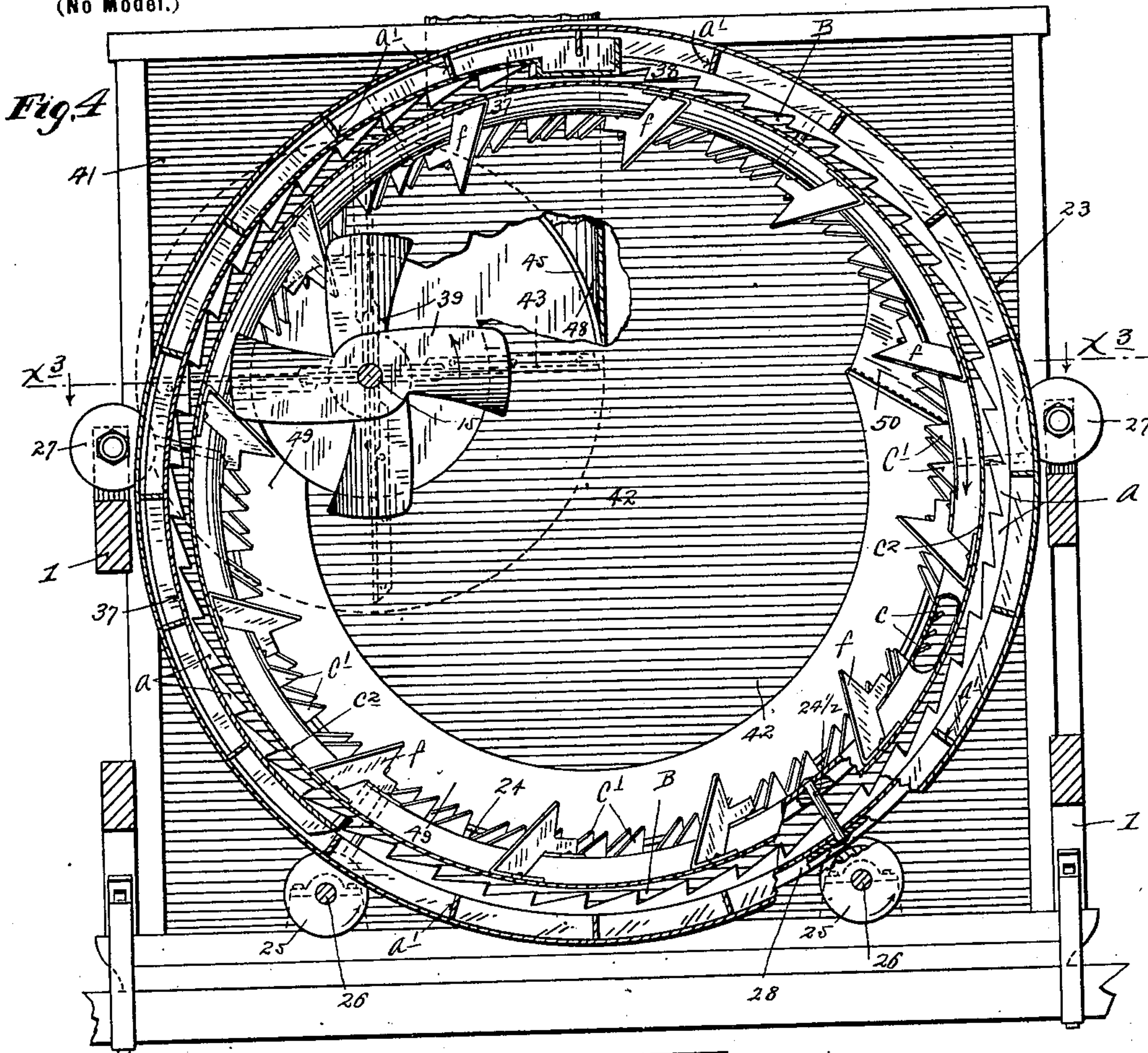
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5 Sheets—Sheet 4.

(No Model.)



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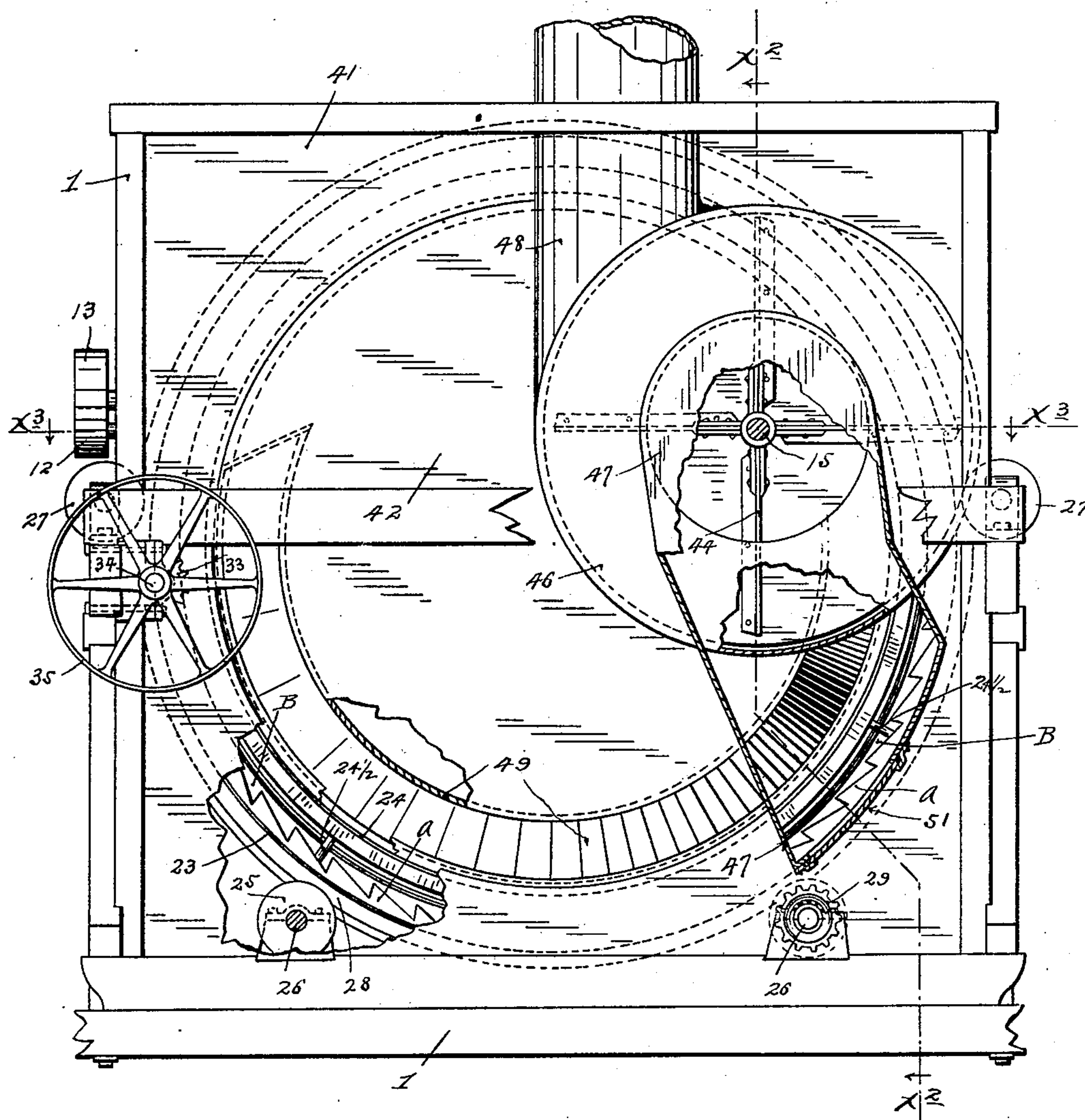
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(No Model.)

5 Sheets—Sheet 5.

Fig. 6.



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# UNITED STATES PATENT OFFICE.

FRANK E. McNALL, OF MINNEAPOLIS, MINNESOTA, ASSIGNOR TO CHARLES J. GOTSHALL, TRUSTEE, OF BLOOMINGTON, ILLINOIS.

## THRESHER AND SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 678,897, dated July 23, 1901.

Application filed March 2, 1900. Serial No. 7,072. (No model.)

*To all whom it may concern:*

Be it known that I, FRANK E. McNALL, a citizen of the United States, residing at Minneapolis, in the county of Hennepin and State of Minnesota, have invented certain new and useful Improvements in a Combined Thresher and Separator; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to combined threshers and separators, and was especially designed with a view of effecting certain improvements in the machine disclosed in my prior patent, No. 588,803, of date August 24, 1897.

To this end my invention consists of the novel devices and novel combinations of devices hereinafter described, and defined in the claims. The design of this class of machines is such as to render centrifugal force and air-pressure simultaneously available on the stock in the separating action, as was fully pointed out in my said prior patent.

My improved machine is illustrated in the accompanying drawings, wherein, like notations referring to like parts throughout the several views—

Figure 1 is a view, chiefly in front elevation, but partly in vertical section, on the line  $x'x'$  of Fig. 2, with some parts broken away, illustrating the structure and relation of the parts at the forward end of the machine. Fig. 2 is a view, partly in left side elevation, but chiefly in vertical section through the machine on the line  $x^2x^2$  of Figs. 1 and 6, with some parts broken away. Fig. 3 is a view in horizontal section on the line  $x^3x^3$  of Figs. 1, 4, and 6, with some parts broken away. Fig. 4 is a vertical cross-section on the line  $x^4x^4$  of Figs. 2 and 3, with some parts broken away. Fig. 5 is a view through the front end portion of the machine in vertical section on the line  $x^5x^5$  of Fig. 3; and Fig. 6 is a view, chiefly in rear elevation, with some parts broken away and others shown in section, for illustrating the parts at the delivery end of the machine.

The main frame 1 may be of any suitable kind, but as shown is of skeleton form and is oblong in shape. To the forward end of the frame are secured a suitable feed-hopper 2

and a casing 3, which casing is provided with an inclined bottom serving as a fixed grain-board 4. Within the casing 3 is mounted the threshing-cylinder 5, a cooperating adjustable concave 6, and grating 7. Within said casing 3, rearward of the cylinder 5, is located a beater 8, in proper position for cooperation with the said threshing-cylinder. Directly rearward of the grating 7 and within the casing 3 is located a comb made up of a series of arms 9, with depending fingers 10 of expanded form crosswise of the casing 3, as best shown in Figs. 3 and 5. As illustrated, the flat fingers 10 have their upper ends bent together and riveted to the arms 9. The arms 9 are arranged in two series, one in advance of the other, thereby permitting the expanded portions of the flat fingers 10 of one series alternating or breaking joints with those of the other series, as best shown in Fig. 3. These comb-fingers 10, therefore, disposed as described, stand in the path of the flying particles of grain as delivered from the threshing-cylinder, concave grating, and picker, and together form a complete barrier or deflector, insuring the interception of the grain and the deflection of the same onto the grain-board 4.

The cylinder-shaft is provided with a driving-pulley 11 for the application of power in the customary way. At its right end the cylinder-shaft is also provided with a small pulley 12, which in practice is connected by a belt (not shown) with a suitable pulley 13 on the right end of the picker-shaft for imparting motion to the picker 8. With the exception of the comb formed by the parts 9 10, as hitherto described, the threshing devices so far noted are of the ordinary well-known kind. The thing to note is that the threshing-cylinder and the parts cooperating therewith within the casing 3 are located to one side of the transverse center of the machine taken as an entirety. This brings the outlet from the thresher proper to one side of the axis of the rotary separating-drum, which will presently be noted, for a purpose which will be stated when tracing the action of the machine.

On the left side of the machine, disposed lengthwise thereof and outward of the thresher-casing 3, is located a main shaft 15,



which is connected at its forward end by a pair of bevel-gears 14 with the left end of the cylinder-shaft. Near its forward end this main shaft 15 has attached thereto a fan 16, 5 working within a housing 17, having its main delivery-spout 18 curved downward and backward for delivering the main body of the current of air from the fan to the chamber or space between the two shells of the rotary 10 separating-drum, as will presently more fully appear. Said air-spout 18 is tapped by a comparatively small spout 19, which extends forward to the front end of the machine and then crosswise thereof, as best shown in Figs. 2, 3, and 5, and is provided with a delivery-slit formed by a pair of projecting flanges 20 properly positioned to deliver a sheet of air directly over the head end of the grain-board 4. This blast of air over the grain-board in- 20 sures the free movement of the grain lengthwise of the board and assists in the separating action. The inlet to the branch spout 19 from the main trunk 18 is controlled by a suitable hand-valve 21, cooperating with a lock-plate 22 for securing the same in any 25 desired adjustment.

Directly to the rearward of the thresher-casing 3 and in position to receive therefrom is rotatably mounted within the main frame 30 1 a rotary separating-drum which, as shown, is made up of a pair of substantially concentric shells 23 and 24, suitably tied together and spaced apart from each other by stay-bolts 24½ or otherwise for affording an intermediate chamber B, open at its forward end for purposes which will later appear. Both 35 of these shells 23 and 24 are of enlarged cross-section at their forward ends for purposes which will later be noted. The said rotary separator rests on a set of four antifriction-rollers 25, carried by shafts 26, and is further 40 guided and held by an additional pair of antifriction-rollers 27, located at the sides of the main frame, for action on the sides of the drum. Of these antifriction-rollers the 45 forward pair of the bottom members 25 and the pair of side rollers 27 have double grooves and flanges with a V-shaped center for cooperation with a grooved annular band 28, secured to the forward end portion of the outer 50 shell 23, directly rearward of the enlarged front end of the drum. This construction of said band 28 and the said supporting and guiding rollers 26 and 27, which cooperate 55 with said band, prevents the longitudinal displacement of the drum, and in cooperation with the rearmost pair of bottom rollers 25, which are ordinary plain-faced rollers in direct contact with the outer shell, serve to hold 60 the rotary separating-drum with freedom for rotation with the minimum of power. The shafts 26, which carry the bottom rollers 25, are provided with sprockets 29 at their rear ends, engaged by a chain 30, as best shown in 65 Fig. 3. The right-hand member of said roller-shafts 26 is also provided with a sprocket 31, engaged by a chain 32, passing over a sprocket

33 on a short counter-shaft 34 at the rear end of the frame, which in turn has a pulley 35, connected by a belt (not shown) with a pulley 36 on the rear end of the main shaft 15. In this way the bottom rollers 25 receive motion in a common direction from the main shaft 15, thereby affording a positive drive for securing the rotary motion of the separating-drum. 70 75

The outside shell 23 of the separating-drum is shown as provided with a series of serrated cleats or ribs *a*, spirally disposed on its interior for directing the grain caught on the interior surface of the drum toward the forward end of the outer shell and into the enlarged forward end thereof. The inner shell 24 is provided with a series of perforations *c* of suitable form for permitting the passage 80 of the grain therethrough into the chamber B between the two shells. The inner shell 24 is also provided on its inner surface with a series of angular brads or upturned lips *c'*, spirally disposed in respect to the inner surface of said shell, with the spiral running in the proper direction for permitting the brads 85 to work the stock delivered thereto toward the rear end of the drum. The enlarged forward section of the outer shell 23 is provided 90 with a series of flights *a'*, which permit this section of the drum to act as an elevator, cooperating with the fixed segmental plate or trough-bottom 37, suitably supported from the main frame, for permitting the said flights 95 *a'* to pass over the same under the rotary motion of the drum as the drum approaches and passes through the upper arc of its travel. The said fixed segment 37 is provided with an outlet or discharge spout 38, through which 100 the grain carried up by the elevator is directed out to a bagger-head (not shown) or other point desired. The enlarged forward end of the inner shell 24 is in the form of a trough in cross-section, having inclined sides 110 and a straight bottom, as shown at *c*<sup>2</sup>. The front side of this trough *c*<sup>2</sup> under-reaches the grain-board 4 and overreaches the rear end of the thresher-casing 3. The said trough-section *c*<sup>2</sup> of the inner shell 24 is provided 115 with a series of comparatively large flights *f*, constructed of proper shape to fit the straight or bottom section of the trough and the inner or inclined section thereof and to extend on an angle lengthwise of the shell and toward 120 the rear end of the same for cooperation with a combined propeller and fan 39, secured to the main shaft 15 at the head of the rotary separating-drum in substantially the same vertical plane in cross-section as 125 the trough *c*<sup>2</sup> of the inner shell 24 of the drum, as best shown in Figs. 2, 3, and 4. The blades of the combined fan and propeller 39 are not housed in, but are provided with a short guard 40, projecting out for a short distance 130 over the same from the thresher end of the frame. The said angles or flights *f*, disposed as described, also serve to carry up the grain and other materials collecting in the trough-



section  $c^2$  of the inner shell 24 and to deliver the same out of the trough-section and into the main body of said inner shell in a gradual manner, instead of by a sudden spill or a roll back into the trough.

At its rear end the rotary separating-drum abuts against or, more accurately speaking, works close to one section 41 of a partition-plate 41 42, transversely disposed across the frame near the rear end of the machine. Directly to the rear of the partition-plate member 42 are located on the main shaft 15 a pair of fans 43 and 44 within suitable housings 45 and 46, one of which housings is partly formed by the division-plate 42. The division-plate 42 is provided with an opening constituting the eye to the fan 43. The back plate of the housing 46 is provided with an opening constituting the eye to the fan 44, and this is covered by a trunk-section 47, extending downward and forward to the chamber B or space between the two shells 23 and 24 of the separating-drum. Both fans 43 and 44 are shown as delivering to the common outlet or stacker tube 48. The two fans 43 and 44, with their respective housings, constitute a bipartite or double discharger for delivering the stock from the rear end of the rotary separating-drum to the stacker-tube 48. The discharger-fan 43 and its housing cooperate with the inner shell 24 of the rotary drum, and the discharger-fan 44 cooperates with the fan 16 at the head end of the machine for joint action on the chamber B or space between the two shells 23 and 24 of the separating-drum. The fixed partition-plate 42 has attached thereto a segmental inwardly-flaring joint-plate 49, projecting forward therefrom and overreaching the rear end of the inner shell 24 of the drum. This joint-plate 49 is provided with end pieces 50 at its upper ends for filling in the corners between the same and the partition-sections 41 and 42, as best shown in Figs. 2 and 3.

The different parts of the machine have now all been specified.

Before undertaking to trace the general action the fact should again be noted that the threshing-cylinder and its cooperating parts within the casing 3, or, otherwise stated, all the elements of the thresher proper, are located to one side of the transverse center of the machine. In the instance illustrated the said threshing elements proper are to the right of the transverse center of the machine. It should also be noted that the main shaft 15, which carries at its rear end the dischargers for the straw, chaff, and other stock delivered thereto from the separating-drum, is located at the left side of the machine, or, in other words, is not in a common line with the delivery end of the thresher-casing 3. It follows that the inlet and the outlet openings from the rotary separating-drum are eccentric to each other or out of line with each other lengthwise of the machine. It being further recalled that the rotary separating-

drum cooperates with the fixed transverse partition between the same and the dischargers, it follows from these peculiar relations of the features named that there is a comparatively-dead-air space at the right-hand side of the rear end of the inner shell of the separating-drum. These facts being borne in mind, the general action of the machine can be more readily understood.

Operation: With the exception of the peculiar action due to the comb formed by the parts 9 and 10 directly to the rear of the grating 7 in the thresher-casing 3 and the peculiar action due to the sheet of air delivered under pressure to the head end of the grain-board 4 from the fan 16 the actions of the threshing elements proper are substantially the same as those in the ordinary machines. The peculiar action of the novel comb formed by the parts 9 and 10 and the peculiar action due to the sheet of air delivered under pressure to the head of the grain-board 4 as another novel feature have already been noted. The rotary separating-drum, composed of the shells 23 and 24, rotates from the left toward the right, as shown by the arrow in Fig. 1. The shaft 15 and all the parts carried thereby rotate from the right toward the left, as shown by the arrow in Fig. 1. Hence the combined fan and propeller 39 rotates in a direction opposite to the rotation of the drum-shells 23 and 24. The separating-drum is of course rotated at a comparatively slow rate of speed. The shaft 15 and the parts carried thereby, including the combined fan and propeller 39, are rotated at a comparatively high rate of speed, but at a speed less than the speed of the threshing-cylinder 5. The combined fan and propeller 39 being located sufficiently near to the enlarged or trough section  $c^2$  of the inner shell 24 for cooperation with the angular flights  $f$ , it follows that the stock delivered to the head end of the inner drum-shell will be given a sharp throw upward, rearward, and toward the right, thereby moving the same through the comparatively-dead-air space at the rear right end of the inner drum-shell. This affords what might be called a "settling-chamber" for the flying particles of grain, permitting the same to drop from the straw, or, in other words, allowing gravity and centrifugal force to act on the grain under circumstances of greatest advantage, or, otherwise stated, at a time when the stock is most free from the suction of the discharger-fan 43. Hence thorough separation is insured, as was noted in my prior patent. The presence of the angular flights  $f$ , properly disposed for coaction with the combined fan and propeller 39, is an improvement over my prior patent both for tearing apart and shaking up the straw and giving to the same a more violent pitch to the rear right-hand corner of the inner drum-shell. The said flights  $f$  also serve the other purpose hitherto noted for getting the loose grain, unthreshed heads, and small broken-up parts out from the trough-section  $c^2$  and into the



main body of the inner shell 24 in a manner most favorable for good separation. Along with the grain more or less of the chaff and fine particles of straw will fall through the openings of the inner shell 24 into the chamber B and onto the inner surface of the outer shell 23 of the drum. In this chamber this light stock becomes subject both to the suction from the discharger-fan 44 and to the blast supplied from the fan 16 at the head of the machine through the air pipe or spout 18 to the head end of the chamber B. In my prior patent this chamber B was subject to the suction from the corresponding discharger-fan 44 only. By the addition of the blast through the spout 18 from the head-end fan 16 the pressure in the chamber B can be kept sufficiently high to prevent any undue suction through the openings of the inner shell 24, thereby insuring a better action from the inner shell on the stock handled thereby and also securing a better action on the chaff and light fine stuff which falls from the inner shell onto the outer shell through the chamber B. All of this light stuff under the conditions named is carried off through the trunk 46 into the eye of the fan 44 of the discharger.

Another feature of improvement in my present machine as compared with the machine disclosed in my prior patent and, so far as I know, any other machine of this general type is the relative disposition of the threshing-cylinder and the main shaft 15, which carries the fan 16, combined fan and propeller 39, and the fans 43 and 44 of the discharger. In my prior patent the discharger and the combined fan and propeller and some other parts were all on a common shaft extending lengthwise of the drum. Hence the feed-hopper for the thresher had to extend out to the side of the frame for a side feed and all the said parts carried by the said single shaft had to run at a common speed coincident with that required for the proper action of a threshing-cylinder. This speed was too high for the desired action of the other parts on the common shaft. By providing the separate shaft 15 for the parts 16, 39, 43, and 44, which cooperate with the rotary drum in the separating and discharging actions, and arranging the same at right angles to the threshing-cylinder, as described, I am able to preserve the desired front-end feed for the thresher and to secure any desired relative speed on the shaft 15 by using bevel-gears 14 of the proper desired relative sizes for connecting the shaft 15 to the shaft of the threshing-cylinder. Hence this improvement is one of considerable importance. It is thought that a machine organized as herein disclosed will have large capacity and at the same time secure thorough separation. People familiar with fieldwork from ordinary threshers which employ pneumatic stackers when built for the heavy business required in the Northwestern wheat belt are well aware

that thorough separation is seldom, if ever, secured. The suction from the pneumatic stacker-fan in the ordinary machines carries out a considerable portion of the grain not separated from the straw into the pneumatic stacker and thence through the same to the stack, which is of course a considerable loss.

It will be understood, of course, that the details of the construction can be changed without departing from the spirit of my invention. For example, the air-distributor which delivers the sheet of air to the head of the grain-board is shown as a part of the pipe 19, leading back to the main delivery-spout 18 from the fan 16; but it is obvious that the said distributor might be in a separate piece and might be otherwise formed for the delivery of the air as long as this air under pressure was delivered in such a way as to have a sweeping action on the face of the grain-board.

The trunk 47 is shown, Figs. 2 and 6, as provided with a check slide or door 51, controlling an opening to the atmosphere for the purpose of regulating the suction from the fan 44 as may be desired in respect to the action of the fan on the chamber B between the two shells of the separating-drum.

What I claim, and desire to secure by Letters Patent of the United States, is as follows:

1. In a combined thresher and separator, the combination with the stacker, of a rotary separating-drum, composed of the shells 23 and 24 spaced apart to afford the intermediate chamber B, the two-fan discharger, having one of its fans connected by draft-trunk with the rear end of said chamber B, for suction action thereon, and a blast-fan having its delivery-spout positioned to discharge into the head end of said chamber B, all for co-operation substantially as described.

2. In a combined thresher and separator, the combination with the thresher, of a rotary separating-drum receiving therefrom, a combined fan and propeller at the head end of the drum, with its blades positioned to work near the inner surface of the drum, and angular flights on the said drum for co-operation with the blades of said propeller, under the opposite rotary movements of said drum and propeller, for conjoint action on the stock delivered to the drum from the thresher, substantially as and for the purposes set forth.

3. The combination with the thresher, of the rotary separating-drum, the straw-discharger, the combined fan and propeller 39 and the flights *f* on the head end of the inner drum, for co-operation with said propeller 39, as described, with the inlet and outlet openings of the inner shell of the drum located out of line or eccentric to each other, all for co-operation substantially as described.

4. In a thresher, the combination with the threshing cylinder and concave, of a comb directly rearward of the concave within the



thresher-casing, which comb is composed of a series of rearwardly-projecting arms 9, the alternative members of which are of unequal length, and a series of expanded fingers 10, secured to the rear ends of said bars and extending downward therefrom in position to lap with each other, for affording a complete deflecting-comb adapted to intercept the flying particles of grain and precipitate the

same to the underlying grain-board, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

FRANK E. McNALL.

Witnesses:

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F. D. MERCHANT.