(No Model.) 3 Sheets—Sheet 1.

# A. HEINE.

## DUST COLLECTOR.

No. 543,133. Patented July 23, 1895.

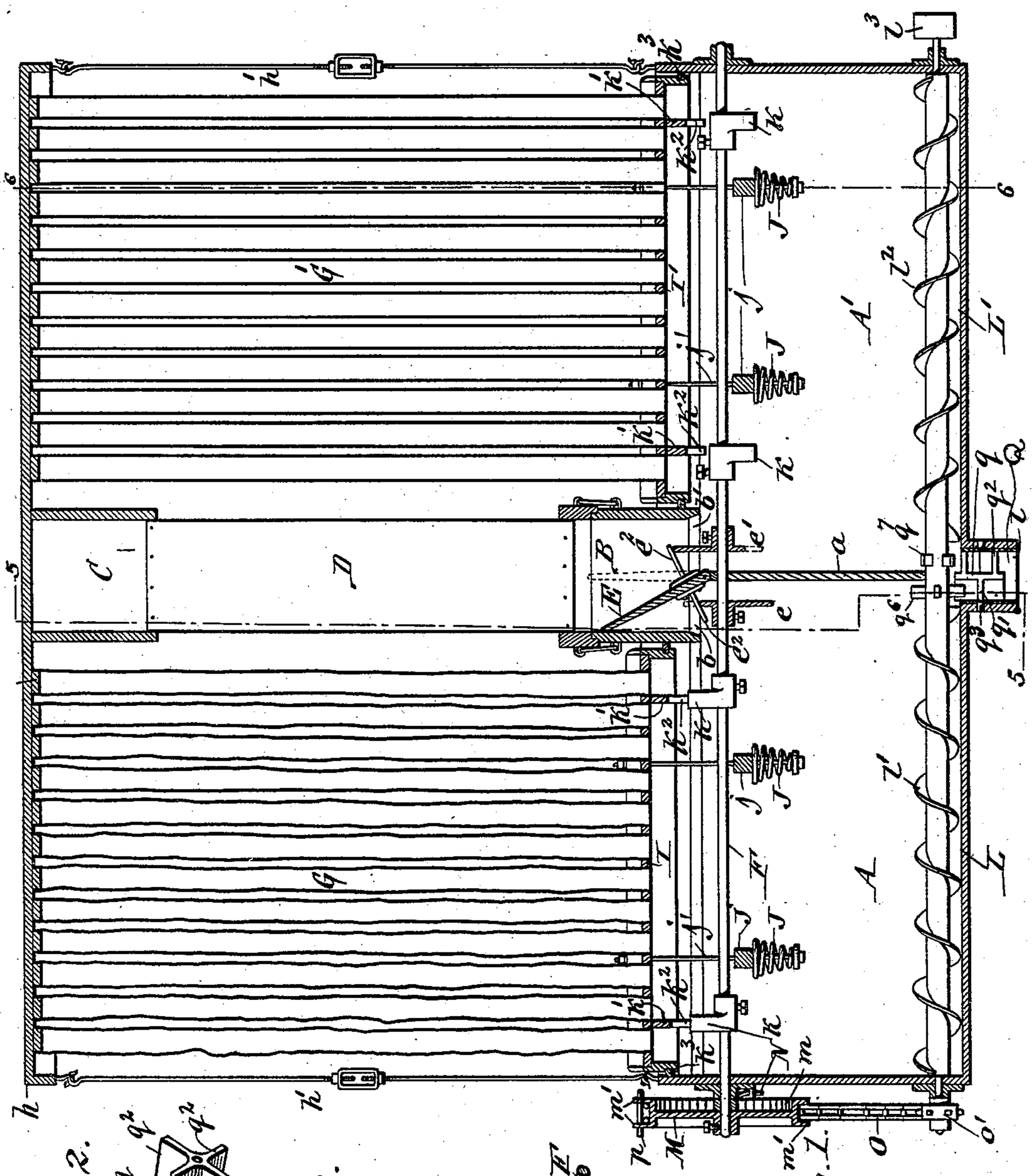

Fig. 1.

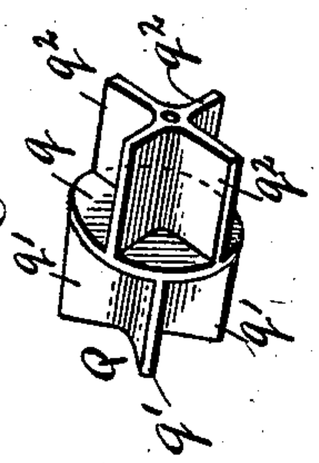

Fig. 2.

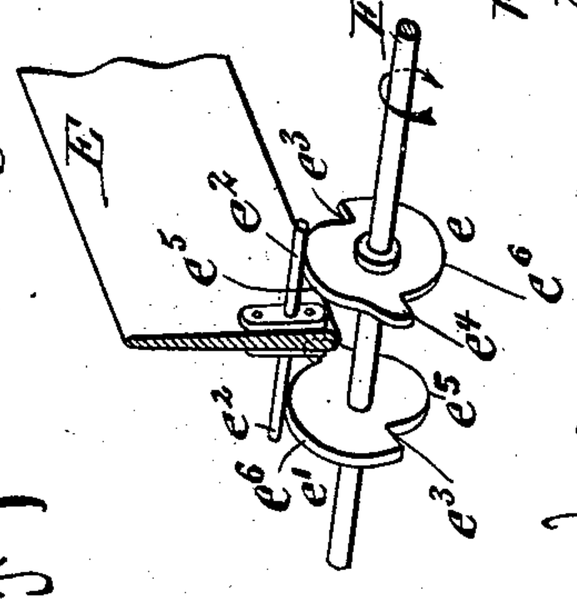

Fig. 3.

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Attorneys.

(No Model.) 3 Sheets—Sheet 2.

# A. HEINE.

## DUST COLLECTOR.

No. 543,133. Patented July 23, 1895.

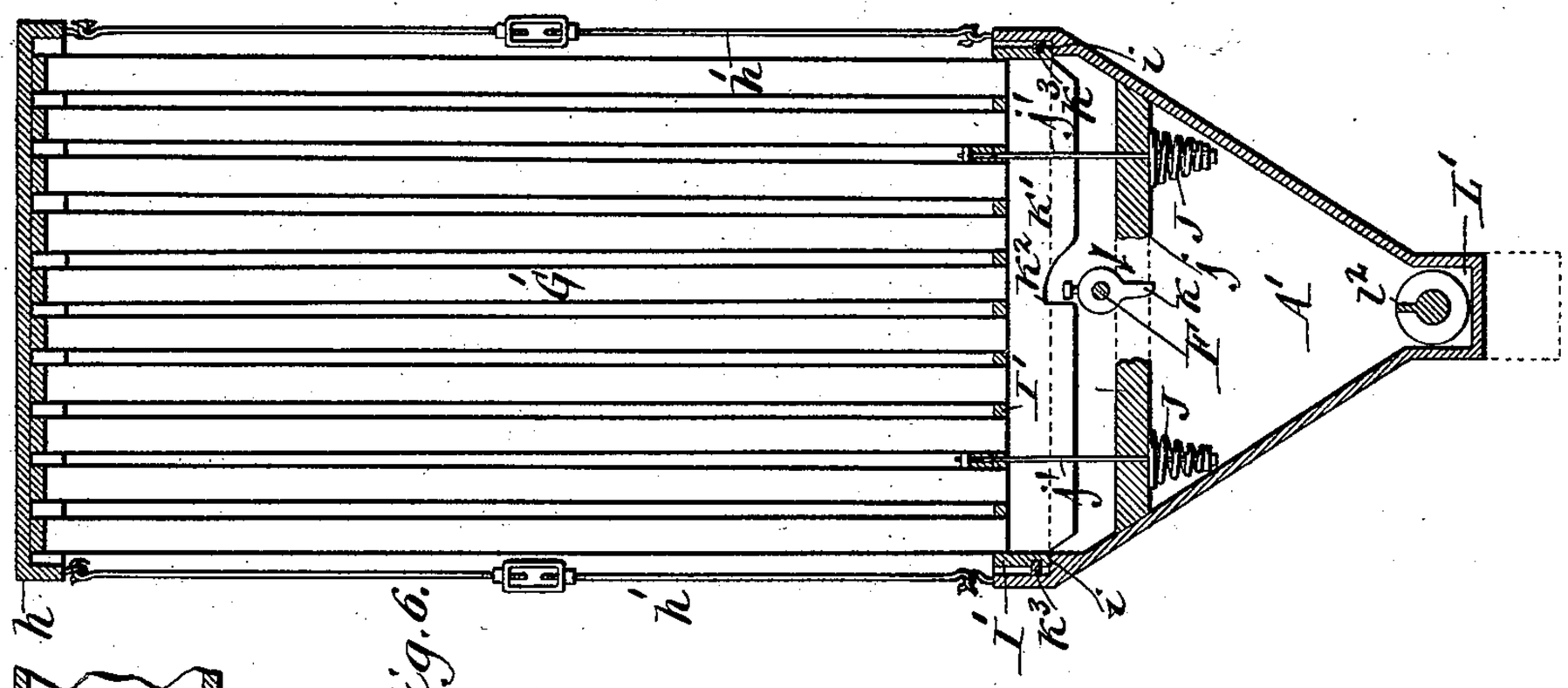

Fig. 6.

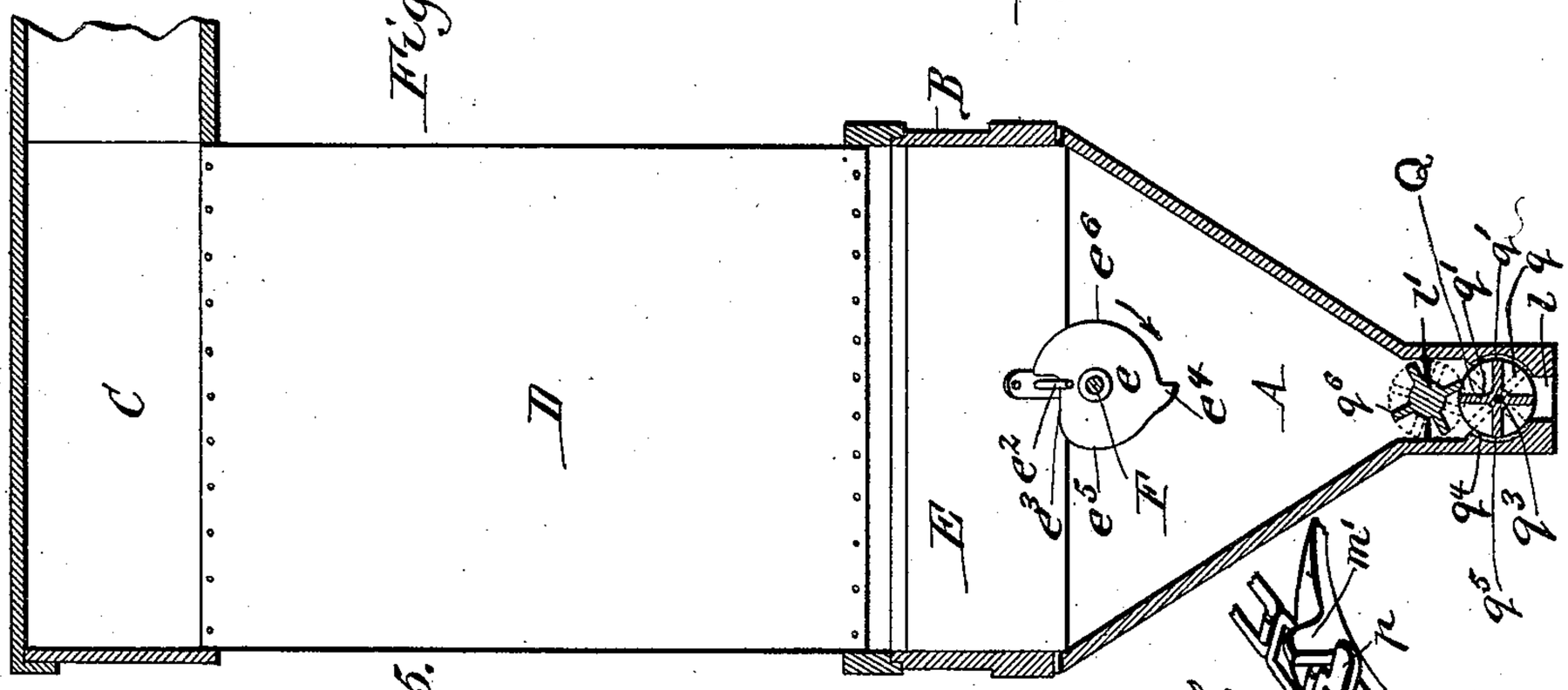

Fig. 5.

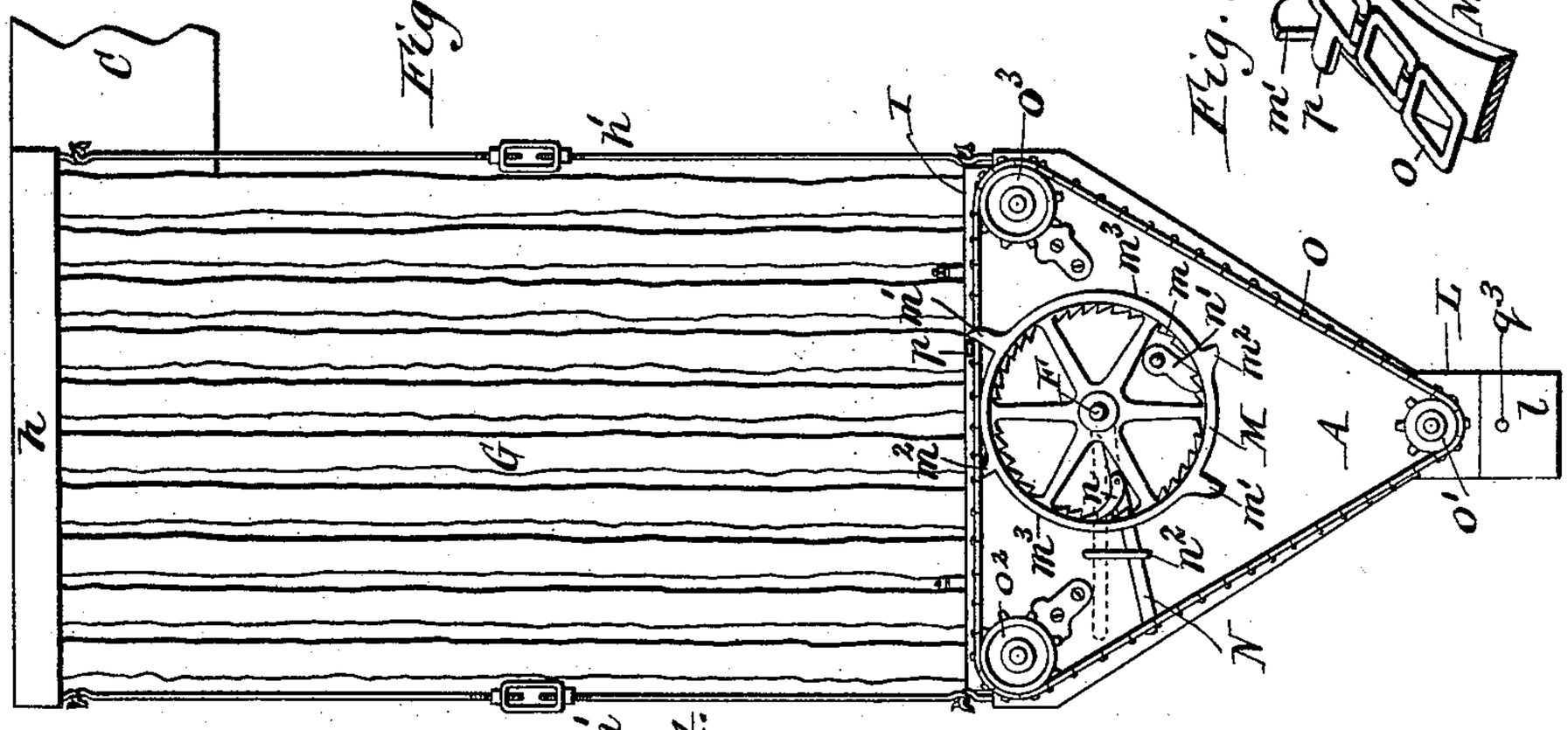

Fig. 4.

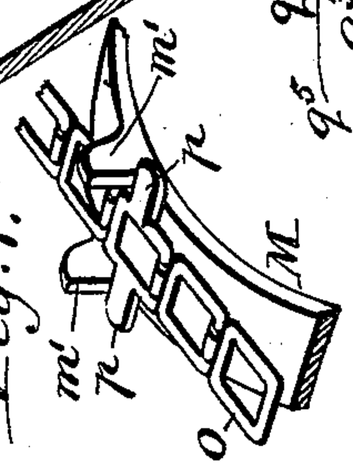

Fig. 7.

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(No Model.)

3 Sheets—Sheet 3.

# A. HEINE.

## DUST COLLECTOR.

No. 543,133. Patented July 23, 1895.

Fig. 9.

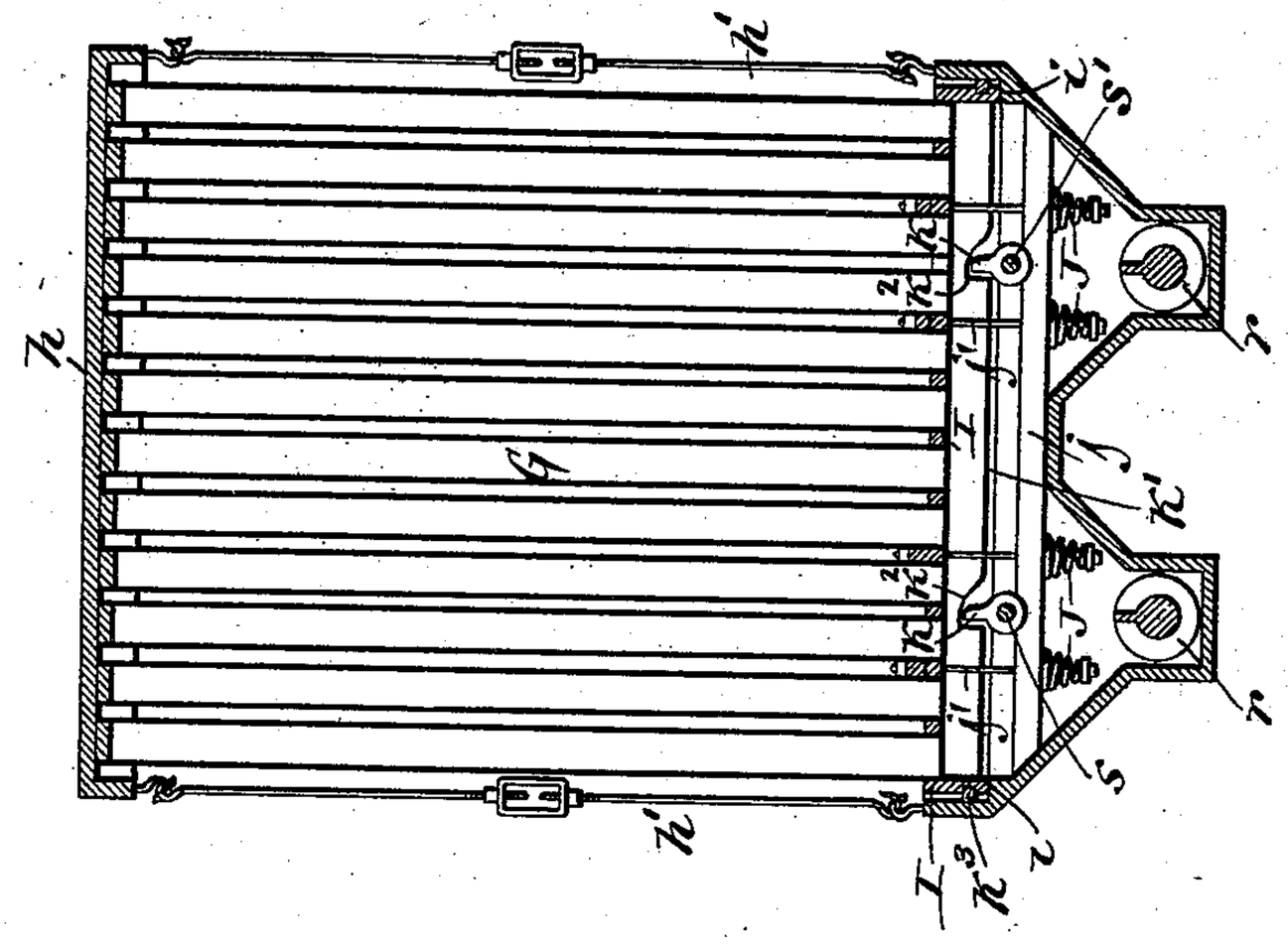
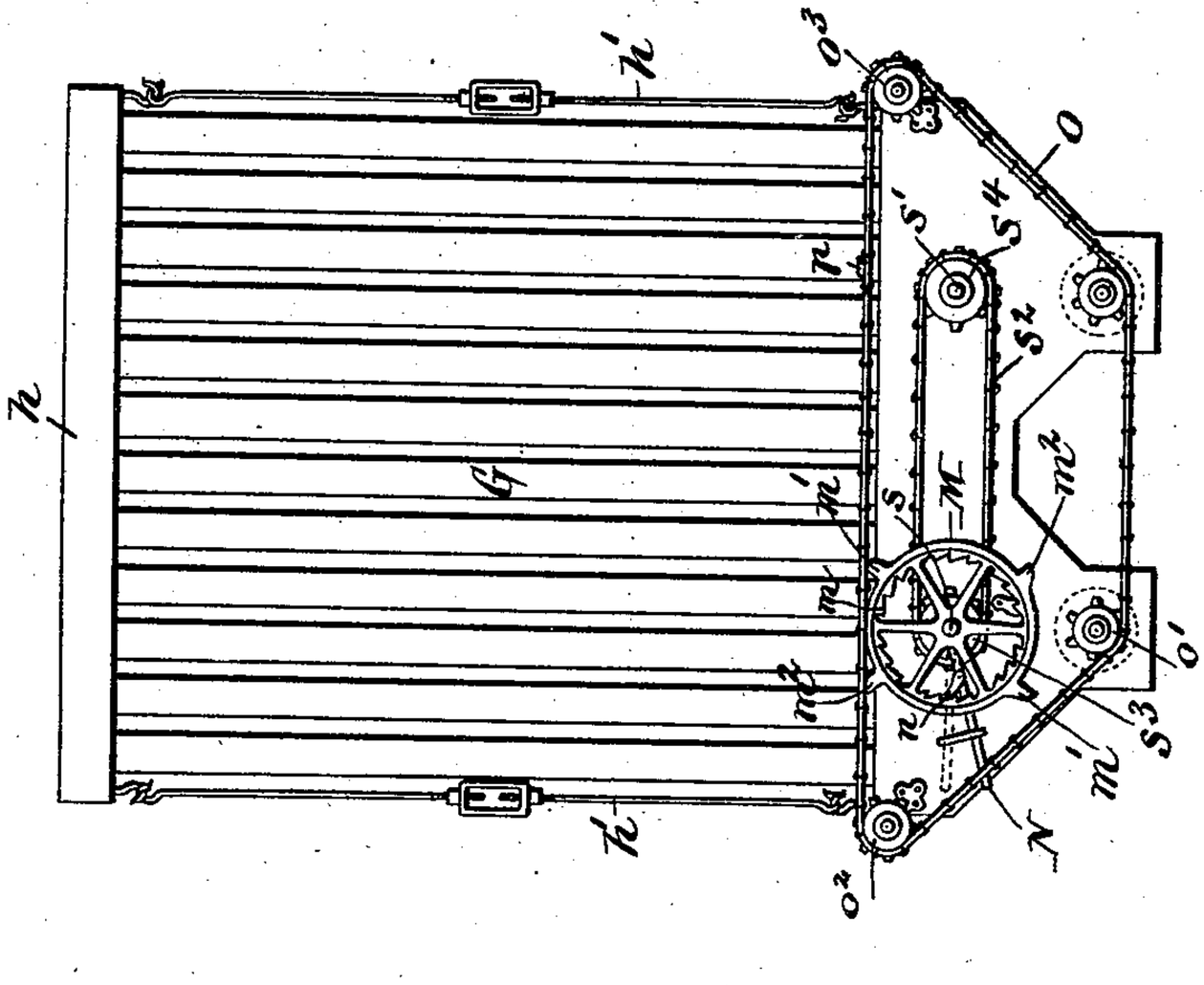



Fig. 8.




Witnesses:-
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# UNITED STATES PATENT OFFICE.

AUGUST HEINE, OF SILVER CREEK, NEW YORK.

## DUST-COLLECTOR.

SPECIFICATION forming part of Letters Patent No. 543,133, dated July 23, 1895.

Application filed March 5, 1895. Serial No. 540,591. (No model.)

*To all whom it may concern:*

Be it known that I, AUGUST HEINE, a citizen of the United States, residing at Silver Creek, in the county of Chautauqua and State of New York, have invented a new and useful Improvement in Dust-Collectors, of which the following is a specification.

This invention relates to that class of dust-collectors in which the dust-laden air is blown into flexible filtering tubes or passages, through the meshes of which the air passes while the dust is intercepted and delivered into a receptacle.

The objects of this invention are to improve the mechanism whereby the filtering-tubes are cleaned and to provide a simple and reliable outlet-valve by which the dust is discharged from the dust-receptacle while the escape of air with the dust is prevented.

In the accompanying drawings, consisting of three sheets, Figure 1 is a vertical longitudinal section of my improved dust-collector. Fig. 2 is a perspective view of the dust-discharge valve. Fig. 3 is a sectional perspective view of the cut-off valve and its actuating-cams, whereby the dust-laden air is directed into one or the other of two sets of filtering-tubes. Fig. 4 is an end elevation of my improved dust-collector. Figs. 5 and 6 are vertical transverse sections in lines 5 5 and 6 6, Fig. 1. Fig. 7 is an enlarged perspective view of a portion of the ratchet-wheel and its drive-chain. Fig. 8 is an end elevation showing a modification of my improved dust-collector. Fig. 9 is a vertical transverse section of the same.

Like letters of reference refer to like parts in the several figures.

A A′ represent two dust-receiving chambers arranged side by side in the base of the machine and separated by a partition *a*.

B represents a valve-chamber arranged centrally above the partition and connected with the receiving-chambers by inlet-throats *b b′* arranged on opposite sides of the upper end of the partition.

C represents the inlet-spout for the dust-laden air entering the upper part of the machine at the front or rear and connected with the top of the valve-chamber, preferably by a descending air-passage or expansion-chamber D, the walls of which below the inlet-spout are preferably constructed of canvas or other filtering material.

E represents a cut-off valve arranged in the valve-chamber lengthwise above the partition *a* and adapted to cut off communication between the inlet-spout and either of the dust-receiving chambers. This valve extends from end to end of the valve-chamber and is pivoted with its lower end adjacent to the upper end of the partition, so that the valve can swing from one side of the valve-chamber to the other and close either of the inlet-throats. *e e′* represent two cams, whereby this cut-off valve is automatically shifted from one side to the other of the valve-chamber. These cams are arranged on opposite sides of the partition *a* and secured to a shaft F, which is arranged lengthwise in the upper portions of the receiving-chambers and journaled in bearings secured to the end walls thereof. The cut-off valve is provided midway between its ends and at a short distance above its pivot-line with laterally-projecting arms $e^2$, which rest upon the faces of the cams. Each cam has a face composed of a notch or recess $e^3$, having an abrupt front side and an inclined rear side, a projection $e^4$, arranged diametrically opposite the recess, and two concentric portions $e^5$ $e^6$, arranged between opposite sides of the recess and the projection. The concentric portions of both cams are arranged in line, but the projection of one cam is in line with the recess of the other cam, as shown in Fig. 3. When the concentric portions of both cams are uppermost both arms of the valve rest thereon and the latter is held in its normal upright position, as represented in dotted lines in Fig. 1 and in full lines in Fig. 3, in which position both inlet-throats are open and the dust-laden air is admitted to both receiving-chambers and sets of air-filtering devices. As the cams are turned in the direction of the arrow, Figs. 3 and 5, the projection $e^4$ of one cam strikes the arm on one side of the valve and raises the same, whereby the arm on the opposite side is depressed into the recess $e^3$ in the other cam and the valve is tilted or inclined against one side of the valve-chamber, thereby closing the inlet-throat of one receiving-chamber, as represented in Figs. 1 and 5. During the continued rotary movement of the cams the cam projection, which is in en-

gagement with one arm of the cut-off valve, will be moved from underneath said arm and the succeeding concentric portion of the same cam will be brought underneath said arm, while the inclined rear side of the recess in the other cam will engage with the opposite arm and lift the latter upon the concentric portion of this cam, thereby returning the cut-off valve to its normal upright position. At the end of the next half revolution of the cams the cut-off valve is tilted in the opposite direction by the reversely-arranged projection and recess of the cams, thereby shutting off communication between the valve-chamber and the other receiving-chamber.

G G′ represent two groups or sets of filtering tubes, chambers, or passages of canvas or other suitable material and arranged vertically on opposite sides of the expansion-chamber and opening with their lower ends into the receiving-chambers, so that the dust-laden air passes from the latter upwardly into the tubes, chambers, or passages. The upper ends of these tubes are closed and secured to a stationary head or frame *h*, which latter is connected with the receiving-chambers by adjustable rods *h′*. The head or frame *h* and the inlet-chamber are connected and secured to the ceiling of the building or other stationary support.

I I′ represent vertically-movable heads or flue or tube sheets, to which the lower ends of the filtering-tubes are attached, and whereby the tubes are shaken for removing the dust which may adhere to the inner sides thereof. One of these movable heads is arranged in the upper portion of each receiving-chamber, and each head is provided with openings in which the open lower ends of one group of filtering-tubes is secured. The downward movement of the movable heads is limited by shoulders or ledges *i*, formed lengthwise on opposite sides of the receiving-chambers. When the movable heads rest upon these shoulders the tubes are drawn comparatively taut, as represented in Fig. 6. The movable heads are yieldingly held in a depressed position by springs J, which bear against the under side of cross-bars *j*, arranged in the dust-receiving chambers and against the lower ends of rods *j′*, which are secured to the movable heads and pass through these cross-bars.

*k* represents trip-cams whereby the movable heads are elevated for slackening or loosening the tubes, two of such cams being secured underneath each movable head to the same shaft to which the valve-cams are secured.

*k′* represents bearing pieces or cleats which are secured to the under side of the movable heads, and against the under side of which the trip-cams bear for lifting the movable heads. Each of the bearing-pieces is provided above each trip-cam with a notch or recess $k^2$, having an abrupt front side. Upon turning the cam-shaft in the direction of the arrow in Fig. 6 the trip-cams will bear against the under side of the bearing-pieces and lift the movable head, whereby the tubes are slackened until the trip-cams pass beyond the abrupt faces of the notches in the bearing-pieces and clear the same, when the movable head will be drawn down suddenly against the shoulders of the receiving-chamber by the springs, thereby jarring the tubes and shaking off the particles of dust clinging to the inner sides of the tubes, which dust drops through the tubes into the receiving-chambers.

The cams controlling the cut-off valve and the trip-cams, whereby the tubes are shaken, are so timed with reference to each other that the shaking of each set of tubes takes place when the inlet-throat of its respective receiving-chamber is closed by the cut-off valve, while the tubes of the other set are held taut while the inlet-throat of their receiving-chamber is open.

The dust-laden air is prevented from escaping through the joint between each movable head and the receiving-chamber by a packing $k^3$, of wool or similar material, secured to the outer sides of the head and bearing against the inner sides of the chamber.

The longitudinal sides of the receiving-chambers are inclined and their bottoms are provided with conveyer-troughs L L′, which are arranged in line and into which the dust drops.

*l* represents a discharge-spout arranged, preferably, below the central partition *a*, so as to open with its upper end into the inner ends of both conveyer-troughs.

*l′* $l^2$ are screw-conveyers arranged in the conveyer-troughs and trending in opposite directions, so that the dust in both troughs is conveyed to the discharge-spout. The ends of the conveyer-shaft project outside of the receiving-chambers, and one end is provided with a driving-pulley $l^3$.

The cam-shaft is driven from the conveyer-shaft, and an intermittent rotary movement, partly slow and partly fast, is imparted to the cam-shaft by the following mechanism:

M, Figs. 1, 4, and 7, represents an actuating ratchet-wheel secured to one end of the cam-shaft outside of the receiving-chambers. The rim of this wheel is provided on its inner side with an annular row of ratchet-teeth *m* and on its periphery with two pairs of teeth *m′* $m^2$, arranged diametrically opposite each other.

N represents a pawl-lever pivoted on the cam-shaft and provided with a pawl *n*, which engages with the internal ratchet-teeth of the actuating-wheel, so that the oscillating movement of said lever produces a slow intermittent rotary movement in the actuating-wheel. Backward movement of the actuating-wheel is prevented by a detent-pawl *n′* engaging with said ratchet-teeth. The free end of the pawl-lever is guided and limited in its movement by a loop $n^2$, secured to the end wall of the receiving-chamber.

*o* represents a drive chain or belt passing

with its lower portion around a sprocket-wheel $o'$, secured to the end of the conveyer-shaft underneath the ratchet-wheel, thence upwardly adjacent to the free end of the pawl-lever and around an idle sprocket-wheel $o^2$ on one side of the ratchet-wheel, thence horizontally over the upper portion of the ratchet-wheel, thence around an idle sprocket-wheel $o^3$, arranged on the opposite side of the ratchet-wheel, to the place of beginning. One of the links of the chain belt is provided with lateral projections or lugs $p$ for moving the pawl-lever and the ratchet-wheel, Figs. 1, 4, and 7. One of these projections or lugs would be sufficient to effect the purpose of moving the ratchet-wheel; but I prefer to use two lugs, one on each side of the chain, and to divide the external teeth of the ratchet-wheel and arrange the chain to run between the two parts of each tooth, as represented in Fig. 7, while only the lug nearest the end of the dust-chamber comes in contact with the pawl-lever and moves the same. Every movement of the lugs on the chain belt upwardly past the pawl-lever causes a forward movement of the lever and a corresponding forward movement of the wheel. The lever is returned by gravity to its lower position when released by the lug. During the time that the long plain portion $m^3$ of the periphery of the actuating-wheel is uppermost the lugs of the chain belt do not engage with the external teeth of the ratchet-wheel, and the latter is turned slowly by the pawl-lever until the first external tooth $m'$ of the ratchet-wheel has been moved into the path of the lugs, when the lugs engage with said tooth and turn the actuating-wheel quickly forward by this direct action of the chain belt upon the wheel. Owing to the tangential movement of the chain belt with reference to the wheel the external tooth of the latter automatically disengages itself from the lugs of the chain belt, after which the wheel is again moved slowly by the ratchet mechanism until the wheel has been turned sufficiently to bring the next external tooth $m^2$ into the path of the lugs. The length of the external teeth is such that when the chain belt engages with one of said teeth the wheel is moved forward a much greater distance than that through which it is moved by one stroke of the ratchet-lever. By this means a slow movement is imparted to the cam-shaft during the time that the cut-off valve occupies its normal open position and both sets of tubes are in operation, while a quick movement is imparted to the shaft for shifting said valve and shaking the tubes. The relative position of the actuating-wheel, the valve-cams, and the tube-shaking cams is such that while the valve-cams hold the cut-off valve in a central position and the trip-cams allow both sets of tubes to be drawn taut by the springs the long space $m^3$ on the periphery of the actuating-wheel between one of the teeth $m^2$ and the following tooth $m'$ is arranged uppermost, so that the chain belt will not operate the wheel directly, but impart a slow movement to the same through the ratchet mechanism. When the cam-shaft has been turned so that one set of its trip-cams is in a position to begin slackening one group of tubes and the valve-cams are in a position to begin closing the inlet to the receiving-chamber of said tubes, and the tooth $m'$, succeeding the long space $m^3$, over which the chain belt has just passed, is brought in the path of the lugs, which causes the latter to engage with said tooth $m'$, as represented in Figs. 1 and 4, and turn the actuating-wheel rapidly, the extent of this movement being sufficient to close the cut-off valve and shake the tubes. The chain belt next operates the ratchet mechanism, and thereby turns the actuating-wheel until the next following tooth $m^2$ is brought into the path of the lugs, so that the belt upon engaging with said tooth gives the actuating-wheel another quick turn for opening the cut-off valve, the extent of the movement being such that the valve is returned to its normal central position. The valve remains in this central position until the actuating-wheel has been slowly turned to bring the next tooth $m'$ into the path of the lugs, during which time the inlet-throats of both receiving-chambers are open and both sets of tubes are drawn taut and held in an operative condition. When the valve has opened the inlet to one of the chambers after the filtering-tubes connected therewith have been cleaned, the valve remains in its normal central position for some time, and is then shifted toward the opposite side for closing the inlet of the other receiving-chamber to permit the tubes connected therewith to be cleaned.

In the operation of this machine the cut-off valve is held normally open and the dust-laden air is directed into both sets of filtering-tubes. At suitable intervals of time the cut-off valve is automatically shifted to cut off the air from one of the set of tubes and held closed for a short time, and the tubes are at the same time automatically jarred to detach the adhering dust, while after this cleaning operation the valve is shifted back to its open position. The valve is shifted alternately in opposite directions, so that the two sets of tubes are automatically cleaned alternately, and this cleaning of each set of tubes takes place at intervals of time which may vary widely, according to the quality of the dust operated upon and other circumstances. I have found that a timing of the mechanism which will hold the valve open for eight minutes, hold it closed for one minute to clean one set of tubes, then hold it open again for eight minutes, and then hold it closed again for one minute to clean the other set of tubes will give good results.

Q, Figs. 1, 2, and 5, represents a rotary trapped discharge-valve which is arranged in the discharge-spout, and whereby the dust is discharged without permitting the escape of air at this point. This valve consists of a

disk $q$ and two sets of wings $q'$ $q^2$, arranged on opposite sides of the disk and extending radially from their central line of junction to the edge of the disk and longitudinally from the disk to the outer ends of the valve. The latter is journaled in the discharge-spout parallel with the conveyer and below the same by a horizontal arbor $q^3$, or otherwise. There are preferably four wings on each side of the disk, and the wings on one side of the disk are arranged opposite the spaces between the wings on the other side of the disk or break-joint, as shown in Fig. 2. The front and rear walls of the spout facing the edges of the disk and the wings are curved concentric with the valve-pivot to fit these edges, as shown at $q^4$, Fig. 5, and these walls are preferably faced with a packing $q^5$, of wool or similar material to secure an air-tight fit. $q^6$ $q^7$ represent two sets of radial teeth or pins, which are secured to the conveyer-shaft above the two sets of wings of the valve for turning the same. The teeth of one set break joint with the teeth of the other set, so that each set of teeth engages between its corresponding set of wings. The material falling into the conveyer-troughs is conveyed to the discharge-spout, whether the latter be arranged at the middle or at one end of the machine, and is delivered into the uppermost pockets or spaces between the valve-wings. The rotation of the conveyer-shaft causes the teeth thereof to engage between the valve-wings and to turn the valve, whereby the filled pockets are carried from the upper to the lower side of the valve, when they are emptied. The teeth on the conveyer-shaft also assist in or promote the delivery of the material into the pockets between the wings of the discharge-valve and insure the prompt filling of the pockets with material to be discharged. This construction of the valve and its driving mechanism possesses the following advantages: The driving mechanism is very simple and located within the dust-chamber. The number of wings in each set can be small, so that each chamber of the valve between two wings is comparatively large, which prevents packing of the material in the chambers, and the disk interposed between the two sets of wings prevents the air from passing along the face of the valve from one chamber of the valve into the other, while the entire number of wings is sufficiently large to cause a proper driving of the valve by the teeth or pins on the conveyer-shaft.

Figs. 8 and 9 represent my improved machine adapted to a room which is comparatively low. Under such circumstances the machine is reduced in height and preferably increased in width to secure the desired amount of filtering-surface, and each receiving-chamber is provided with two parallel conveyers $r$ and two parallel cam-shafts $s$ $s'$ and connecting parts. In this construction only one of the cam-shafts $s$ is provided with an actuating-wheel, the other cam-shaft $s'$ being driven by a chain belt $s^2$, passing around sprocket-wheels $s^3$ $s^4$ on the shafts.

I claim as my invention—

1. The combination with two sets of air filtering devices, conduits for the dust laden air leading thereto, and a valve which controls said conduits, of a cam mechanism actuating said valve and constructed with concentric face portions whereby the valve is held normally open to admit the dust laden air to both conduits and with projections and depressions whereby the valve is shifted to close said conduits alternately at intervals for cutting off the air from the two sets of filtering devices alternately, substantially as set forth.

2. The combination with two sets of air filtering devices and conduits for the dust laden air leading thereto, of a rock valve supported by a horizontal pivot in said conduits and adapted to exclude the air current from either set of filtering devices, arms projecting laterally from opposite sides of said valve, and actuating cams which are arranged on opposite sides of the pivot of said valve, and upon which the arms of the valve rest loosely, substantially as set forth.

3. The combination with two sets of air filtering devices and conduits for the dust laden air leading thereto, of a pivoted valve adapted to exclude the air current from either set and provided on opposite sides with arms, and two rotary cams engaging respectively with said arms for actuating the valve, each cam having its face provided with a projection, a recess arranged diametrically opposite the projection, and two concentric portions between opposite sides of the projection and the recess, the two cams being arranged with the projection of one cam in line with the recess of the other cam, substantially as set forth.

4. The combination with two dust receiving chambers arranged side by side, two sets of filtering tubes arranged above the same, vertically movable heads to which the lower ends of said tubes are secured and which are arranged within said dust receiving chambers, a valve which is arranged between said chambers and which controls the air current flowing to said chambers, of a horizontal cam shaft arranged in said chambers, a cam mechanism mounted on said shaft within said chambers and actuating said valve, and cams mounted on said shaft within said chambers and actuating said movable heads, substantially as set forth.

5. The combination with two sets of air filtering devices air conduits leading thereto, and a valve which controls said conduits, of a cam mechanism which shifts said valve, and a variable ratchet mechanism which actuates the cam mechanism and which imparts to the same a slow movement for holding the valve open and a quick movement for shifting the valve, substantially as set forth.

6. The combination with two sets of air filtering devices, air conduits leading thereto,

and a valve which controls said conduits, of a cam and shaft by which said valve is shifted, a ratchet wheel secured to said shaft, a pawl lever, and an endless chain or belt by which said ratchet wheel is turned directly and by which said pawl lever is actuated, substantially as set forth.

7. The combination with two sets of air filtering devices, air conduits leading thereto and a valve which controls said conduits, of a cam and shaft by which said valve is shifted, an actuating wheel secured to the cam shaft and provided with an internal ratchet rim and external teeth, a pawl lever engaging with said ratchet rim, and a drive chain or belt provided with a projection which is adapted to engage with said pawl lever and with the external teeth of said actuating wheel, substantially as set forth.

8. The combination with a receiving chamber, a conveyer shaft arranged therein, and the discharge spout, of a rotary discharge valve provided with wings forming pockets which receive and discharge the material, and actuating teeth secured to said conveyer shaft and engaging between the wings of the valve, said teeth serving to rotate the valve by direct contact with its wings and also to promote the filling of the pockets between the wings with material to be discharged.

9. The combination with the discharge spout of a receiving chamber and a shaft arranged in said chamber, of a rotary discharge valve composed of a disk and two sets of wings arranged on opposite sides of said disk out of line with each other, and two sets of actuating arms secured to said shaft side by side out of line with each other and engaging between the wings of the valve, substantially as set forth.

Witness my hand this 1st day of March, 1895.

AUG. HEINE.

Witnesses:
JNO. J. BONNER,
KATHRYN ELMORE.