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C. P. FULLMER.

SEPARATOR FOR GRAIN, &c.

No. 587,549. Patented Aug. 3, 1897.

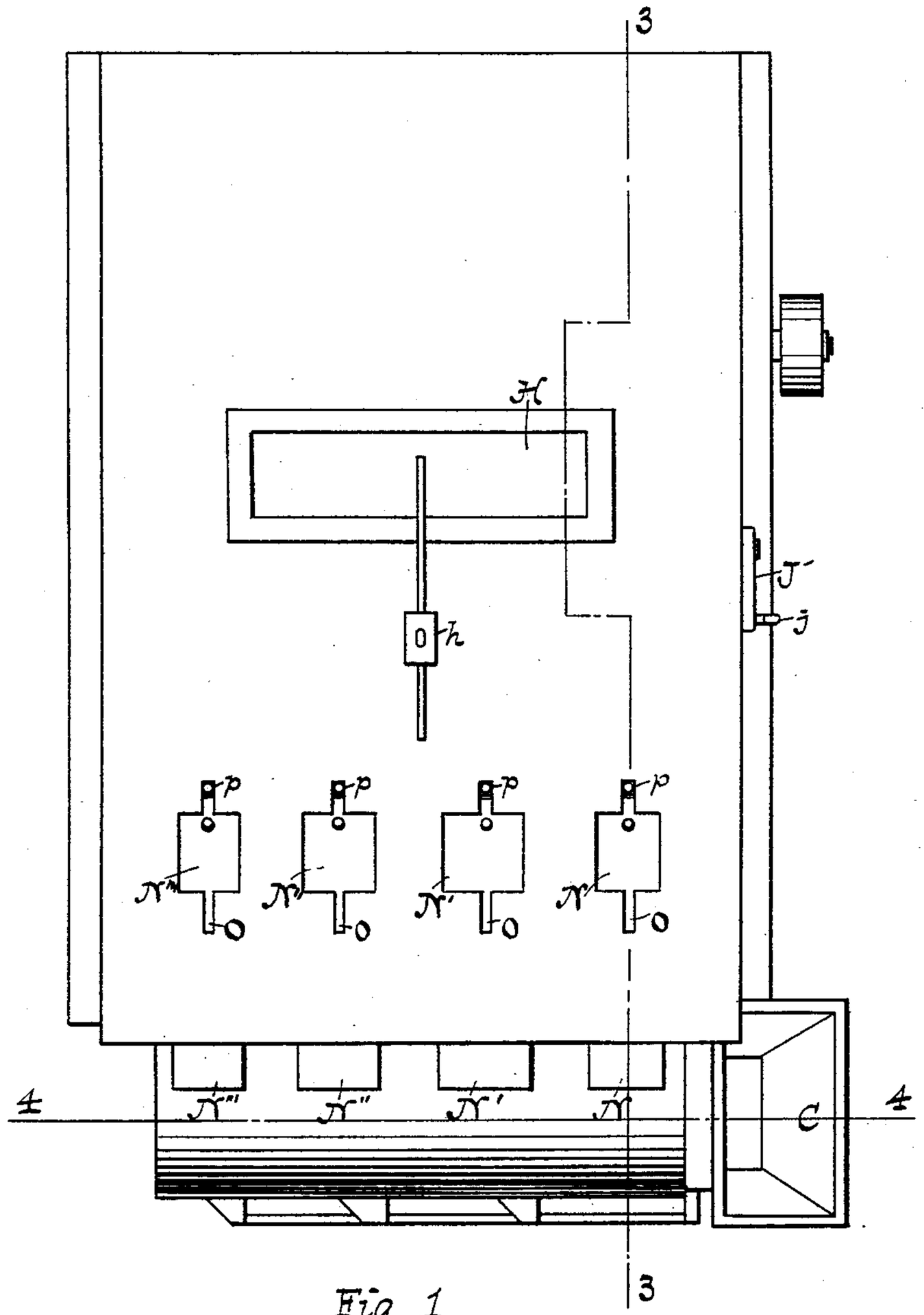

Fig. 1.

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Fig. 2.

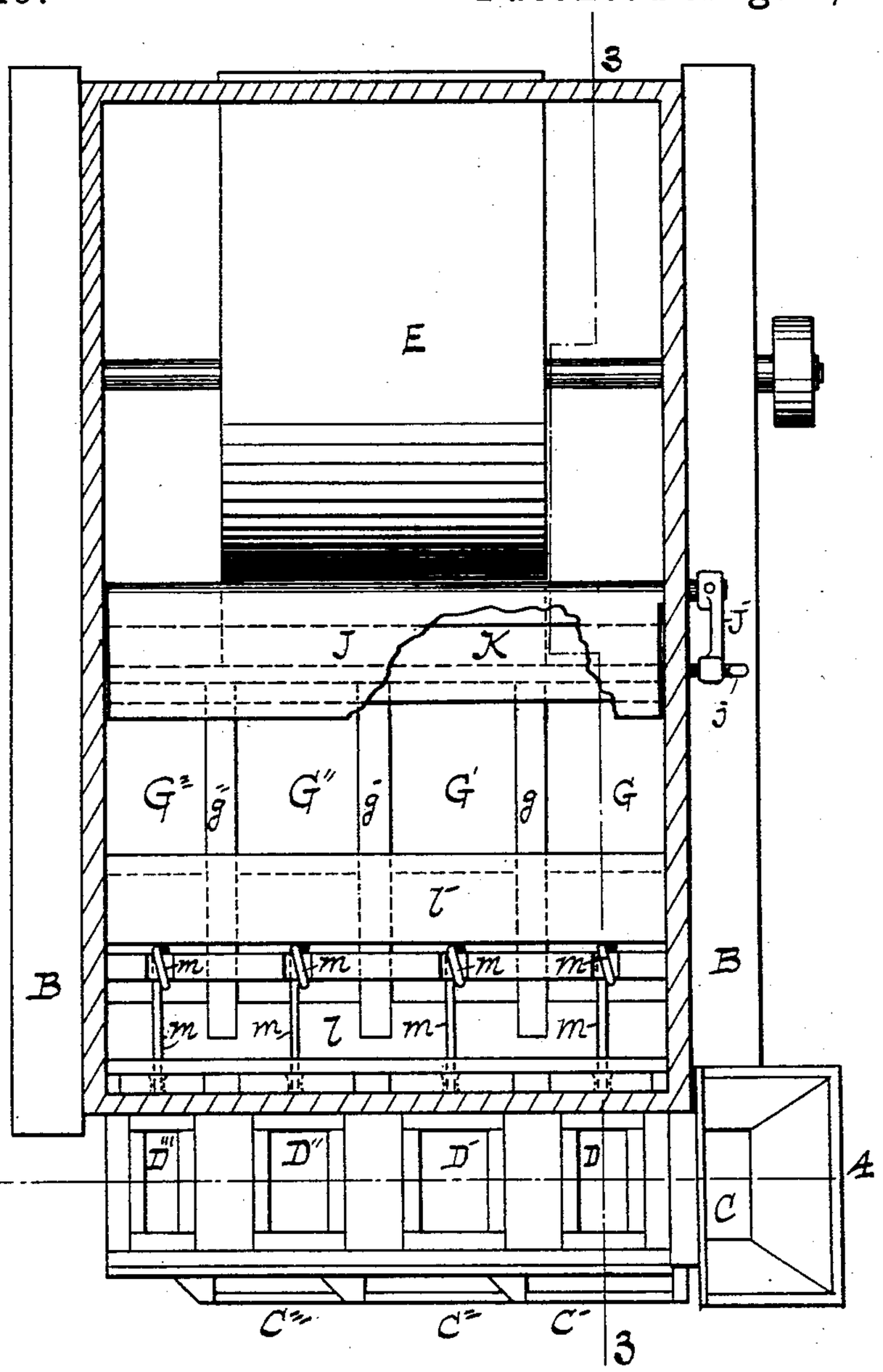
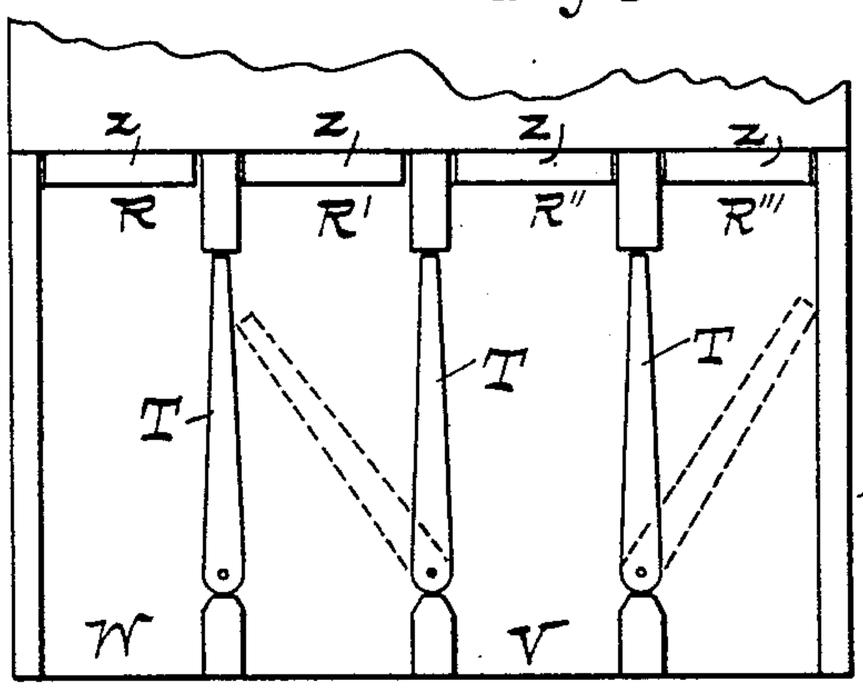


Fig. 5.



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(No Model.) 4 Sheets—Sheet 3.

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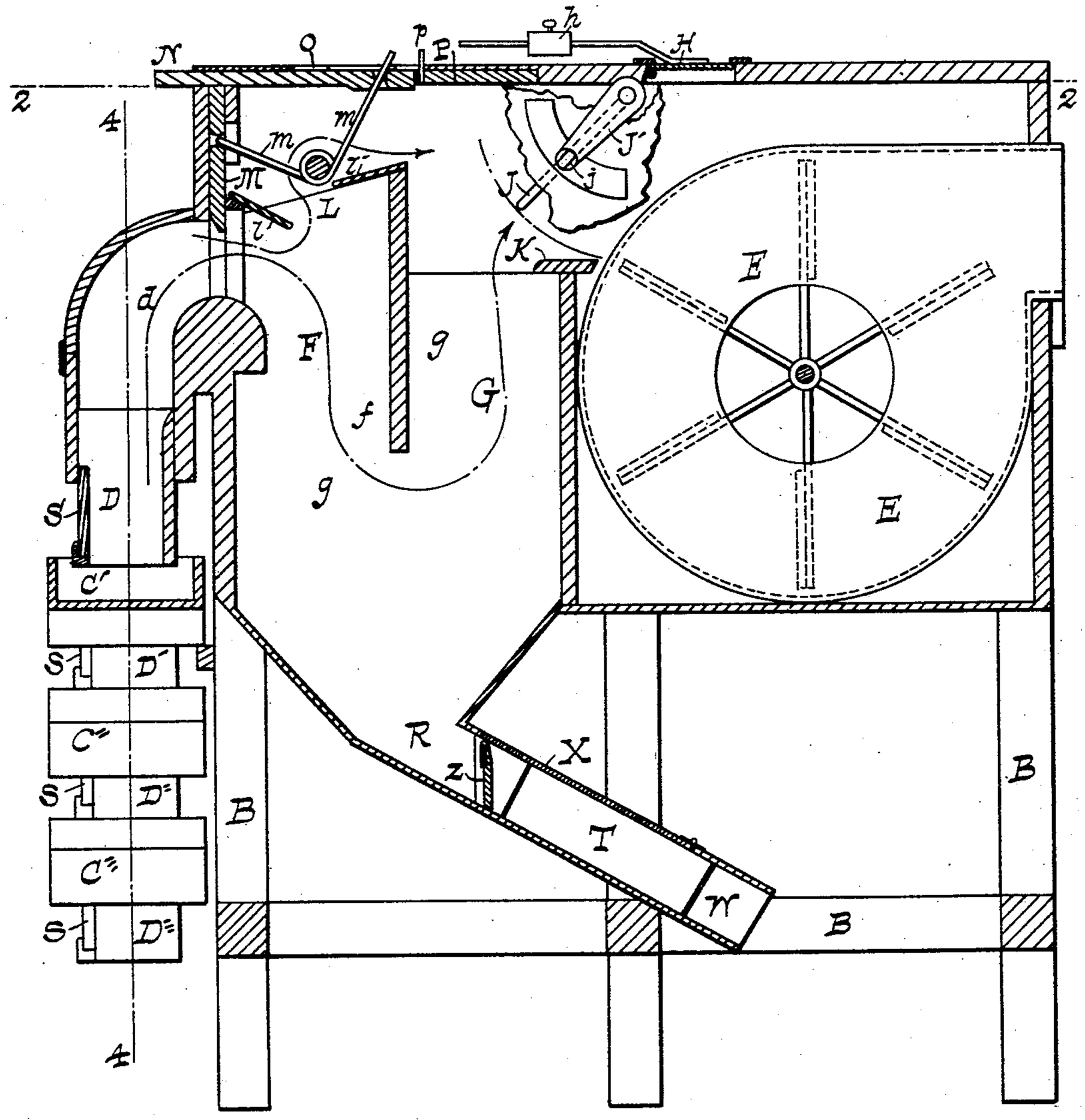

Fig. 3

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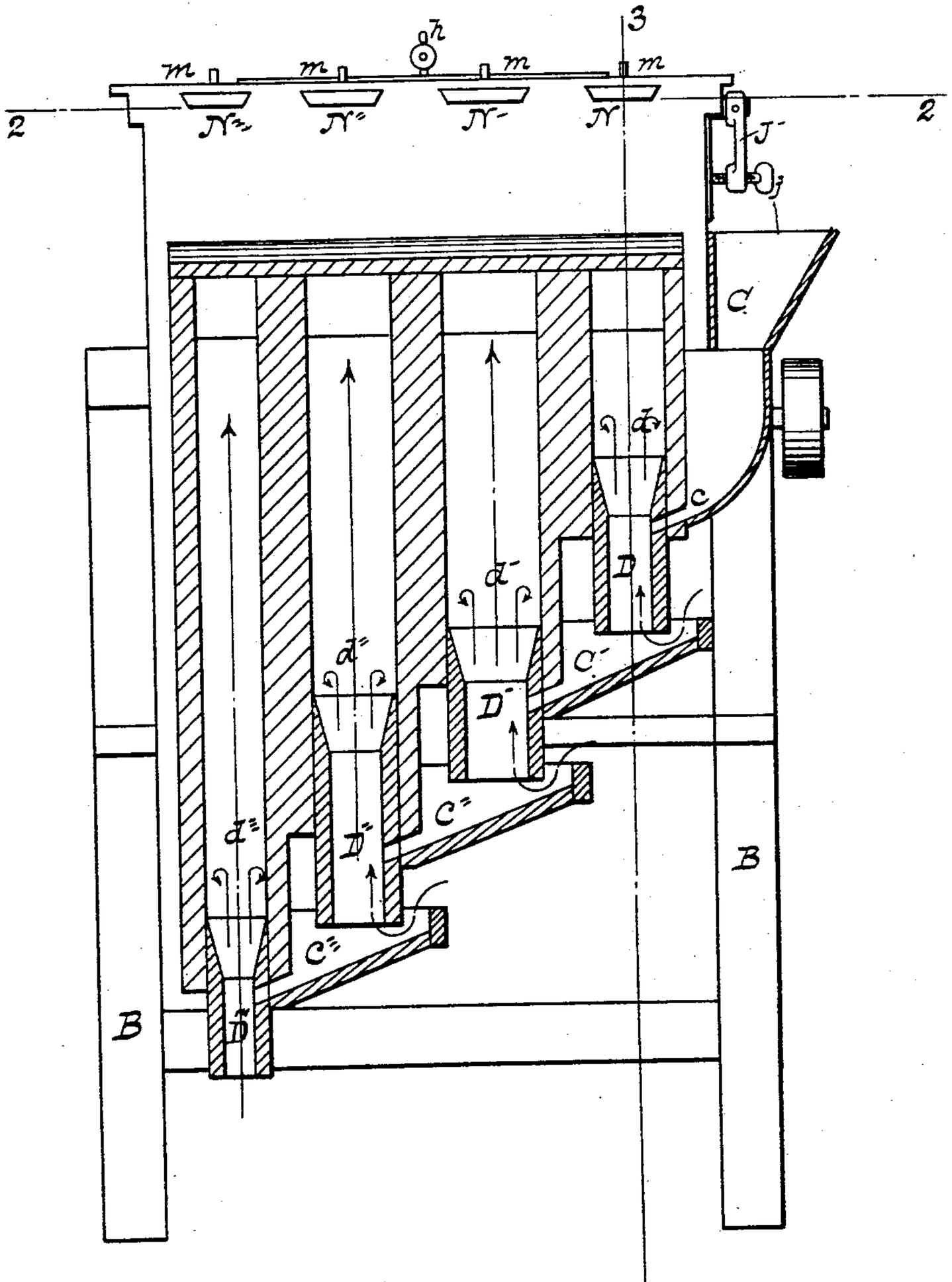

Fig 4

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UNITED STATES PATENT OFFICE.

CHARLES P. FULLMER, OF BENTON, PENNSYLVANIA, ASSIGNOR OF ONE-HALF TO WILLIAM H. MAGILL, OF SAME PLACE.

SEPARATOR FOR GRAIN, &c.

SPECIFICATION forming part of Letters Patent No. 587,549, dated August 3, 1897.

Application filed June 17, 1896. Serial No. 595,833. (No model.)

To all whom it may concern:

Be it known that I, CHARLES P. FULLMER, of Benton, Columbia county, Pennsylvania, have invented certain new and useful Improvements in Separators for Grain and other Materials, of which the following is a description, referring to the accompanying drawings, which form a part of this specification.

The invention relates to grain-separators; and its object is to simplify and at the same time render more efficient, compact, and economic in operation such apparatus. Indeed the improvements are of so simple a nature that they will be readily understood from a description of the accompanying drawings, which illustrate one preferred embodiment of my invention.

Briefly stated, by the operation of my improved separator the grain or other material is subjected to a fractional or successive separating process by which first only the dust and similar materials are carried off, and in the following separations the heavier materials are carried over by the draft of air, so that not only can the grain be far more efficiently separated from the impurities than where it is attempted to make the separation at a single operation, but also it is both possible and convenient with my improved separator to grade the different qualities or sizes of grain and other materials to which the separator is applied. The air-drafts are so delicately regulated and so directed that only the finest dust and impurities can follow the windings of the air-passages and be carried out by the blower. The heavier impurities and the grain will be severally received in the separator-chutes beneath the apparatus, while nails, ore, stones, and other heavy foreign objects will be delivered from another chute.

In the drawings, Figure 1 is a plan view of the separator. Fig. 2 is a similar view of the separator, the top being removed, as indicated by the planes 2 2 of Figs. 3 and 4. Fig. 3 is a longitudinal section on the plane 3 3 of Figs. 1, 2, and 4, looking from the right. Fig. 4 is a vertical section on the plane 4 4 of Figs. 1, 2, and 3, looking from the left of Fig. 3; and Fig. 5 is a detail view of the delivery-chutes, the cover and upper walls of the chutes being removed.

Throughout the drawings like letters of reference indicate like parts.

The supporting-framework B may be of any wooden or other construction, and is of course not material to the principles of my invention.

It will be most convenient to consider the various parts of my apparatus in the order of their normal operation.

At C is shown the receiving-hopper, which for the purpose of explanation we will consider is intended for grain, the separator illustrated being particularly adapted for the separation of wheat and other grain. From the hopper C the chute *c* delivers the grain into the vertical air passage or flue D, up which is drawn a constant current of air which can be carefully and accurately regulated to suit the requirements and effect the desired operation of the separator. This air-draft is produced by the blower E, which creates a partial vacuum within the inclosed housing or casing of the apparatus. The direction of the air-current is indicated by long arrows in all the figures, particularly in Fig. 3, and from these it will be clear that constant drafts of air pass up the flues D, D′, D″, and D‴. Each of these air blasts or drafts is deflected downward in its respective passage upon entering the casing, as at F, and thence passes under the vertical deflector *f* and again upward through the rising flue G into the main chamber of the housing or casing, from which the air is exhausted by the fan or blower E.

It will be seen from the plan view Fig. 2 up to the point where the current of air leaves the flue G and enters the main chamber each of the air-passages is distinct from the others, being separated by the partitions *g g′ g″*.

In order to maintain a constant air-exhaustion within the housing, I provide the automatic regulator-valve H, which, as clearly shown in Fig. 3, is a trap which opens downward and is provided with the counterweight *h*, which may be delicately adjusted to regulate the exhaustion to a nicety. The area of the valve H being considerable, an almost inappreciable increase of exhaustion beneath

the trap will cause it to open slightly and allow more air to enter, while in the same way any decrease of exhaustion will allow the weight *h* to fall and close the trap.

Just in front of the valve H and within the casing is placed the adjustable valve J, which, by means of the arm J′ and set-screw or equivalent device *j*, may be controlled from the outside of the casing to regulate the width of opening between the transverse sill K and the edge of the valve J. In addition to the main passages for the air through the flues F F′ F″ F‴ and G, G′, G″, and G‴ some air escapes from the flue F by passing up through the opening L between the deflecting-sills *l l′*.

At M is shown a vertical gate-valve for regulating the communicating passage between the flues *d* and F, there being one such gate-valve for each of the flues D *d*, D′ *d′*, D″ *d″*, and D‴ *d‴*, so that besides the regulation of draft by means of the speed of the blower and the automatic regulator-valve H and adjustable valve J, which is common to all the flues, each of the flues may be separately regulated or entirely shut off, if desired, by means of these valves or gates M, M′, M″, and M‴. I control these valves by means of the bell-crank levers *m*, one arm of each lever extending through a hole in its respective valve and the other extending through a slide, as at N, N′, N″, and N‴. It is clear that when a slide, as at N, is drawn upward it closes the corresponding valve, as M, and in so doing it opens an air-passage in the top of the box, as at O, Figs. 1 and 3. In order to provide for the regulation of this opening O independently of the regulation of the respective valves M, M′, M″, and M‴, the slides P are provided, which are entirely disconnected from the levers *m* and may be set as desired to regulate the admission of air through the openings O. In the drawings I indicate pins *p* projecting through the top of the housing for the purpose of adjusting the slide-valves P.

Returning now to the receiving-hopper C, the grain passing from the hopper C through the chute *c* is shot downward diagonally across the rising current of air in the flue D. The draft is so regulated that the air acts upon the fine dust and even the lighter grain, carrying it up through the short flue D into the enlarged portion of the flue *d*, while the heavier materials and almost all the grain falls directly into the hopper C′. The current of air in D, expanding into the enlarged portion *d* of the chute, is necessarily checked, and the rising effect being thereby decreased the grain and indeed all materials except the dust and the like, after passing upward a few inches by their own impetus, fall back again and drop through the constricted portion of the flue D into the hopper C′. I attribute considerable importance to this arrangement of flues D *d* and chutes *c*, by which the grain as it comes from the chute *c* without much downward impetus is acted upon by the strong draft within the constricted portion or mouth D of the flue and particles thereby carried upward into the enlarged portion *d* and there allowed to fall back under the decreasing draft and back through the constricted portion of the flue D, owing to their increased impetus. Moreover, in the case of flat stones or scales I find that falling from the chute *c* and often presenting a flat surface to the rising draft they are carried up into the enlarged flue *d*, where they turn edgewise and instantly drop back through the chute into the hopper C′. Such dust and fine particles as are carried by the draft of air into the casing and into the flue F are again separated to some extent, some of the finer dust passing through the opening L and thence directly to the blower, while most of the dust and all the heavier dust is carried down through the flue F and thence up through the flue G to the blower. Fine particles of broken grain and other solids of appreciable size are prevented from passing through the opening L by means of the two deflected sills *l l′*, for the tendency of such particles is of course to be projected in straight lines rather than to follow the sudden turn in the air-current. Striking against the vertical deflector F, they are thrown down into the first of the series of delivery-chutes R, and even such particles as are drawn up into the flue G are thrown down by the deflecting-sill K and fall back into the chute R.

If the draft is regulated so as to be very light in the first flue D, the delivery-chute R may be made to contain nothing but the heavier particles of dust; but in practice I prefer to so regulate the draft in the first flue that the first delivery-chute R will receive the broken grain or the finest grade of the grain.

The operation in the second flue D′ and its enlarged portion *d′* are substantially similar to the operation just described, the constricted portion of the flue D′ receiving the grain and heavy impurities from the hopper C′. I prefer to so regulate the draft in the second chute that it carries over about a third to one-half of the grain, though this will vary with the grain, and in case the separator is used to separate two or more kinds of grain it will depend on the relative sizes and weights of the kernels or grains. In a similar manner the third and fourth series of flues operate, the third flues preferably carrying over from a third to a half of the total amount of grain, the fourth flue carrying over all the remaining grain, which will be the largest kernels only. Small stones, broken ore, nails, and other heavy foreign substances will fall by their own gravity from the bottom of the flue *d‴*.

It will be seen that the first flues D *d* are the shortest, while the last D‴ *d‴* are the longest, this being my preferred construction not only because of the convenience in arranging the hoppers C C′ C″ C‴ so that they will deliver by gravity successively from one flue to the other, but because there should

be the greatest draft ordinarily in the last flue. It is an advantage for the more perfect operation of this last flue to have it considerably longer than the others, since such particles as are first carried up by the draft and afterward fall back require a greater free rise when they are drawn up at a greater speed and by greater draft. All these matters of proportion, however, may be considerably varied without departing from the principles of operation, which from the foregoing description will be clearly apparent to those skilled in the art.

The drafts in the respective flues are separately regulated by means of the valves M M′ M″ M‴ and by the admission of air in greater or less quantities through the openings O. The fan should be run at a speed which produces the necessary exhaustion without opening the automatic regulator-valve H more than a fraction of an inch, as it is clear that air admitted at this point means a waste of mechanical power in driving the blower.

In order to facilitate the regulation of the drafts, I make one or more of the sides of the flues D D′ D″ D‴ of glass, as indicated at S in Fig. 3. Through this glass the separation of the material as it passes through the hoppers into the flues may be seen and the drafts regulated accordingly.

Where but a single kind of grain is being separated from the dust and impurities and where it is not necessary to grade the grain, I may shut off some of my flues entirely and only employ two or more, and even where I employ all four, which in general I prefer to do, I may connect the delivery-chutes R, R′, R″, and R‴, so that two or more of them will deliver together. This is accomplished in the manner indicated in Fig. 5, the passages being provided with the pivoted partitions T, by which any three adjacent chutes may be made to deliver together. If two of the pivoted partitions are turned, as indicated in the dotted lines, it is clear that the chutes R′, R″, and R‴ will deliver at the point V. The chute R will deliver, as before, at the point W. In order to conveniently get at these pivoted partitions and the respective chutes, I provide the hinged cover X, as shown in Fig. 3, which may be raised, and the partitions T and the respective chutes be thereby exposed. To prevent the admission of air through these chutes into the interior of the casing, I provide the automatic flap-valves Z, which remain closed until the weight of accumulating grain or other material within the hopper or chute R, R′, R″, or R‴ opens them.

Having now fully described one preferred embodiment of my invention, I claim and desire to secure by these Letters Patent, together with such modifications as may be made without departing from the principles thereof, as follows:

1. In a separator, the combination with a main or common chamber, and means for exhausting the air therefrom, of a plurality of flues or grain-tubes leading upwardly into said chamber said flues enlarging abruptly toward their upper ends thus producing whirls or eddies within said enlarged portions whereby any of the heavier particles that may have been carried up through the lower portions of the flues may be separated and returned down and out of the flues against the upflowing blast, means for separately regulating the draft in each of said flues, means for delivering the grain and other material which is not carried through the first flue into the second flue and so on in succession, and a separate hopper or receiving-chute for each flue opening from the main chamber, the whole operating to simultaneously clean and grade the grain, substantially as set forth.

2. In combination in the flue of a separator, a gate or valve for closing the said flue, and another gate or valve for regulating the draft, and connections, for simultaneously operating the two said gates or valves, substantially as set forth.

3. In combination in the flue of a separator, a gate or valve for closing the said flue, another gate or valve for regulating the draft, connections for simultaneously operating the two said gates or valves, and an independently-adjustable gate or valve coöperating with the said gate or valve for regulating the draft, substantially as set forth.

4. In combination with the main chamber or casing, the plurality of grain-flues leading thereto, separate gates or valves in the said flues, and a plurality of gates or valves in said main-chamber casing coöperatively connected with the said gates or valves in the several flues, substantially as set forth.

In testimony whereof I have hereunto set my hand this 12th day of June, A. D. 1896.

CHARLES P. FULLMER.

In presence of—

WM. H. MAGILL,

SAMUEL S. HARVEY.