

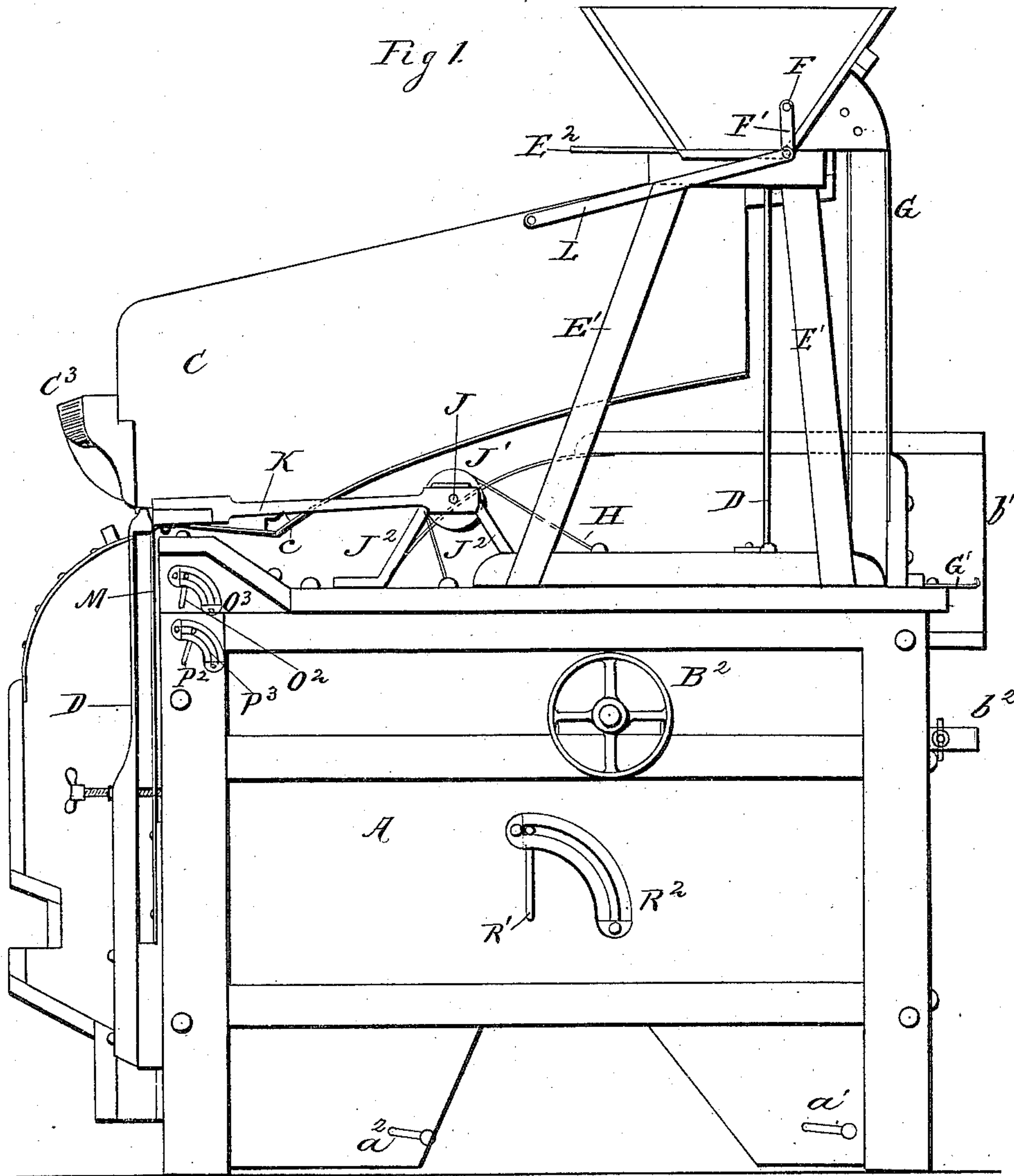
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4 Sheets—Sheet 1.

W. W. INGRAHAM.
GRAIN SEPARATOR AND GRADER.

No. 307,654.

Patented Nov. 4, 1884.



Witnesses
W. C. Coates
A. M. Best

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(No Model.)

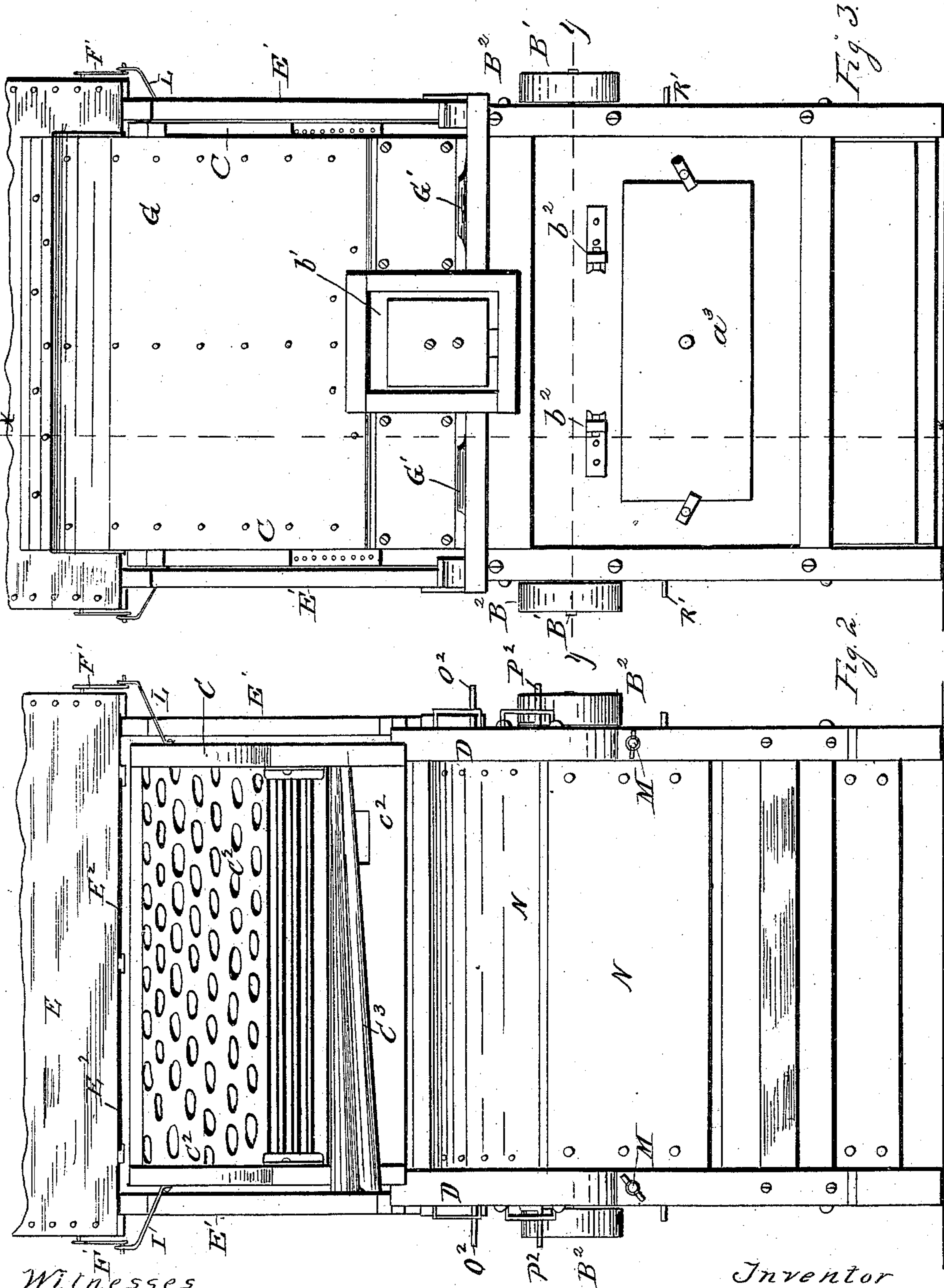
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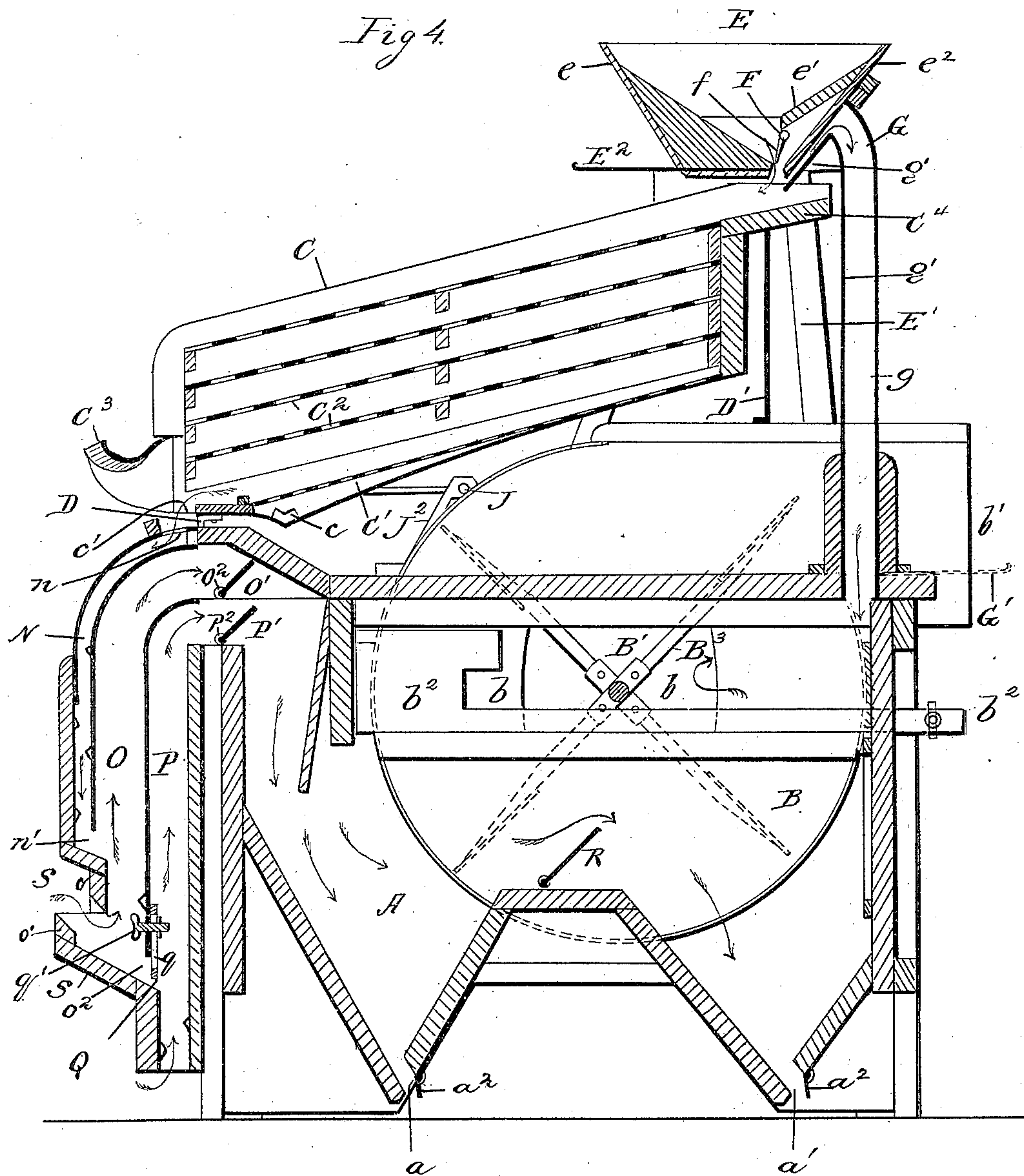
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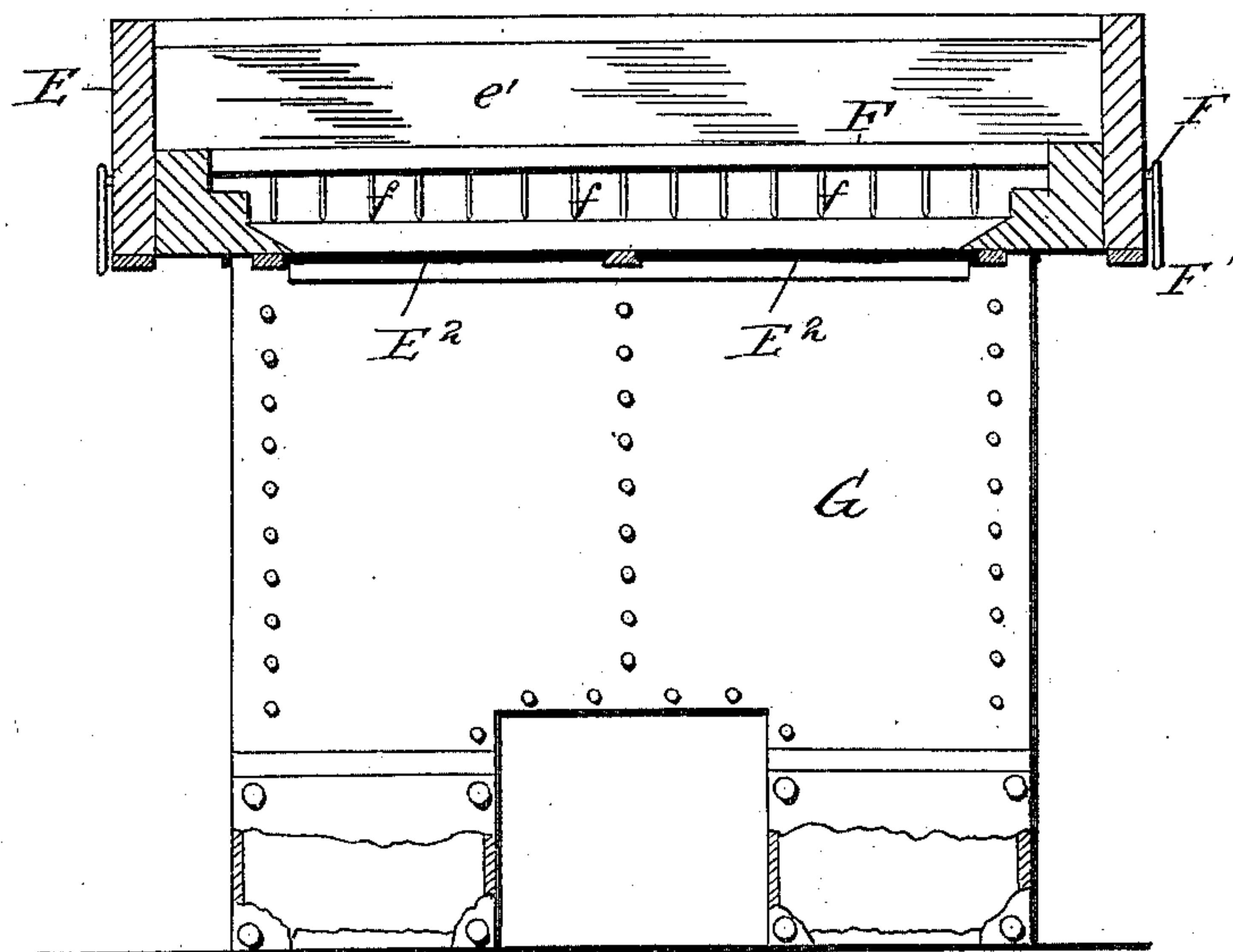
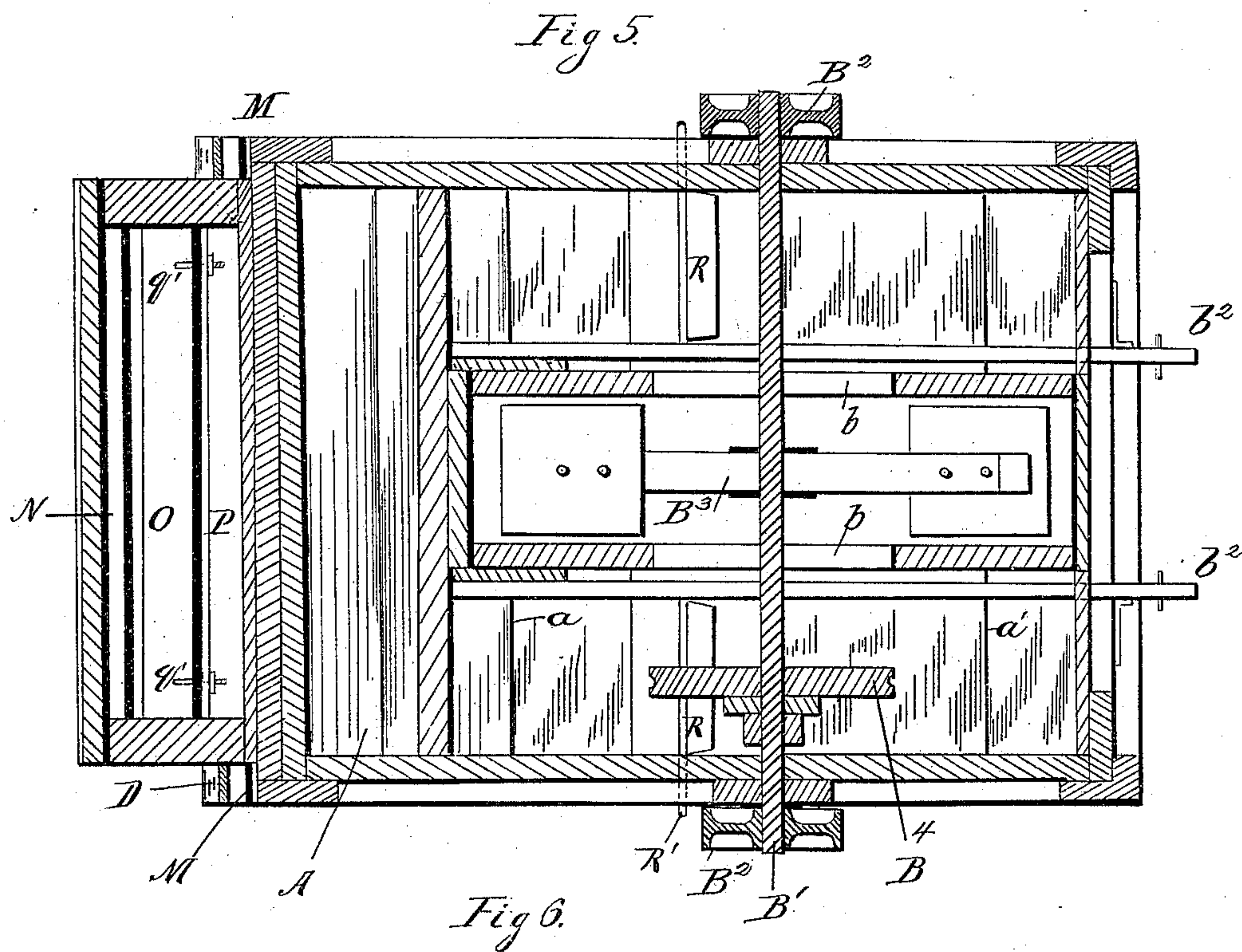
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UNITED STATES PATENT OFFICE.

WILLIAM W. INGRAHAM, OF CHICAGO, ILLINOIS.

GRAIN SEPARATOR AND GRADER.

SPECIFICATION forming part of Letters Patent No. 307,654, dated November 4, 1884.

Application filed February 17, 1883. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM W. INGRAHAM, a citizen of the United States, residing at Chicago, in the county of Cook, in the State of Illinois, have invented certain new and useful Improvements in Grain Separators and Graders, which are fully set forth in the following specification, reference being had to the accompanying drawings, in which—

Figure 1 is a side elevation of my improved separator and grader. Fig. 2 is a front elevation of the same broken away at the upper edge. Fig. 3 is a rear elevation of the same similarly broken away. Fig. 4 is a section on the line *x x* in Fig. 3. Fig. 5 is a section on the line *y y* in Fig. 3. Fig. 6 is a detailed front view of the hopper and suction trunk or chute, the former being shown in section.

The same letters denote the same parts in all the figures.

My invention relates to apparatus for separating grain from the refuse which is mingled with it as it comes from the granary and for separating the different grades from each other. The object of it is to effect both these results by one machine, and more readily and economically than it has heretofore been done.

To this end the invention consists in the several devices and combinations of devices, which will be set forth hereinafter, and definitely pointed out in the claims.

In the drawings, A denotes a separating-chamber constructed on the same general principle as that shown in Patent No. 130,804, granted to John C. Hunt and Wm. W. Ingraham, August 27, 1872; but instead of terminating at the bottom, like the chamber there shown, in four inversely-pyramidal pockets each with an opening at the apex, it has only two pockets, each a triangular prism in general shape, extending from side to side of the machine, and having an opening, *a* or *a'*, along the bottom edge. A hinged valve, *a''*, closes each of these openings, the pressure of air outside being sufficient, when the air within the chamber is exhausted by the operation of the fan, to keep these valves closed until the weight of grain from above forces them open. A man-hole in the back wall of the chamber facilitates cleaning it out, and is closed at other times by a shutter, *a'''*. A fan-case, B, is supported vertically, front and rear, in the

separating-chamber midway between the two sides of the machine, and rising somewhat above the roof of the chamber. It has in each side a central opening, *b*, communicating with the separating-chamber, and a discharge-opening, *b'*, at the back of the machine; otherwise it is closed. Sliding valves *b''* serve to close the central openings *b* when desired. A shaft, *B'*, which has bearings in the sides of the machine, and receives power by means of a band-wheel, *B''*, or other equivalent device at its end, passes through the center of the fan-case, within which it carries a fan, *B'''*. The revolution of this fan in such a direction that its upper wings will approach the discharge-opening *b'* will obviously produce a current of air from the separating-chamber into the central openings of the case and out at the back discharge-opening.

Above the separating-chamber and fan-case a shoe or shaker, C, extending nearly all the way from front to rear of the machine, and sloping downward and forward at an angle of about eighty degrees to a perpendicular, is supported front and rear on bars D and D' of spring metal or other elastic material which allows it to oscillate back and forth. It is in form a nearly square box with the upper part of its front cut away. It has a transverse depression in its bottom near the front, so as to form a sort of trough, at the ends of which are small openings *c* for the discharge of grass-seed, cockle, sand, and other like refuse. The cockle-sieve C' covers this depression. Above this, and parallel with it, are set in the shoe one or more grain-sieves, C'', the number being varied according to the kind of grain to be separated, the coarsest sieve (when several are used) being uppermost, the next below being finer, and so on. The refuse which is rejected by the upper sieves passes down into an inclined trough, C'', open at its lower end, arranged on the upper edge of the truncated front of the shoe, and the grain passes over the cockle-sieve and down through a transverse opening, *c'*, in the bottom of the shoe near the front, and so into the passages leading to the separating-chamber. From the upper edge of the back of the shoe a shelf, C'', projects backward, having the same inclination as the sieves. A little above this, on a pair of standards, E', at each end rests a hop-

per, E, extending the whole length of the shelf C⁴ and projecting a little in front of it. It is trough-shaped, and has in its bottom a narrow opening extending the length of the shelf. Outside it is flat-bottomed, but its front inner wall, e, slopes down to the edge of the opening, and its back inner wall, e', sloping at a greater angle terminates almost vertically above the lower edge of the front inner wall. Immediately under the lower edge of the back wall, e', is a rock-shaft, F, having its bearings in the ends of the hopper. Teeth f project from this shaft toward the front inner wall, stopping barely short of contact with it. They are arranged at suitable distances apart to allow the grain to pass through, but arrest the straw and like refuse. Against the outer back wall, e², of the hopper, about half-way between the top and bottom, terminates the back wall, g, of a suction trunk or chute, G. This wall curves slightly forward at its upper end to meet the back wall of the hopper, but otherwise it is upright. The front wall, g', is parallel with the other up to within a short distance of the hopper, where it turns abruptly into a direction parallel with the back outer wall, e², of the hopper and continues in this direction to within about an inch of the shelf C⁴, thus forming in conjunction with the back of the hopper an upward passage into the chute G. This chute extends the whole width of the shoe, and rests on the roof of the separating-chamber and the top of the fan-case, being shortened in the middle to allow the fan-case to pass through, as shown in Figs. 3 and 6 of the drawings. It is closed at the sides and at the bottom also, except where it rests on the separating-chamber A. There it opens into that chamber, as shown in Fig. 4, but may be wholly or partly shut off from it by means of slide-valves G', operated from the back of the machine. When the fan is in motion, drawing the air from the separating-chamber A, and consequently from the chute G, it is obvious that as soon as the grain falls from the hopper on the shelf C⁴ at the back of the shoe, the chaff and other light refuse will be caught up by a current of air and carried up between the deflected front wall, g', of the chute and the outer back wall, e², of the hopper into the chute, through the chute into the separating-chamber; thence through the openings b into the fan-case and out through the discharge b'. The force of the current may be regulated by means of the slide-valves G', so as to make sure of carrying off the chaff and not carrying off the light grain. One or more openings, e², in the front of the shoe insures a sufficient current of air along and between the sieves. This current passes up through the openings of the uppermost sieve, and thence below and behind the hopper into the suction-trunk G. The fan-shaft B' carries a pulley or band wheel, B⁴, which, by means of a belt or chain, H, and a pulley or band wheel, J', communicates motion to a shaft, J, parallel with the fan-shaft, and having its bearings in

standards J² on top of the separating-chamber and near the sides of the machine. This shaft J is crank-shaped at each end, so that its revolution imparts a reciprocating motion to each of the horizontal connecting-rods K, which link the shaft J at each end to the shoe C. The turning of the fan-shaft, therefore, gives the shoe a rapid backward and forward motion. This motion will ordinarily be rapid enough with a band-wheel on the fan-shaft considerably smaller in proportion than that shown in the drawings. A connecting-rod, L, on each side of the shoe is pivoted also to the lower end of a rocking arm, F', at each end of the shaft F, and thus communicates to the teeth f at the lower opening of the hopper an oscillating motion, which separates the straw from the grain and throws the former toward the front of the hopper. The breadth of the opening in the bottom of the hopper is regulated by slide-valves E², operated from the front. On drawing these out so as to give the opening its full width, the straw will be carried down by the current of grain onto the topmost sieve, and can be drawn off at the front of the shoe. This operation will take but a moment, and the valves can then be replaced, so that the separation of grain from straw may proceed as before.

It is obvious that the forward slope of the shoe C, in conjunction with the weight of the grain on it, will cause it to move forward much more readily than backward. To equalize the motion, I attach to the forward end of each connecting-rod K and to the front of the machine a spring, M, (shown in Fig. 1 of the drawings,) whose elasticity tends to push the rod, and consequently the shoe, back to the limit of its motion in that direction. I thus make the vibration of the shoe equal in velocity and force both ways. The springs M may conveniently be arranged behind the front supports, D, of the shoe, and may be adjusted by set-screws passing through those supports.

On the front of the machine, and extending its whole width, are three parallel passages of different length, one in front of the other, each curving backwardly in its upper part and perpendicular in its lower part. The outermost of these, N, is closed at both ends, but has in its outer wall near the upper end an opening, n, corresponding to the opening c' in the bottom of the shoe. Through this opening the sifted grain falls from the cockle-sieve C' to the bottom of the passage, which slopes downward and inward, as shown in Fig. 4. The rear wall of this passage does not extend quite to the bottom, leaving an opening, n', through which the grain falls into the second passage, O. The front wall of this second passage is the same with the rear wall of the passage N, so far as that extends, but is continued below the bottom of the passage N by a short apron or strip, o, which in turn stops short of the bottom of the passage O. The bottom of O is parallel to that of N, and extends forward for

the same distance, and of course considerably beyond the front wall of O. On its forward edge is raised another strip, o' , to a level with the bottom of the strip o , thus leaving a nearly horizontal opening between the two, through which air is admitted to the passage O. This passage opens at its upper end into the upper part of the separating-chamber A, but may be closed by a hinged valve, O' , operated by crank-arms, O^2 , at its ends, moving in quadrantal guides O^3 on the outer sides of the machine. The rear wall of the passage O, like that of N, stops short of the bottom, leaving a similar opening, o^2 , into the third passage, P. The breadth of this opening is regulated according to the amount of grain which is to pass through it by a slide, Q, having vertical slots q , so that it is adjustable at different heights by screw-clamps q' . The opening can thus be made barely large enough for the passage of the grain, leaving no space for any current of air. The passage P is open at both ends; but its upper end may be closed by a valve, P' , operated by crank-arms P^2 , in guides P^3 , similar to those just described. Its upper end communicates, like that of the passage O, with the separating-chamber A. Each passage has arranged in its walls one or more projecting ledges, S, with upper surfaces sloping downwardly and outwardly, so as to check the momentum with which the grain descends through the passage. While the fan-wheel is in motion, drawing the air from the separating-chamber, the valves O' and P' being open, there will necessarily be a current of air into the opening between the strips o o' , which will meet the stream of grain as soon as it falls from the bottom of the passage N into the passage O and carry up the light, shrunken, and unsound grain, as well as any light refuse which may still be mixed with it, through the passage O into the separating-chamber A, where the heaviest of the grain thus taken falls through the opening a at the bottom of the front division of the chamber, the lighter is carried onto the rear division and falls through the opening a' at the bottom of it, while the dust, chaff, &c., which had not previously separated from it are drawn into the fan-case through the central openings, b , and discharged at the back of the machine through the opening b' . Meanwhile the first grade of grain, too heavy to be lifted by the current of air, slides down the inclined bottom of the passage O into the passage P, where it undergoes a second separation, its remaining light elements being carried up the latter passage by the air-current into the separating-chamber, there to be disposed of in the way just described, while the

sound grain falls out at the bottom of the passage P.

By means of the oscillating valve R, extending from side to side of the separating-chamber A, at the highest part of the bottom, and operated by external cranks R' in guides R^2 in the same manner as the valve O' , heretofore described, a partition may be raised between the front and rear divisions of the chamber, so high that little or no grain will pass over it. All the grain that enters the chamber will thus be discharged through the opening a , the dust and chaff being carried over the valve R and into the fan-case. By closing the valve O' or P' the whole current of air will evidently be directed through the open passage O or P, and will thus exert on the grain a single separating operation of increased force. Should any light grain be carried with the first elimination of the chaff into the back chute, G, it will fall to the bottom of the rear division of the separating-chamber and pass out at the opening a' .

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The hopper having the converging walls e and e^2 , and a bottom opening between them, and the inner wall, e' , arranged as described, the rock-shaft F, arranged immediately below the projecting edge of the wall e' , and provided with the downwardly-projecting teeth f , means for rocking the shaft upwardly, and the slide-valve E^2 , arranged as described, all in combination, substantially as and for the purpose described.
2. The vibrating shoe C, the hopper E, arranged on independent supports above the shoe and having a longitudinal discharge-opening, the rock-shaft F, arranged on one edge of this opening, and provided with teeth projecting across the opening, the rocking arms F' , and means for communicating to the rocking arms the motion of the shoe, all in combination, substantially as and for the purpose described.
3. The parallel and communicating grain-passage N, and suction-passages O and P, the passage O being provided with an air-inlet below the bottom of the passage N, in combination with the adjustable valve Q, arranged on the upper margin of the opening between the passages O and P, for the purpose of regulating the entrance of grain and preventing the entrance of air through said opening, substantially as described.

WILLIAM W. INGRAHAM.

Witnesses:

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W. C. CORLIES.