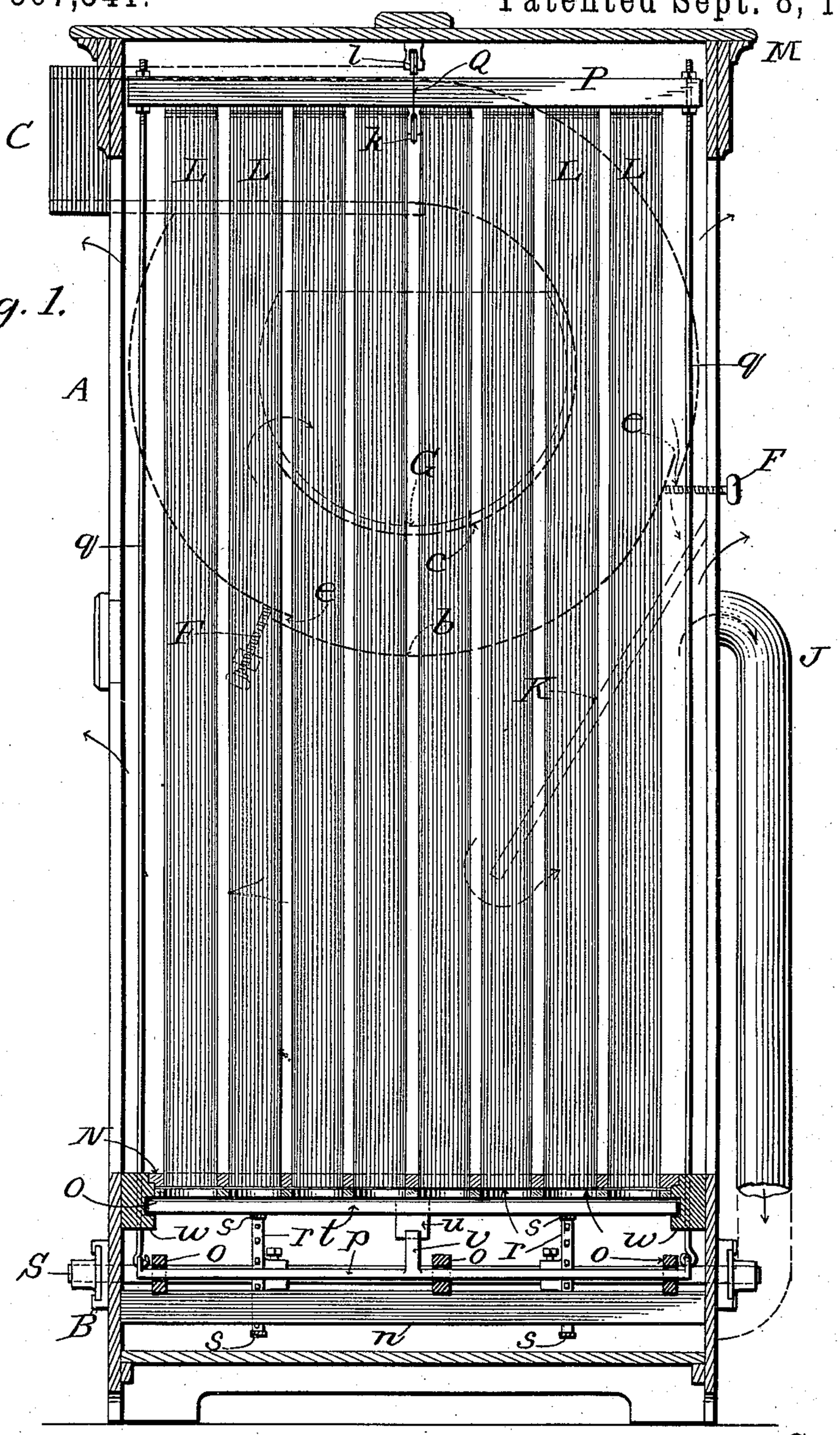
(No Model.) 6 Sheets—Sheet 1.

W. D. GRAY.

DUST COLLECTOR.

No. 567,341. Patented Sept. 8, 1896.

Fig. 1.



Witnesses
C. C. Burdine
C. B. Bull.

Inventor
William D. Gray,
by Dodger & Lone
Attorneys.

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W. D. GRAY.

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Fig. 2.

Fig. 8.

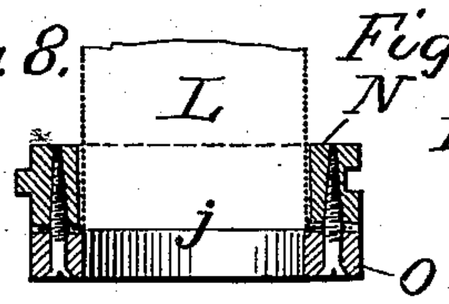
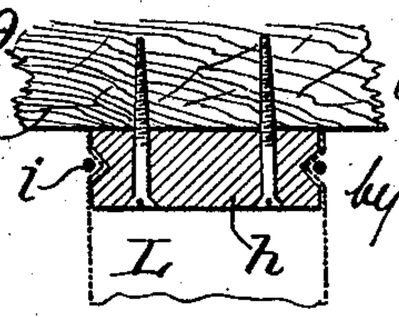


Fig. 9.



Witnesses
C. Burdine
C. B. Bill.

Inventor
W. D. Gray,
by Dodger Sons
Attorneys.

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W. D. GRAY.

DUST COLLECTOR.

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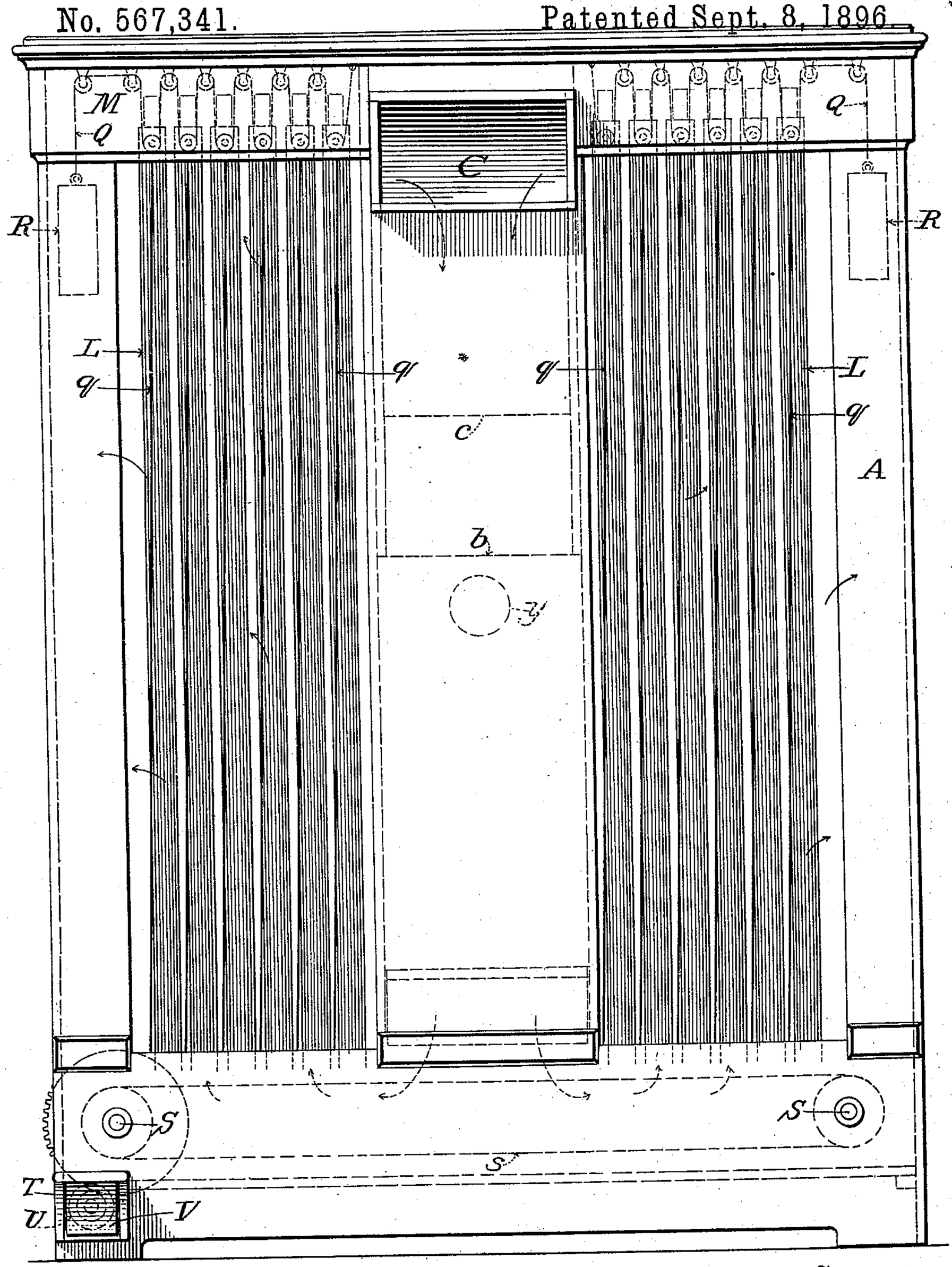

Fig. 3

Witnesses
W. Burdine
C. B. Bull.

Inventor
William D. Gray,
by Dodger Sons, Attorneys

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W. D. GRAY.

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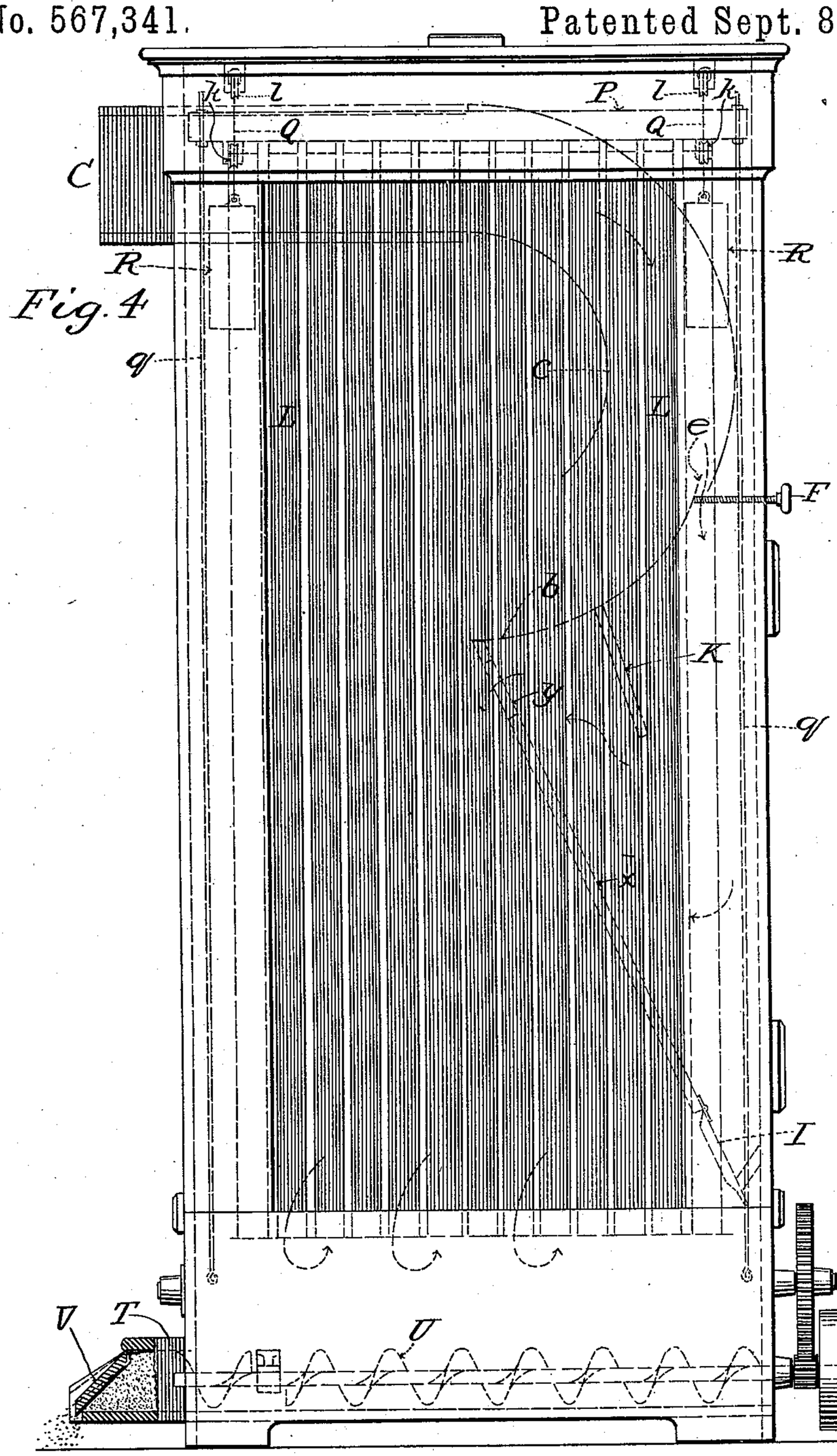

Fig. 4

Witnesses
C. B. Burdine
C. B. Bull.

Inventor
William D. Gray,
by Dodger & Sons
Attorneys.

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W. D. GRAY.

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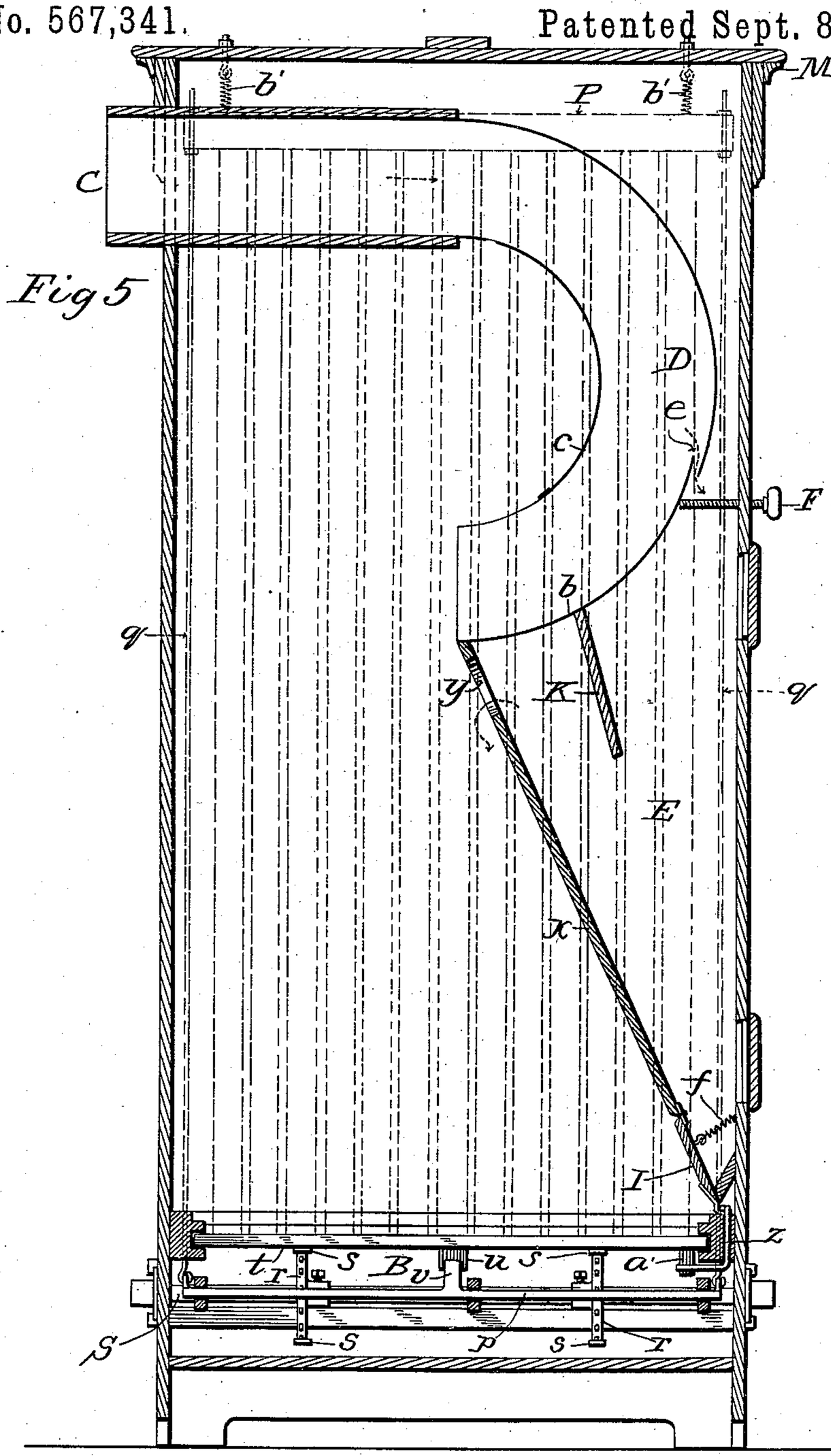
Fig 5



Witnesses
W. B. Burdine.
C. F. Bull.

William D. Gray, Inventor
by Dodger Sons
Attorneys.

(No Model.) 6 Sheets—Sheet 6.

W. D. GRAY.

DUST COLLECTOR.

No. 567,341. Patented Sept. 8, 1896.

Fig. 6.

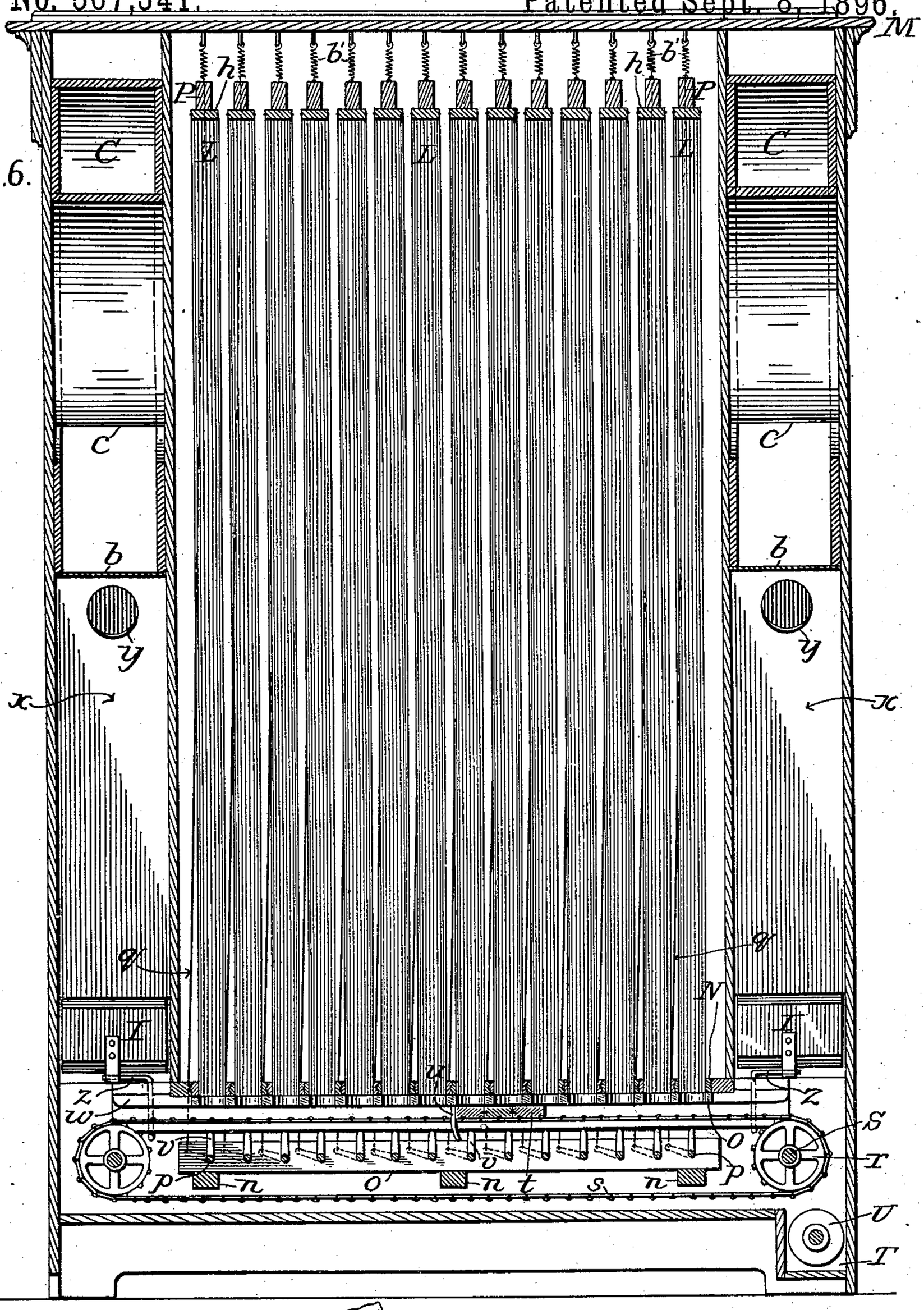


Fig. 7.

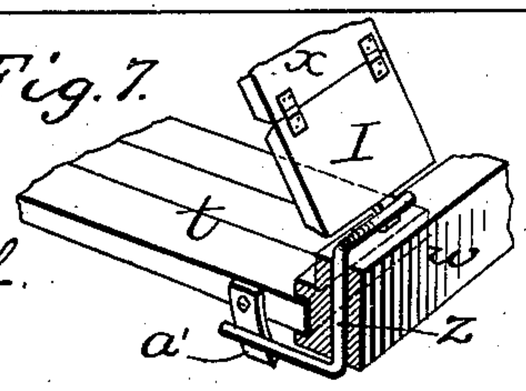


Fig. 10.

Witnesses
C. B. Burdine
C. B. Bull.

Inventor
W. D. Gray,
by Dodger Sons
Attorneys.

UNITED STATES PATENT OFFICE.

WILLIAM D. GRAY, OF MILWAUKEE, WISCONSIN, ASSIGNOR TO THE EDWARD P. ALLIS COMPANY, OF SAME PLACE.

DUST-COLLECTOR.

SPECIFICATION forming part of Letters Patent No. 567,341, dated September 8, 1896.

Application filed April 26, 1895. Serial No. 547,265. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM D. GRAY, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Dust-Collectors, of which the following is a specification.

My invention pertains to dust-collectors; and it consists in a variety of features and details hereinafter set forth, whereby high efficiency is secured, while the structure is made simple, compact, and durable.

The embodiment of the invention may be varied somewhat as required or suggested by circumstances. Thus for air containing a large percentage of heavy impurities greater capacity should be given the preliminary or centrifugal separator, whereas in the case of relatively pure air, or air containing only lighter impurities, the filtering capacity should be relatively greater. These and similar considerations will control or affect the designing and proportioning of the machine.

In the drawings, Figure 1 is a transverse sectional elevation of my improved dust-collector in the form preferred for small machines, and Fig. 2 a longitudinal vertical section of the same. Fig. 3 is a face elevation of a double machine embodying my invention; Fig. 4, an end elevation; and Fig. 5, a transverse vertical section of a machine similar to that of Figs. 1 and 2, but differing therefrom in certain features, as hereinafter explained, being the construction embodied in Fig. 3; Fig. 6, a longitudinal vertical section of a machine having two inlet trunks or spouts and centrifugal separating-chambers, such construction being peculiarly suitable to the collection of heavy mineral substances reduced to a powdered state; Fig. 7, a detail view of the mechanism for opening the discharge-gate of the preliminary collecting-chamber; and Figs. 8, 9, and 10, detail views hereinafter referred to.

The present invention is designed to embody two familiar plans of dust-collection, viz: elimination of dust from a moving air-current through centrifugal action and filtering or straining the air.

It is evident that where the particles to be removed are relatively heavy and are present in considerable quantity separation may be advantageously effected by centrifugal action; but where the particles to be removed are but little heavier than air or are thin and flaky, and consequently liable to float in the air when the latter is in motion, filtering or straining is necessarily resorted to to effect a dry separation.

Impurities encountered in flour-making partake of both the qualities noted, some being very light and flaky and others being heavier and granular. Hence it is desirable to combine in one and the same machine the two modes of separation or collection.

It will be seen, too, that the heavier matters should be first separated or removed in order to lighten the moving current and permit its easier movement, and particularly because while the motion is more vigorous the centrifugal action will be greater and the separation more effective.

With these considerations in view I construct my machine as follows: Referring first to Figs. 1 and 2, A indicates a framework, conveniently of rectangular form, in the base of which is a chamber B, in which all the dust is collected.

C indicates an inlet spout or trunk through which the dust-laden air is brought to the machine from a fan or other air-forcing device. This spout opens directly into or forms part of a circular chamber D, the side walls *a* of which may conveniently be made of wood, while the circular walls *b* and *c* are advisably made of smooth sheet-iron.

The wall *b* is or may be carried around until it meets the under side of the spout or trunk C, as shown by dotted lines in Fig. 1, but the inner wall *c* is carried through a shorter arc, as shown.

The space beneath the circular chamber D is inclosed by the side walls *a a* and by end walls *d d* to form a settling and collecting chamber E, and the curved wall *b* of the chamber D is provided with openings *e*, one or more, through which the heavier particles carried by the air-current may escape into the chamber E.

The openings *e* are narrow slits which may

conveniently be made by cutting the metal of wall *b* from side to side and pressing one edge inward, as indicated in Fig. 1.

It is desirable that the openings be made variable as to size to suit the class of material operated upon, and this may be effected readily by passing set-screws F through fixed bars, brackets, or portions of the framework and arranging their ends to bear against or to swivel in the edge to be adjusted, as indicated in Fig. 1.

It is of course understood that when the rapidly-moving current of air enters chamber D and is deflected by wall *b* the heavier matters are thrown against said wall by centrifugal force and glide over its surface until they come to the openings *e*, whereupon they escape into the chamber E.

G indicates an opening concentric with the chamber D and communicating with the rear or inner end thereof, as indicated in Figs. 1 and 2. This opening communicates, by the passage H, with the chamber B in the base of the machine, as shown in Fig. 2. Chamber E is formed with a hopper-bottom or with an inclined gather-board and with a hinged gate I, which is normally held against the edge of the gather-board by a spring *f*. The dust and impurities delivered to chamber E settle therein by reason of the fact that but very little air enters said chamber, and that which does enter is free to expand, and the particles, being heavier than the air, settle by gravity into the lower portion of the chamber.

To prevent a back pressure of air in chamber E, a pipe J opens therefrom into chamber B, as shown in Figs. 1 and 2, but to prevent the air from passing directly from the opening *e* to said pipe, a shield or guard K is carried across the chamber from side to side from a point above the opening into the tube J downward and forward into chamber E, as shown by dotted lines in Fig. 2. This shield or guard compels the impurities to descend a considerable distance before the air can rise or pass to the outlet-pipe J, and by reason of the expansion of the air in the chamber E and the sudden change of direction it is compelled to make before escaping the impurities are almost wholly extracted therefrom before the air enters pipe J.

L indicates a tube of cotton flannel, or other pervious material, a series of which tubes is arranged between the top or decking of chamber B and the top M of the machine, as shown in Figs. 1 and 2.

The top or decking of the chamber B is formed of a series of bars or slides N, provided at one edge with a tongue and at the other edge with a groove, as shown in Fig. 8 and also in Fig. 2. These slides are adapted to be applied and removed as required, and by reason of the interlocking tongues and grooves they form a close air-tight joint. Each slide N is formed with a series of openings *j* of a size to receive the lower end of a tube L. The tubes are passed through the openings *j* and the lower ends of the tubes are spread out and tacked to the under faces of the slides, after which a second bar or strip O, having holes registering with the holes or openings *j*, is secured by screws or otherwise to the under face of the slide N, as shown in Fig. 8, thus permanently securing the lower ends of the tubes in place. By thus securing the tubes to slides I am enabled when necessary to draw out one entire line or series of tubes without disturbing the others, and I may replace the withdrawn tubes by another slide, so that the machine may continue in operation while repairs are being made to the tubes thus removed.

Each tube is provided at its upper end with a circumferentially-grooved block or plug *h* of a size to fit and fill the upper end of the tube, as shown in Fig. 9. The tube encircling the block is glued to its periphery, and is further made fast thereto by a flexible wire *i*, wrapped about the tube and pressing the same into the groove of the block, the ends of the wire being twisted together or otherwise made fast. The blocks or plugs *h* are in turn secured to bars P, which extend across the machine parallel and in line with the corresponding slide N at the lower end of tubes of the same series. The bars P may be supported and the tubes stretched and held taut either by springs or by weighted cords or bands, as found expedient. In Figs. 1 and 2 I have represented each cross-bar P as provided with a grooved pulley *k* at a point midway between its ends, and I have shown a second set of pulleys *l*, alternating with the pulleys *k* and carried in hangers secured to the top M of the machine.

Q Q indicate ropes or flexible bands, each passing from a fixed support *m* under and over the pulleys *k* and *l* alternately and each provided at its free end with a weight R. Under this construction it will be seen that any bar P of the series may be drawn down without affecting the others, or that two or more bars may thus be drawn down without affecting the remaining bars. It will also be seen that when left free to rise each bar will return promptly to its elevated position under the influence of weight R, and thus the tubes L will be stretched taut and held in an upright position.

As above mentioned, the chamber D communicates by opening G and flue or passage H with the chamber B, and consequently any air escaping from the chamber D through the opening G will pass to chamber B and escape through the openings *j* into the tubes L. The tubes being of porous material, preferably cotton flannel, with the rough side in, the air will deposit its impurities on the inner surface of the tubes and escape through the meshes of the tubes completely purified.

Continuous use of the machine would in a comparatively short time result in the clogging of the pores or meshes of the cloth by the impurities deposited on the inner sur-

faces of the tubes were not provision made for removing such accumulation. This must be done at short and frequent intervals and may be conveniently done by the mechanism shown in Figs. 1 and 2. In said figures *n* indicates cross-timbers which support side bars *o*, in which are journaled rock-shafts *p*, each provided with three radial arms, one at its mid-length and one at either end. The arms at the ends of the rock-shaft *p* are connected by rods or wires *q* with the cross-bars P at the upper ends of the tubes, one pair of such arms to each cross-bar, as plainly shown in Fig. 1.

Journaled in the framework of the machine and near the ends of chamber B are two shafts S S, to one of which motion may be imparted from any convenient prime motor. These shafts are provided with sprocket-wheels *r*, about which pass endless chains *s*, preferably of the chain-belt type. Secured to these chains are narrow cross bars or slats *t* of such thickness as just to fill the space between the lower ends of the tubes L or their retaining-strips and the upper side of the chains, so that as the slats *t* pass beneath the open ends of the tubes they shall close said tubes successively and exclude the air therefrom. The forward slat is provided with a beveled contact-block *u*, which projects downward sufficiently to engage one after another the arms *v* of the rock-shafts *p*, thereby pressing said arms forward, drawing down upon the rods *q* against the resistance of the weight R, and thus slackening the tubes L, attached to the cross-bars.

As the contact-block *u* rides off and out of contact with arm *v* of the rock-shaft *p*, the weight R suddenly elevates the cross-bar P, and thereby draws taut all the tubes attached to it. This sudden action gives a quick throw or jerk to the cloth, analogous to the snapping of a whip, and very effectually dislodges adhering matter therefrom. As this action does not take place until the slats P have passed fairly beneath the ends of the tubes of the line or series operated upon, it will be seen that there is no internal air-pressure to hold the material against the inner walls of the tubes, and that owing to the weight of the material it will promptly descend to and rest upon the slats, from which it will be scraped by the walls of the openings J as the slats pass from beneath the tubes. The dust being thus collected in a mass will readily fall to the bottom of chamber B and will not be materially disturbed or taken up by the current of air flowing through said chamber.

After passing the tubes L the slats *t* encounter the downwardly-projecting edge of the gate I of chamber E, and, pressing the same back before it, cause the accumulated material in said chamber to drop to the floor or bottom of chamber B. The slats then passing to the under side of the chains on their return to their working position travel close to the bottom of chamber B and scrape the accumulated dust and impurities before them into a trough T, containing a conveyer U. (Shown in Fig. 2.) This conveyer serves to deliver the entire accumulation from the machine, the outlet being suitably trapped to prevent the escape of air, as will be hereinafter explained.

To prevent the slats *t* from falling away from the mouths of the tubes, and thereby permitting air to enter them, the ends of the slats are carried by guides or grooved ways *w*, as shown in Fig. 1.

In some cases it may be found desirable to divide the tubes into two groups and to arrange the inlet pipe or duct, the centrifugal chamber D, and collecting-chamber E at the middle of the machine, as in Fig. 3. In such case openings G and passages H may be made at both sides of the chamber D, but the same chains, cut-off slats, conveyers, and like parts may serve for both groups or series. I prefer, however, when using the centrifugal air duct and chambers to adopt the construction illustrated in Figs. 4 and 5.

As shown by dotted lines in Fig. 4 and by full lines in Fig. 5, the chamber D, in which the centrifugal action is secured, curves through about a half-circle and opens directly into the space H, which has the same function as the passage or chamber H of Fig. 1; that is to say, it serves to conduct the air from the centrifugal chamber D down to the chambers B in the base of the machine. A partition *x* extends from the lower end of wall *b* of chamber D downward and rearward toward the rear wall of the machine, and thereby separates from the chamber or passage H a settling-chamber E to receive the heavier particles thrown off by centrifugal force and escaping through the slit or opening *e*, Fig. 5. There may be as many of the openings *e* as found desirable, and their size may be controlled by set-screws F, as in Fig. 1.

The partition *x* is provided near its upper end with an opening *y*, through which the air entering chamber E, through the opening or openings *e*, may pass to the chamber H to remingle with the main air-current, a guard or deflector K being placed between the opening *e* and the openings *y* in essentially the same manner as in Fig. 1 and for a like purpose.

At or near the lower end of the partition *x* there is a hinged door or gate I, which is normally held closed by a spring *f*, as in Fig. 1, but under the present construction this gate I extends in the direction of the travel of the cut-off slats *t*. Hence it will be seen that it cannot be opened by the direct pressure of the cut-off, as under the previous construction. I therefore provide a two-armed elbow-lever *z*, (shown in Figs. 5, 6, and 7,) one horizontal arm of which is arranged to bear against a lip or lug at the lower edge of the gate I and the other horizontal arm of which is arranged to project in the path of a tongue or lug *a'*, carried by the cut-off slats *t*, as best shown in Fig. 7. Under this construction the

gate I will be thrown open by the cut-off slats *t* in essentially the same manner as before, and the accumulation of chamber E will be dropped to the bottom of chamber B, whence it will be carried to the conveyer-trough.

Fig. 6 shows the same construction as Figs. 4 and 5, except that the spout C and chambers D and E and their appurtenances are duplicated and placed at each end of the machine, such construction being more particularly designed for handling mineral substances reduced to a powdered form. It may, however, be employed in connection with flour-making machinery and for other and like purposes.

In Figs. 5 and 6 the cords, weights, and pulleys are dispensed with and springs *b'* are substituted. The action, however, will be practically the same as in the case of the weights and cords. In Fig. 4 it will be seen that the cords, weights, and pulleys are in duplicate series, a supporting-cord being applied near each end of the several bars P.

As above mentioned, it is necessary to prevent the escape of air with the dust and impurities from the conveyer-trough. To accomplish this, I construct the conveyer as shown by dotted lines in Fig. 4; that is to say, it is interrupted at a point somewhat inward from its delivery end, and its shaft is supported at the point of interruption by a suitable hanger or bracket. This leaves the screw exposed at the extreme end and enables it to force the material into the delivery end of the conveyer-trough, and to pack it therein from top to bottom, a heavy or weighted valve V being applied to the mouth of the trough and offering sufficient resistance to cause the material to bank up and fill the end of the trough before it can escape. When thus accumulated and compressed by the screw action of the exposed end of the conveyer, the material will force its way beneath the valve, lifting the same and escaping as required, but precluding the escape of air by reason of the solid mass completely filling the outlet.

Referring now to Fig. 10, the preferred construction of the cut-off will be explained. As here shown, the edges of the slats *t* are grooved longitudinally to receive pieces of cotton belting or similar material, one edge of each of which is allowed to project somewhat beyond the groove, and is raveled, as indicated. Two such raveled edges being pressed together, as they will be when the slats are supported in their guides or runways and lie in a horizontal position, will effectually cut off any flow of air; but when the slats pass about the wheels *r* the raveled edges will separate sufficiently to entirely discharge any accumulation of matter that may lie between the slats. This is a feature of some consequence, as it prevents the clogging of the parts and avoids any danger of straining the connections between the slats. Rubber, leather, or other material may, however, be employed, sufficient slack being allowed to afford proper movement in the case of inelastic materials.

It is obvious that instead of varying the size of the opening or openings *e* by pressing inward a section of the wall *b* a gate or slide may be used for that purpose; but I prefer the construction shown, for the reason that the edge or lip may be thrown more or less into the path of the air-current, and thus caused to skim off a greater or less stratum of the air.

It will be seen that instead of the weight or weights R a spring may be employed to keep the cord Q under tension.

The pulleys *k* may be located at the outer extremities of the bars P and beyond the tubes L when two supporting-bands are employed for a single bar, and such arrangement will be found desirable in that it permits the cords to be readily slipped off the pulleys and clear of the bars, so that the latter may be removed from the machine without otherwise disturbing the cords or bands.

It is obvious that cords may be used instead of wires to secure the upper ends of the tubes L to the blocks *h*.

I am aware that various patents have been granted for machines embodying the idea of centrifugal separation of dust, and also for machines designed to filter or strain the air.

I am further aware that tubes, bags, and other forms of filter have been sustained by weights and springs, and have been cleansed or freed from the accumulated dust by being slackened and then suddenly drawn taut. My invention, however, is designed to produce a machine combining the two modes of operation and embodying the same in a compact and simple form capable of doing thorough and efficient work, yet occupying small space and free from liability of injury.

Having thus described my invention, what I claim is—

1. In a dust-collector, the combination of a chamber having a curved outer wall *b* formed of flexible material in separated sections; an opening *e* between proximate sections; and a set-screw F applied to one of the flexible sections and serving to throw its edge more or less within the chamber as required, whereby the size of the opening *e* may be varied and a greater or less skimming effect be given to the edge of the adjusted section.

2. In a dust-collector, the combination of a chamber D provided with a curved wall having an opening *e;* a chamber B; a pipe or passage connecting the chambers D and B; a series of filtering-tubes communicating with chamber B; and a guard or shield K interposed between opening *e*, and pipe or passage J, substantially as and for the purpose explained.

3. In a dust-collector, the combination of a settling-chamber E provided with gate I; a collecting-chamber B; filtering-tubes L communicating with said chamber B; a chain

belt *s*, arranged within said chamber, and a cut-off *t* carried by said chain belt and adapted to engage with and open the gate I.

4. In a dust-collector, the combination of chamber D having a curved wall *b* provided with an opening *e;* a settling-chamber E; a gate I at the lower part of chamber E; a yielding support for said gate; and an endless belt provided with a projecting part which serves to engage with and to open the gate when carried thereagainst by the travel of the belt.

5. In a dust-collector, the combination of a frame A; a collecting-chamber B; an air-trunk C; a chamber D having a curved wall *b*, provided with an opening *e;* a settling-chamber E beneath the chamber D; a central outlet G from the chamber D; a passage H connecting chambers D and B; a pipe or passage J connecting chambers E and B; and a series of filtering-tubes L communicating with chamber B, substantially as set forth.

6. In a dust-collector, the combination with a series of filtering-tubes secured at one end to a fixed support and at their opposite ends to movable bars; pulleys carried by a fixed support; a second set of pulleys carried by said movable bars; and a flexible band made fast at one end to a fixed support, passing about pulleys of the two series successively, and provided at its free end with a yielding take-up device, substantially as set forth.

7. In a dust-collector, the combination of a chamber B; a series of filtering-tubes L communicating therewith; cross-bars P attached to the upper ends of the tubes L and provided with pulleys *k;* pulleys *l* secured to the framework of the machine; a flexible band Q passing about said pulleys; and a weight R applied to the band.

8. In combination with chamber B and tubes L communicating therewith; cross-bars P carrying the upper ends of the tubes; pulleys *k* carried by said cross-bars, intermediate pulleys *l* carried by fixed supports; flexible bands Q passing under and over said pulleys successively; take-up devices applied to said bands; rock-shafts *p* having projecting arms; rods connecting the bars P with the arms of the rock-shafts; and an endless belt *u* provided with a cut-off *t* adapted to pass beneath and to close the mouths of the tubes successively, and also to engage an arm of each rock-shaft, whereby the shafts may be turned to draw down the bars P, substantially as described.

9. In a dust-collector and in combination with a filtering tube or tubes, a cut-off composed of slats or boards grooved along their proximate edges, and having strips of belting or like woven material seated in and protruding from the grooves, the protruding edges of the belting being raveled, substantially as and for the purpose explained.

10. In a dust-collector, the combination of a frame; a chamber at the base of said frame; independent slides constituting a top for said chamber; filtering-tubes applied to said slides; supporting-bars attached to the upper ends of the tubes; flexible bands passing beneath the bars, and yielding take-up devices for said bands, all substantially as shown and described.

11. In combination with chamber B, slides N provided with filtering-tubes L, bars P attached to the upper ends of the tubes, pulleys *k* carried by the bars near their outer ends, pulleys *l* carried by the frame of the machine, bands Q passing over and under said pulleys alternately, and a weight or take-up device connected with said bands.

In witness whereof I hereunto set my hand in the presence of two witnesses.

WILLIAM D. GRAY.

Witnesses:
RICHARD HOPPIN,
THEODORE F. WAMBOLD.