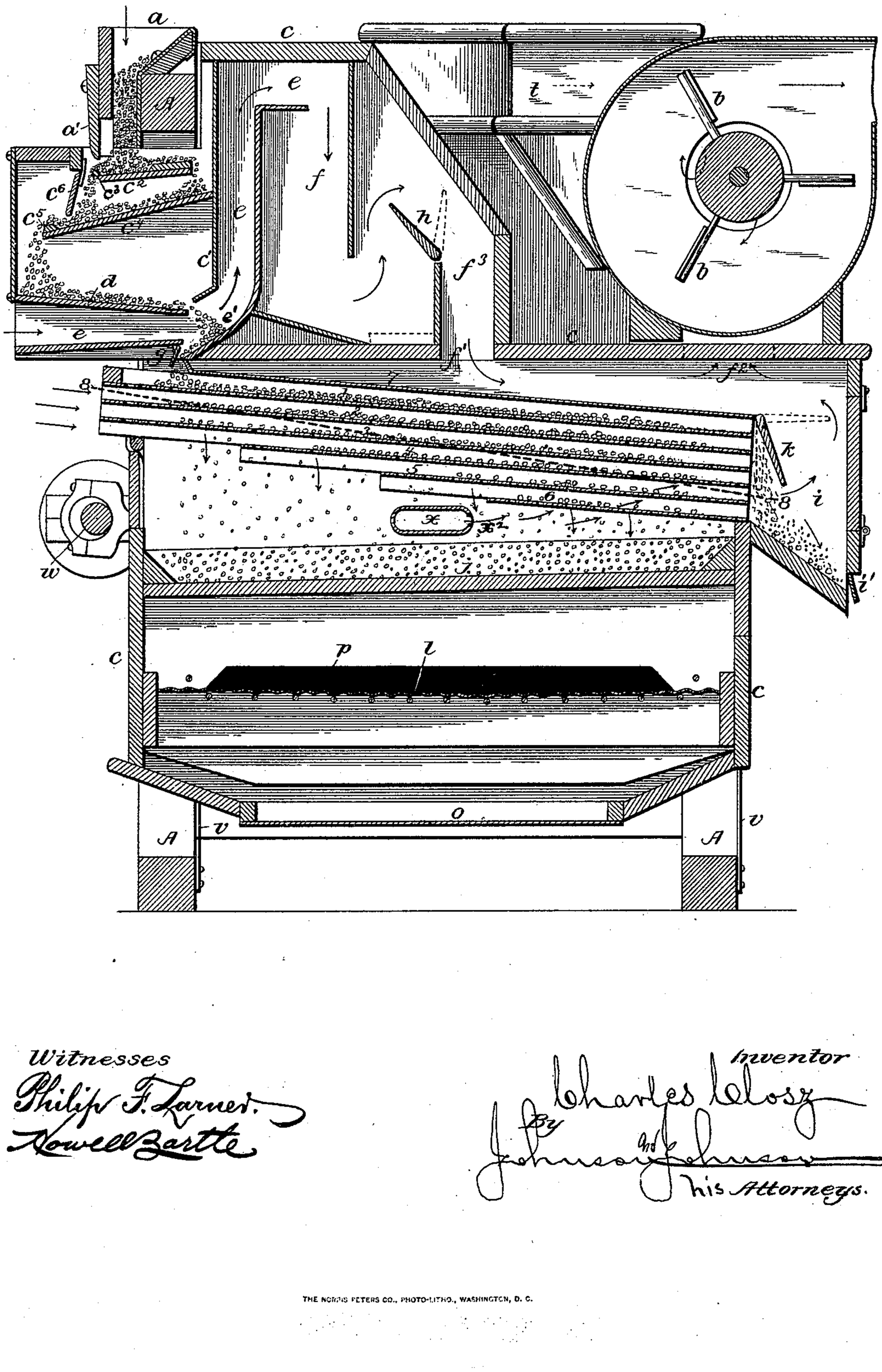
(No Model.) 6 Sheets—Sheet 1.

C. CLOSZ.

GRAIN CLEANING AND SEPARATING MACHINE.

No. 466,125. Patented Dec. 29, 1891.

Fig. 1.



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(No Model.) 6 Sheets—Sheet 2.

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GRAIN CLEANING AND SEPARATING MACHINE.

No. 466,125. Patented Dec. 29, 1891.

Fig. 2.

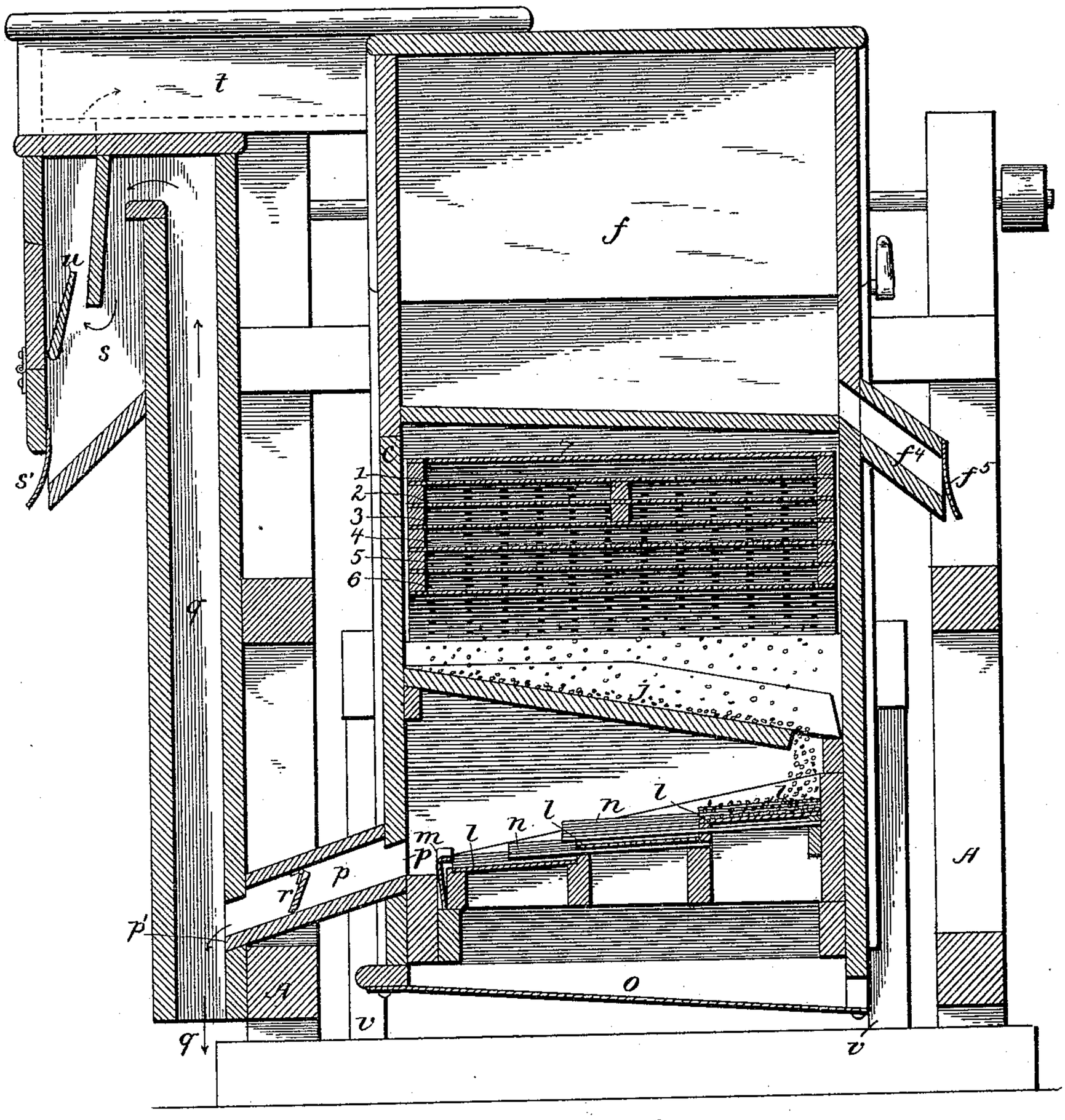
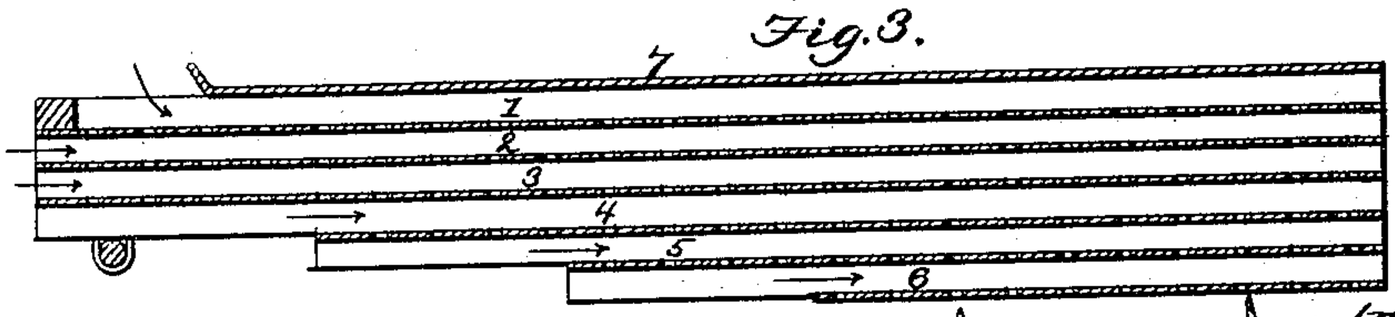


Fig. 3.



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(No Model.) 6 Sheets—Sheet 3.

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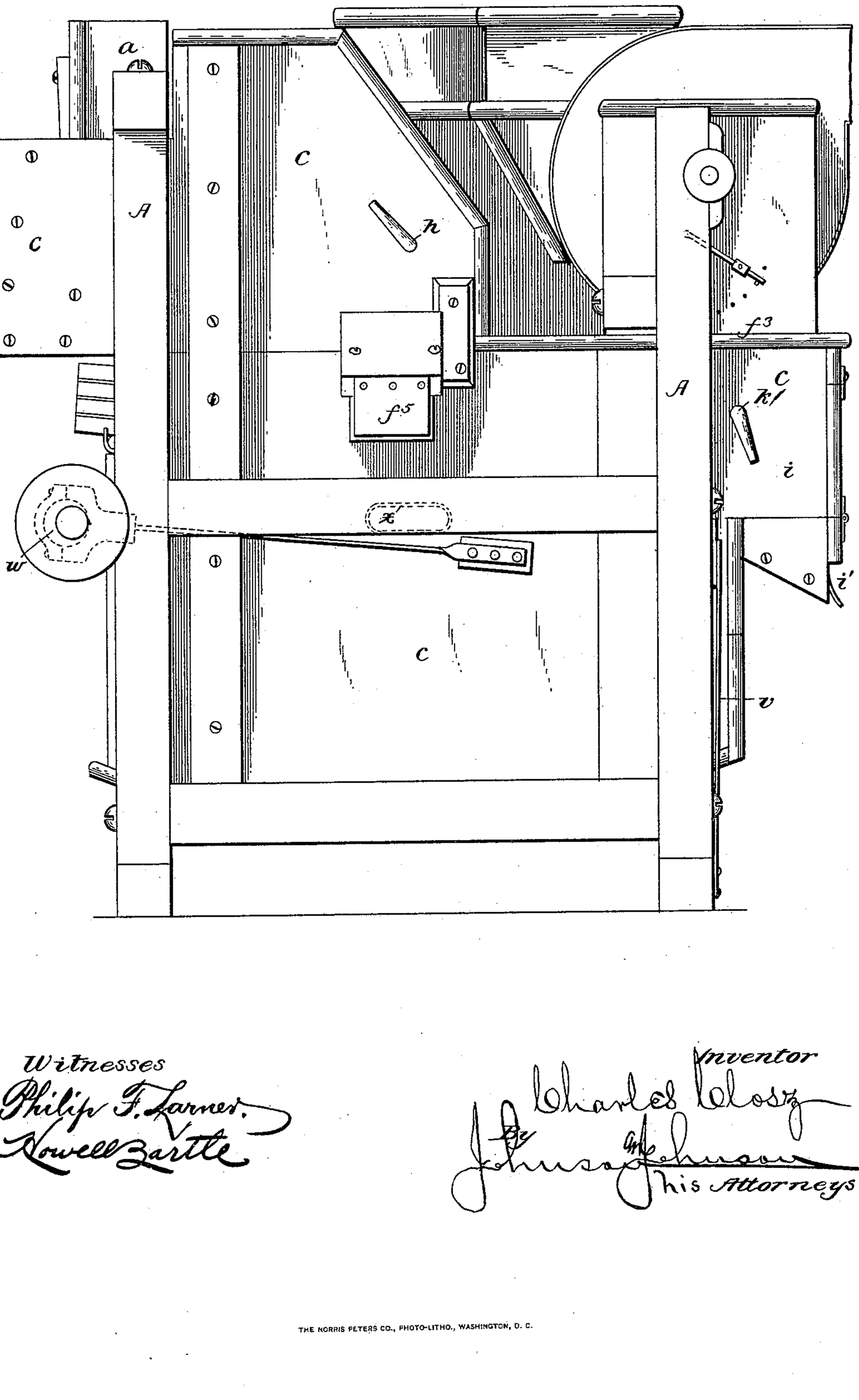
GRAIN CLEANING AND SEPARATING MACHINE.

No. 466,125. Patented Dec. 29, 1891.

Fig. 4.



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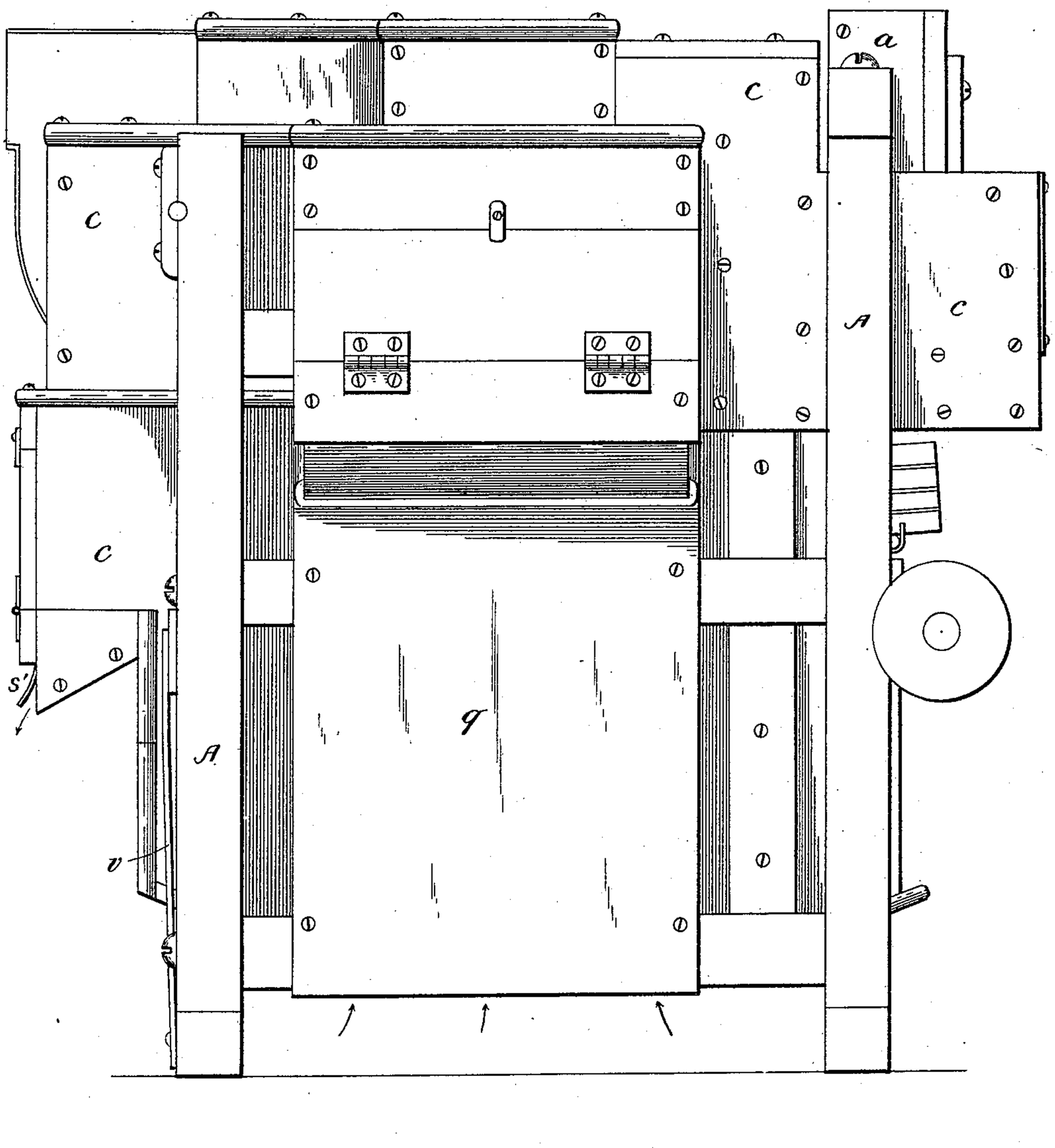
GRAIN CLEANING AND SEPARATING MACHINE.

No. 466,125. Patented Dec. 29, 1891.

Fig. 5.



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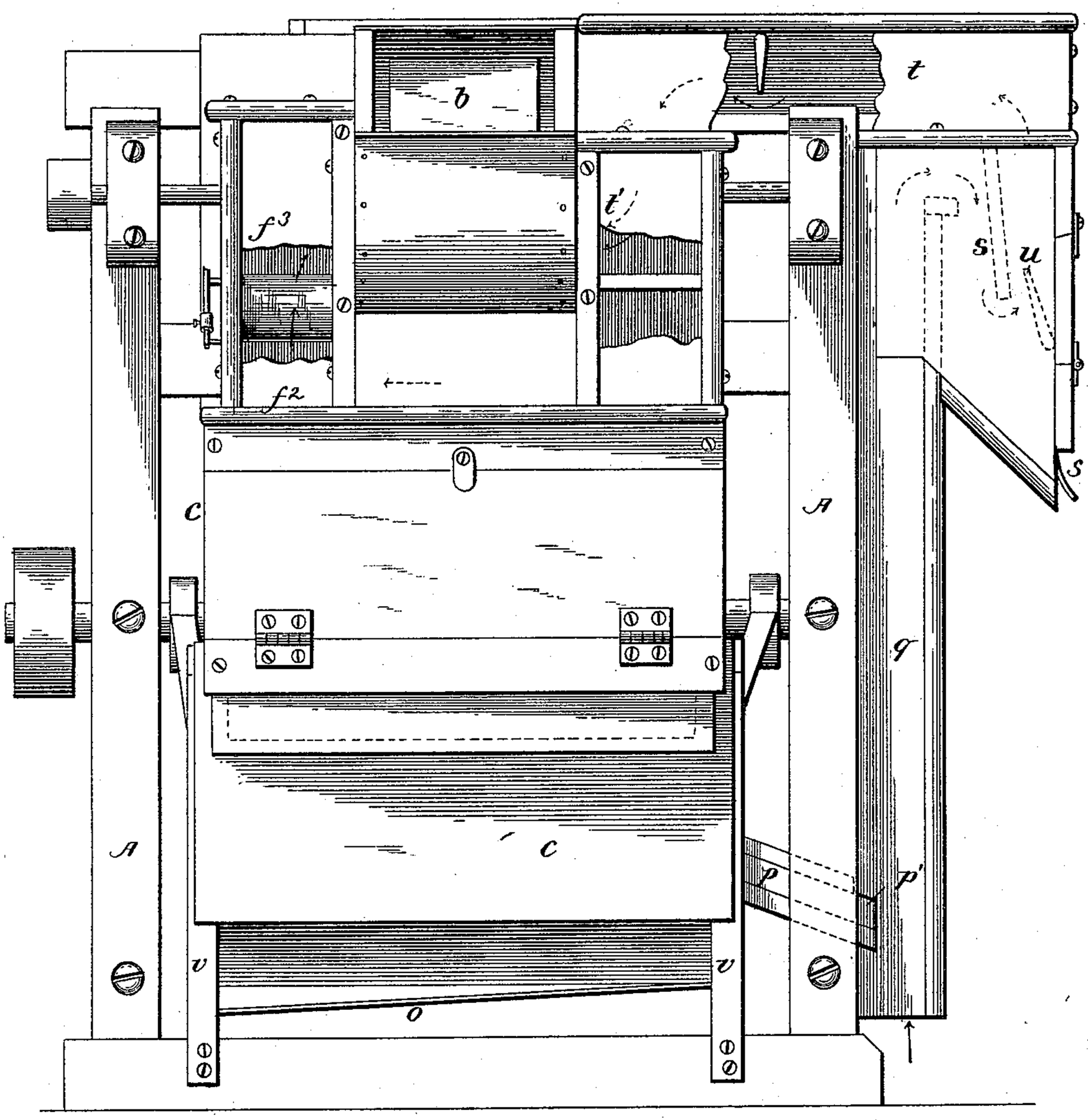
GRAIN CLEANING AND SEPARATING MACHINE.

No. 466,125. Patented Dec. 29, 1891.

Fig. 6.



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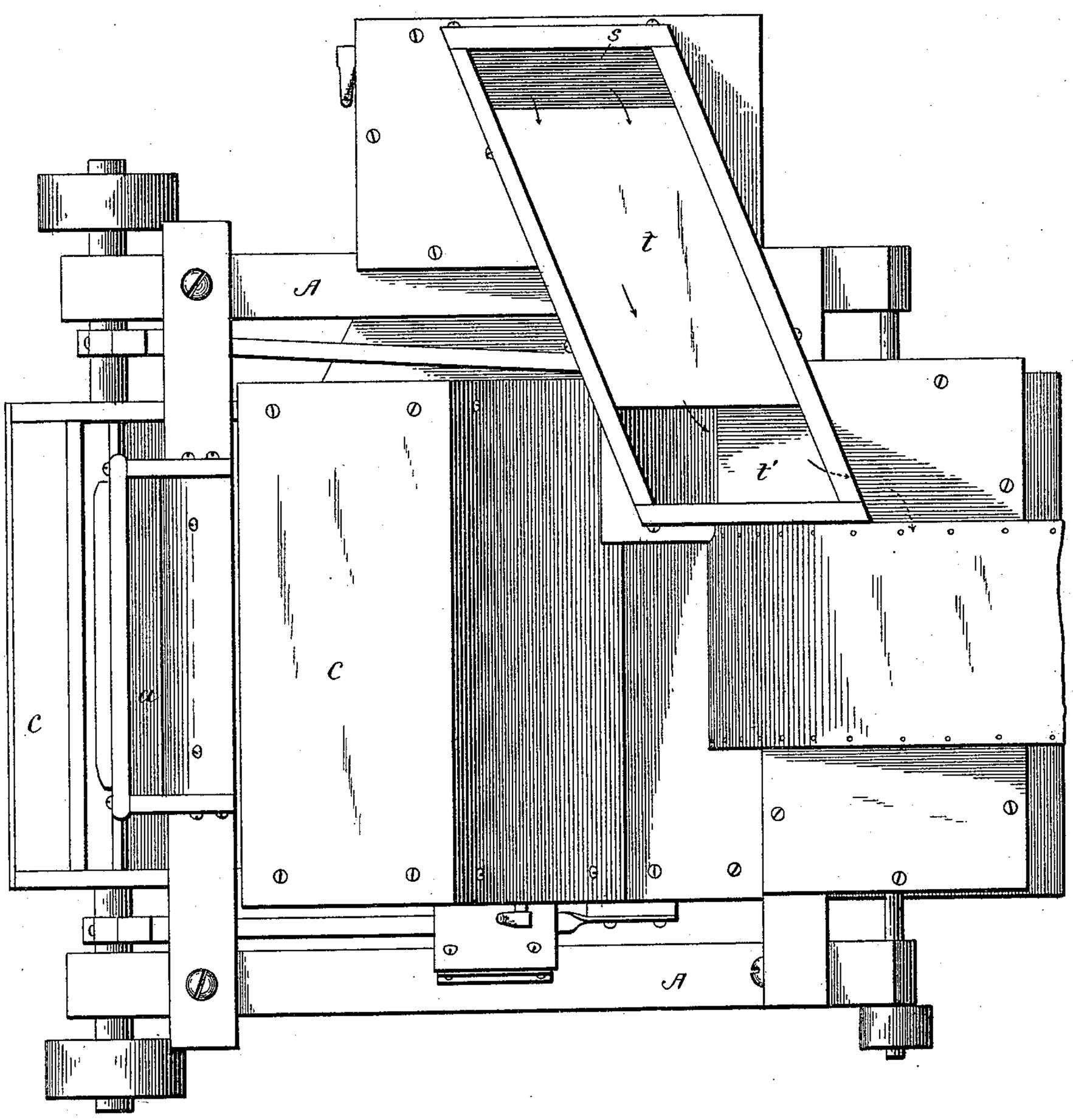
(No Model.) 6 Sheets—Sheet 6.

C. CLOSZ.

GRAIN CLEANING AND SEPARATING MACHINE.

No. 466,125. Patented Dec. 29, 1891.

Fig. 7.



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UNITED STATES PATENT OFFICE.

CHARLES CLOSZ, OF ST. ANSGAR, IOWA.

GRAIN CLEANING AND SEPARATING MACHINE.

SPECIFICATION forming part of Letters Patent No. 466,125, dated December 29, 1891.

Application filed May 11, 1891. Serial No. 392,301. (No model.)

To all whom it may concern:

Be it known that I, CHARLES CLOSZ, a citizen of the United States, residing at St. Ansgar, in the county of Mitchell and State of Iowa, have invented certain new and useful Improvements in Grain Cleaning and Separating Machines; and I do 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 machines for separating and cleaning grain, especially wheat, for milling; and my said invention consists of certain novel parts and combination of parts, the several features of which will be separately and specifically pointed out in the claims concluding this specification.

An important feature of my invention is the provision for controlling the air-currents through and in parallel relation to the screens, and also in an oblique downward direction through them, by the co-operation of an imperforate cover for the screens and an adjustable gate at the end thereof, whereby to effect the complete separation of oats from the grain.

Before specifying the claims of my invention I will describe the organized machine, which is illustrated in the annexed drawings, showing a structure embodying the several features of my said invention in combination.

The following description, read in connection with the accompanying drawings, will enable persons skilled in the art to which my invention relates to understand its nature and to practice it in the form in which I at present prefer to embody it; but it will be understood that my invention is not limited to the precise construction and relation of the devices herein illustrated and described, as various modifications may be made without departing from the spirit of my invention and without exceeding the scope of the claims concluding this specification.

Referring to the accompanying drawings, Figure 1 is a vertical longitudinal section of my improved milling-separator, taken through the supply-hopper. Fig. 2 is a vertical section taken at right angles to the line of section of Fig. 1. Fig. 3 is a vertical longitudinal section of the covered nest of screens detached from the machine. Fig. 4 shows in elevation one side of the machine. Fig. 5 shows in elevation the other side of the machine. Fig. 6 shows in elevation the rear side of the machine. Fig. 7 is a top view of the machine.

A suitable strong frame A is provided for containing the operating parts, three of which are mounted in fixed relation to this frame—viz., the supply-hopper *a* at the top and front, and a suction-fan *b* at the top and rear thereof, and at one side a suction-uptake in direct communication with the fan-case. Mounted within this frame is the body of the machine, which consists of a vibrating box or closure *c*, containing all the operating parts which have certain relations to and communicate with the said fixed parts, as I shall hereinafter describe.

At the head of the machine and upon an upper cross-beam of the fixed frame is mounted the hopper *a*, having a vertically-adjustable slide *a'* at its front side to regulate the volume of grain passing through it. The vibrating box or closure is constructed to form the closed back and the bottom of this hopper, the back being formed by the vertical board *c'* and the bottom formed in the closed front projecting part of the box by three parts—a tray c^2, inclining forward and downward and terminating just under the slide *a'* in an overflow-ridge c^3, an under board c^4, inclining downward and forward beyond said tray c^2 and terminating with an overflow-ridge c^5, and a gate c^6, flexibly hinged so as to hang down in front of the tray c^2 between it and the overflow-ridge c^5, and to automatically close upon the sheet of grain flowing down the surface c^4. This gate, besides acting with the overflow-ridges c^3 and c^5 to spread the grain into an even sheet, serves by its position to shut off the air-suction which would otherwise pass down with the grain and interfere with the suction from the fan upon the grain at the point where the grain is delivered upon the screen. The grain overflowing the ridge c^5 is delivered upon a board *d*, inclining inward and downward from the front of the box, from which it passes through a primary suction conduit or leg *e* to and is delivered upon the front end of the screens. This primary suction is formed by an L-shaped passage

opening at the front beneath the hopper-board *d*, and passing up behind the hopper terminates in a diving settling-chamber *f*, which opens into the top of the box at *f'* above the closed top of the screens, and communicates with the fixed fan-case at f^2 at the rear closed end of the shaking-box. The grain in passing from the hopper through this primary suction-passage is delivered upon the inclined bottom back part *e'* of the said suction-leg and thence moves downward to a valve-controlled bottom-opening, the valve *g* whereof hangs so as to automatically tend to close such opening.

The object of the primary suction is to separate from the moving grain the light stuff and chaff before it reaches the screens, and this is done by drawing the air-currents inward through the open horizontal part of this suction-leg, so that such air-currents pass directly through the grain, falling in a thin sheet. For this purpose the primary suction-passage is placed between the gate c^6 and the valve *g*, so that air can neither enter it from the hopper-passage above or from the box-chamber below, thus confining this primary suction-draft to its direct passage through the grain as it falls in a sheet through such primary suction-passage. The function of the valve *g* is twofold, as it prevents a current of air entering from below at the grain-discharging opening of this primary suction, which should draw a condensed and strong current only through its open end, while such valve also serves to prevent a possible counteraction of the air-currents passing into the screens at the point of receiving the grain with the currents passing into the primary suction.

The diving settling-chamber *f* acts to so modify the suction-currents as to permit the screenings and chaff to settle therein, while a gate *h*, placed in the wall of this chamber, serves to regulate the volume of air drawn through the primary suction. This gate *h* is so placed as to control the passage through this chamber, which at one side of the valve has a bottom opening *f''* formed in a space f^3 at one side of the settling-chamber, through which the suction-draft passes down into the chamber of the box, where, passing over and along the imperforate top of the screens, they unite with the air-currents emerging from the "tail" end of the screens and are drawn up into and through the fan-case.

The light screenings and grain which settle in the diving-chamber are removed through the outside valved opening f^4, the valve f^5 of which may be of suitable flexible material, as seen in Fig. 2.

I use a platform-screen composed of a group or nest of screens, and arrange it within the vibrating box so that its forward end stands just under the valve-controlled opening of the primary suction to receive the grain as it passes down from the supply-hopper. I prefer to form the platform of six screens 1, 2, 3, 4, 5, and 6, placed in parallel relation to each other about an inch apart and support it in the box in a slightly downward and rearward inclination, all the screens terminating even at the inner discharge end. I prefer to make the three upper screens of equal length and the under ones of unequal length, the lowest one being the shortest and all open at the front and at their rear ends, so as to permit the air-currents to pass freely through between and parallel to or obliquely downward through them from their outer to their inner ends, the front ends of the screens for this purpose extending outside of the vibrating box for receiving the air. Supplementing the screens, I provide an imperforate cover 7, which stops short of the full length of the top screen at the front end, so as to leave the top screen open to receive the air and grain and allow both the air and grain to pass under the cover. At this point it is important that the cover have a close joining at its front with the chamber-casing, so that no air can enter the chamber above the screen from the outside. The cover is parallel with the screens and may be a fixed part of the screen-platform, or it may be formed as a part of the vibrating box, and it may be adjustable; but it is important that it have a comparatively close relation to the top screen and connect with the chamber-casing, as stated. At the rear end the screens discharge into a dead-air chamber *i*, in which the tailings from the screens settle, and from which they can be removed by a self-closing valve *i'*. The grain passing through the screens is delivered upon an inclined bottom board *j*, from which it passes into a bottom shelved separator-tray, as I will presently describe.

In connection with the screen-platform composed of a multiple of screens and having an imperforate cover for directing air-currents through and between the screens in horizontal lines, I provide for directing air-currents diagonally downward through the screens for the important purpose which I will now state. At a point about on a plane with the imperforate cover of the screen and at the inner end thereof I hang a gate *k*, so as to depend in position more or less over the rear open ends of the screens or to leave them fully open. This gate is controlled by a handle *k'* at the outside of the box, so as to set it in the desired position in relation to the ends of the screens. When this gate *k* is turned in a horizontal position, as shown by dotted lines in Fig. 1, the air-currents are directed by the action of the imperforate cover through the screens in lines parallel with their surfaces, and when this gate is turned down in an oblique position over the ends of the screens the air-currents are directed by the conjoint action of the cover and the gate downward obliquely through the screens in the direction of the dotted line 8. In the construction shown these air-currents are produced by the action of a suction-fan; but they may be produced by a blast.

The importance of air-currents in relation

to screens, as stated, will be seen from the following in separating oats from wheat: Generally, if not always, milling-separators as now used have no air-currents acting on the grain as it passes over the screens, neither suction nor blast. Fanning-mills generally have an air-blast; but the direction of the blast has always been upward through the screens, the action being to lift the oats, (as they are lighter than the wheat,) and thus screen them off. This lifting action on the oats, however, is wrong in fact, as it promotes their passage through instead of over the screens, because the oat-berry, being heavier on one (the germ) end, is by this lifting action "stood on end," and being considerably thinner than wheat easily passes with the wheat through the screens. For this reason milling-separators, as above stated, have no air on the screens, and they are expected to tail over oats by the vibrating action of the machine. As a result, the screens are easily choked by weeds and light stuff, and the separation of the oats from the wheat in this way is very imperfect and unsatisfactory. To remedy such imperfect work in such machines, they have been provided with suction-conduits adapted to subject the grain to the action of vertical air-currents; but in every such suction provision the difficulty of the oats "standing on end" presents itself, and only the lightest oats, presenting a comparatively large surface in proportion to their weight, can thus be removed, while the heavy and "hulled" oats remain with the wheat. If the oats would retain a horizontal position under the action of upward air-currents, they could of course be readily separated from wheat in a vertical air-current conteracting the specific gravity of the grain. It is obvious, then, that if the oats are not turned up endwise, but are left in a horizontal position on the screens and an air-current be applied without changing such positions, being much longer than wheat and of less specific gravity, that they are easily tailed off over the screens while the wheat passes down through the screens. This is precisely the result obtained by my new construction of screens and control of the air-currents, whereby the oats are not lifted but slid off. Again the oats while left in a horizontal position on screens without air actions move off but slowly, being light, and on account of this slow movement are liable to tip if the heavy end comes over the opening first. To guard against this difficulty, the openings or perforations have to be comparatively small, and as a result the large berries of wheat tail over, and then there remains an inevitable and interminable "tail end" to be cleared up. The perforations of screens in my construction can be comparatively large, because the oats move along with the horizontal air-currents more rapidly than wheat, and passing over the openings so quickly are prevented from tipping into them, while the wheat moving more slowly, owing to greater specific gravity and being shorter than oats, finds an easy passage through the screens. Moreover, a large amount of light and chaffy stuff and weeds, usually passing through or lodging in and choking the screens in milling-separators, is by my construction carried along by the air-currents and thrown off at the tail end, leaving the screens clear and open.

Adjustment of the gate for causing a downward direction of the air-currents through the screen is important, because the strongest currents are needed above, in front, and below at the rear ends of the screens, and as the screens are about five or six inches deep a downward direction through the upper screens on the tail end is necessary, in order to avoid a lifting action on the lower screens.

While I have shown and prefer to make the lower screens of the nest of less length than the upper ones, for the purpose of allowing air-currents from the box-chamber to enter the lower screens at their front ends, which open in said box-chamber, and thus aid in carrying the dust therefrom and giving uniform air-currents through all the screens, yet it is obvious that all the screens may be of equal length without modifying the direction of the air-currents through them, and that a single screen may be used covered in the way described.

The shelved tray of which I have spoken is placed in the bottom of and between the walls of the vibrating box and has a side overflow-discharge. The form shown of this shelved tray is preferred, and it consists of a series of trays *l*, arranged at relative different levels, each having a foraminated bottom. The shelves are arranged in a frame the ends of which rise above the ends of the shelves, as seen in Fig. 1, and the highest shelf receives the grain preferably at one side of the box, while the lowest shelf delivers the grain at the other side of the box. The length of the trays is preferably equal to the length of the box and the grain passes upon them in a thin sheet, and the perforations are of a size to permit dust, dirt, and small seeds to pass through them, while the grain has a retarded movement sidewise from and over each shelf on the one next below. I prefer to provide the lowest shelf with an edge overflow-ridge *m*, the better to retard the movement of the grain and to retain any heavy particle—such as metal, gravel, &c.—in the tray, which may pass down with the grain through the top screen.

Standing out from the overflow edges or crossing the surface of the shelves are fingers or wires *n* for agitating the grain upon the surface of the tray. These wires or fingers are arranged at right angles to the endwise movement of the box and overhang the shelves, and they give a shuffling action to the grain upon the perforated surface, which acts to sift the dust, dirt, and small seeds from the grain and to facilitate the settling of metal, gravel, &c., in the tray. The bottom discharge of the small seeds and fine stuff is delivered

upon a bottom board *o* and is directed into a suitable receptacle. The cleaned grain from the overflow-shelf is delivered into a covered valved passage *p*, which opens into a secondary suction, as I will now describe. This covered valved passage *p* has a horizontal width about equal to the length of the shelf and extends out at the side of the box in a downwardly-inclined direction from the overflow of the lowest shelf and terminates in the secondary suction *q*, which extends to the top of the machine and leads into the suction-fan. The valve *r* hangs crosswise in this passage in a way to close by gravity to permit the free passage of the grain under it, while at the same time it serves to check the momentum of the flow of the grain from the trays into the secondary suction and prevents the air from being sucked through this passage *p* with the grain from the machine into the secondary suction. Were the grain permitted to descend this passage *p* with a free and unrestrained momentum it would be thrown with some force across the suction-leg *q*, so as to cause it to mass against the wall and counteract the air-currents and crowd down such light stuff, which ought to pass upward from the falling grain. Were this passage *p* not covered the required uniform force in the suction of the leg *q* would be seriously interfered with by reason of the inflow of a large volume of air that would enter the suction-leg at the very point where the grain enters, and would thereby increase the suction force drawn upward from below such point to such an extent at this point as to draw up sound grain and carry it off with the screenings, because there would be the force of a side moving volume of air entering the vertically-moving volume of air, and thus prevent the uniform and desired action of the secondary suction. This covered passage *p* shuts off the air from the outside of the machine and its gravity-closing valve *r* serves both to prevent a possible air-current through this passage from the body of the machine and to check the momentum of the grain, giving the important advantages of allowing the grain to enter the secondary suction in a thin wide sheet, and of subjecting it to the perpendicular action of the volume of air without counteracting momentum and without an increased air-current at the point where the grain enters said suction. At the top of the machine this secondary suction terminates in a diving-chamber *s*, at the bottom of which the screenings are collected and discharged by a valve *s'*, preferably flexibly arranged to prevent the inflow of the air. This diving-chamber *s* opens at its top into a horizontal passage *t*, and is provided with a valve *u*, which is arranged to control the force of the suction which leads to the fan through this horizontal passage *t*, which enters the fan-case by an opening *t'* at one side of the latter, while the primary suction-draft enters the fan-case by an opening f^2 at the other side of the latter, so that the dust and light screenings from both suction-drafts pass out through the fan-case. Suitable automatic operating-valves may be arranged to regulate the suction force of the fan, one of these valves being placed in the passage f^3 of the fan-case, which opens into the top of the reciprocating box-chamber and the other into the top horizontal passage of the secondary suction, which, with the fan-case, is mounted upon the fixed frame so that the box reciprocates under the fan-case and the two communicate by a practically closed joining at one side only of the fan-case, as seen in Figs. 3 and 7.

The foregoing construction gives a perfectly-controlled top suction-draft in direct communication with the screens and with the grain-supplying hopper through the box or closure, wherein the draft from the outer air through the screens is effected longitudinally over their surfaces within a top covered nest of screens or diagonally downward through such top covered nest of screens to obtain the complete separation of the oats from the grain, as I have stated, while the draft from the grain-supplying hopper is also from the outer air through a sheet of grain falling upon the covered nest of screens to carry off the dust and light particles from the grain before it is delivered upon the screens. In connection with the conjoint action—this screen and draft separation—the construction gives a perfectly-controlled bottom suction-draft in direct communication with the final discharge of the grain, wherein the draft from the outer air is vertical through the falling grain to separate and carry off from it the dust and light screenings which pass through the screens with the grain. The suction-drafts from the hopper-supply, through the screens and through the finally discharging grain, have each one or more suitable valves or gates for controlling the force of the draft, and each suction-draft has a chamber for the collection and discharge of the screenings, so that the grain is delivered from the machine in perfect condition for milling.

The box or closure which contains the separating and screening devices is supported or mounted in the fixed frame by spring-supports *v* or other means, so as to have a longitudinal reciprocating movement only, which may be given to it by means of the eccentric *w*, operated from any suitable power.

The shelved-tray device can be removed from the box through a door to clean it of such heavy particles as may collect therein.

The delivery of the grain from the machine from a perforated surface of steps or shelves placed at relatively different heights, by a sidewise movement over and from such steps, produced by a shaking movement in the line of such steps or shelves, gives the advantage of causing the grain to pass into the secondary suction-passage *q* in a thin sheet and with a uniform movement, and it

gives the advantage of using a short valved covered chute p as an outside extension of the lowest shelf as a means of forming a movable connection of the box or closure with the fixed secondary suction-leg at p'.

It is important to notice that the box or closure has direct and free communication with the outer air in direct communication with the fan at two points only, one directly through the nest of screens at its delivering end only and the other directly through the grain passing from the hopper to the screens at their receiving ends, while the fan has free communication with the secondary suction-leg independent of the connection of the latter with the box or closure, so that the volumes of air passing into and through the box and its screens are not affected by the volume of air drawn through the secondary suction.

While I prefer to admit the air to the screens entirely at the outer end of the nest, as shown, yet provision may be made by side openings x (shown in Figs. 1 and 4) in the box or closure for admitting air also at points beneath the screens in such manner as to cause it to enter and to pass upward through the lower short screens which open at their outer ends in box-chamber. For this purpose I may provide a tube x', extending from the side openings x across the chamber beneath the screens and opening into the chamber, so that currents of air drawn through said tube at the side openings will be caused to pass out a slot x^2 or slots in said tube and upward and between and through the short bottom screens, as shown by arrows in Fig. 1. This provision co-operates with the gate k at the delivery end of the screens to effect a downward, parallel, and upward direction of the air-currents through the screens. When the gate is closed downward over the ends of the imperforate cover and the screens, as seen in dotted lines, the air-currents are caused to spread downward between and through the upper screens into the dead-air chamber l, by reason of closing or partially closing their inner ends, while the air-currents entering the chamber beneath the screens are caused to spread upward between and through the bottom screens into the dead-air chamber. In this way the force of the downward air-currents is diminished and the force of the upward air-currents is increased and made most effective in carrying the oats and tailings from the lower screens into the dead-air chamber. In the horizontal adjustment of the screen-gate this action of of the air-currents will be modified so that the strongest air-currents will be parallel through the upper screens and the weakest air-currents will be upward through the lower screen, so that these co-operating features are important in adapting the machine for separating and cleaning different kinds of grain and for the regulation and control of the air-currents in such operation. As conducing to the effectiveness of this co-operation, the box or closure and the arrangement of the gate k therein in relation to the screens closed at the top, as described, serve to confine the air-currents in a comparatively narrow space at the delivery end of the screens, and thereby carry the oats and tailings into said dead-air chamber and prevent them from being drawn freely into the fan-case, which opens into the closure into the dead-air chamber. In this co-operative relation the closed screen-cover 7 and the gate k give the advantage of using a strong cleaning suction through the machine without the disadvantage of carrying the grain with it into the fan-case.

Referring to the hopper-supply device, it will be seen that the overflow-ridge c^5 terminates within a closure, from the open side of which the gate c^6 depends so as to form one side thereof and the inlet for the grain-passage to the screen, and that the pendent position of said gate is such as to close upon the tray against the flow of the grain between the overflow-ridges of the upper short and the under long tray, whereby should the grain feed a little heavier on one side of the tray than on the other the under tray, the gate, and the overflow-ridge will co-operate to give an even positive sheet flow of grain into the closed passage above the primary suction-conduit.

While I prefer to provide the adjustable gate for directing the air-currents in an oblique downward direction through the screens as being better adapted for separating oats from the grain than an upward draft through the screens, yet I find that the provision for directing the draft through the screens lengthwise and parallel with their surfaces is well adapted for separating oats from the grain, and it will be understood that such provision may be used with or without the provision for giving a downward direction to the air-currents through the screens; but the efficiency of the machine in the perfect separation of the oats from the wheat is enhanced by the co-operative functions of the two provisions.

While the nest of screens having an imperforate cover under which the grain is received, and between which the air-currents are forced over and parallel with their surfaces, is arranged for satisfactory operation in the machine shown in the drawings, yet it is obvious that such screen device may be used in machines differently constructed. It is also obvious that while the hopper-supplying device which I have shown and described is well adapted for use with screens having provision for horizontal and downward currents of air in the way which I have stated, it may be used advantageously with other constructions of screens.

While I have in the foregoing specification described some of the modifications which might be employed in practicing my invention, I desire it to be distinctly understood

that such mention of such modifications is not intended to exclude others not referred to, but which are within the spirit and scope of my invention. I also wish it to be understood that many of the combinations and details illustrated and above described are not essential to some of the features of my invention, broadly considered. All this will be indicated in the concluding claims, as in any claim the omission of an element or the omission of reference to the particular constructions of the elements mentioned is intended to be a formal declaration of the fact that the omitted elements or features are not essential to the invention therein covered.

Having thus described a milling-machine embodying in preferred forms the several features of my present invention in combination, what I separately claim, and desire to secure by Letters Patent, is—

1. In a milling-separator, a hopper-supplying device consisting of a hopper having an adjustable slide, a bottom inclined tray having an overflow-ridge, an under inclined board extending beyond the tray overflow-ridge and terminating in an overflow-ridge, and a gate depending between the said overflow-ridges and coacting with the under inclined board, in the way and for the purpose stated.

2. In a milling-separator, a hopper-supplying device consisting of a hopper having an adjustable slide, a bottom inclined tray having an overflow-ridge, an under inclined board extending beyond the tray overflow-ridge and terminating in an overflow-ridge, and a gate depending between the said overflow-ridges and coacting with the under inclining board, in combination with an air-suction passage or leg under and crossing the vertical flow of the grain from the bottom hopper-opening, in the way and for the purpose stated.

3. The combination of a suction-fan, suitable screens, and a hopper with a grain regulating, distributing, and feeding passage consisting of an upper and an under tray c^2 and c^4, each having an overflow-ridge, the under tray extending in front of the upper one, the automatic gate c^6, the oppositely-inclined bottom boards d and e' and the air-suction passage e, and the automatic gate g, arranged to close with the board e' in the direction of the inflow of the suction-draft through said passage, as described.

4. In a milling-separator, the combination, with a reciprocating box forming a closed chamber, of a nest of screens and inclosed within and reciprocating with said box, arranged to form shallow spaces between them and supplemented by an imperforate cover of less length than the top screen, and a valved grain-supplying passage at the end of said imperforate cover and screens, substantially as described.

5. In a milling-separator, the combination of a reciprocating box forming a closed chamber with a platform-screen fixed therein, composed of a multiple of screens arranged to form shallow spaces between them, the under screens being of unequal length and shorter than the upper one, an imperforate cover of less length at its outer end than the top screen and forming a shallow space above the latter, and a valved grain-supplying passage at the short end of said imperforate cover, substantially as described.

6. In a milling-separator, a longitudinal shaking-screen composed of a series of parallel screens open at both ends and supplemented by an imperforate cover having a length less than said screens, in combination with a gate arranged to operate in relation to the open delivery ends of the screens to direct the air-currents through said screens, in the way and for the purpose stated.

7. In a milling-separator, the combination of a box forming a closed chamber with a platform-screen fixed therein, composed of a multiple of screens arranged to form shallow spaces between them, the upper screen extending outside of said chamber, the under screens being of unequal lengths, shorter than the upper ones and terminating at their front ends within said chamber, an imperforate cover of less length at its front end than the top screen and forming a shallow space above the latter, and a gate at the inner ends of the cover and screens, for operation substantially as described.

8. The combination, in a milling-separator, a hopper-supplying device, a longitudinally-shaking screen composed of a series of parallel screens open at each end, an imperforate cover for said screens, having a less length than the latter, a primary suction-leg for said hopper-feed, a valve arranged at the bottom opening of said suction-leg, a gate arranged to operate in relation to the open delivery ends of said screens, a reciprocating chamber-forming box, and means for producing air-currents through the primary suction-leg and through the screens, substantially as described.

9. In a milling-separator, the combination, with a reciprocating chamber-forming box, a hopper-supplying device, a separating-screen, and a stepped separating-tray having a side discharge, of an exterior suction-leg having a suction-controlling valve and a covered passage extending from the stepped tray into said suction-leg and having an automatically-closing valve and means for producing air-suction through said leg, substantially as described, for the purpose specified.

10. In a milling-separator, the construction of the reciprocating chamber-forming box, as described, the upper part containing a valved feed device below the hopper, and a suction-leg forming the bottom and the back of said hopper-feed device terminating in a diving-chamber having a suction-regulating gate and opening into the top of said chamber, the lower part of the said reciprocating chamber containing the separating-screens, the stepped tray, and the covered valved discharge-pas-

sage at the bottom, in combination with the fixed frame having the hopper, the bottom suction-leg, and the suction-fan, substantially as described.

11. In a milling-separator, the combination, with the reciprocating box *c*, forming a closed chamber, the nest of screens having an imperforate cover 7, the latter and the screens arranged to form shallow spaces between them, and a series of separating-trays *l* under said screens, of the suction-passage *e*, opening into said top screen and into said box-chamber above screen-cover 7, and the fixed secondary suction-leg *q*, having a covered valved passage *p* joining said closed chamber with a free sliding connection, said fixed suction-leg having communication with the said trays, and the suction-fan independent of the top suction-leg *e*, substantially as described.

12. In a milling-separator, the combination of the reciprocating box forming a closed chamber, the hopper, and the suction-current having a fixed relation to said reciprocating box, the nest of screens having an imperforate cover 7, and the suction-leg *e*, crossing the grain-supplying passage and opening into said screens and into said closed chamber above said imperforate cover, as described.

13. In a grain-cleaning machine, the combination of the box forming a closed chamber, the hopper, and the suction-fan with the multiple screen having an imperforate cover arranged to form shallow spaces between them, and a gate *k* at the inner ends of said cover and screens, for operation as described.

14. In a grain-cleaning machine, the combination of the box forming a closed chamber, the hopper, and the suction-fan with a multiple screen having an imperforate cover arranged to form shallow spaces between them, the gate *k* at the inner ends of said cover and screens, and the dead-air chamber inclosing said gate, substantially as described.

15. In a milling-separator, the nest of screens having the imperforate cover arranged in parallel relation with shallow spaces between them, the cover at its front end being shorter than the top screen and the under screens being successively shorter at their front ends than said top screen and cover, the lowest screen being the shortest, in combination with a hopper, a suction-fan, and a chamber inclosing said screens, substantially as described.

16. In a milling-separator, the nest of screens herein described, adapted for descending or for upward draft-currents, or for both, consisting of a multiple of screens and an imperforate cover therefor arranged in parallel relation, with shallow spaces between them, the cover at its front end being shorter than the top screen, the under screens being successively shorter at their front ends than said top screen and cover, the lowest screen being the shortest, substantially as described.

17. In a milling-separator, the nest of screens having the imperforate cover and arranged in parallel relation with shallow spaces between them, the cover at its front end being shorter than the top screen and the under screens being successively shorter at their front ends than said top screen and cover, the lowest screen being the shortest, in combination with a hopper, a suction-fan, a chamber inclosing said screens, air-inlets at the front ends of said screens, and side air-inlets in said chamber beneath said screens, substantially as described.

18. In a grain cleaning and separating machine, the combination, with a suction-fan, of a screen having an imperforate cover, a gate adapted for adjustment at the delivery end thereof, and the dead-air chamber *i*, substantially as described.

19. In a grain cleaning and separating machine, the combination, with a multiple screen having an imperforate cover, of a case-forming closure therefor having a dead-air chamber, and side air-inlet openings in said closure beneath said screen, and a suction-fan, for operation as described.

20. In a grain cleaning and separating machine, the combination, with a suction-fan, of a multiple screen having an imperforate cover, a gate *k*, adapted for adjustment at the delivering end thereof, and a case forming a closure for said screen and having a dead-air chamber at the delivering end of the latter, and side air-inlet openings in said closure beneath the screen, for operation substantially as described.

21. In a grain cleaning and separating machine, the combination of a multiple screen, open at both ends and having an imperforate cover 7, a box or closure having the air-inlet *e* above the screen, intercepted by a diving-chamber *f*, opening into said closure above said cover, side air-inlet openings *x* in said closure beneath the screen, and the dead-air chamber *i*, for operation substantially as described.

22. In a milling-separator, a hopper-supplying device consisting of a hopper having a slide *a'* for regulating the outflow therefrom, a horizontal tray c^2, having an overflow-ridge c^3 extending in advance of said hopper-outflow, a tray c^4, extending with a downward incline in advance of the upper tray and terminating in an overflow-ridge c^5, a gate c^6, arranged to close upon said tray c^4 against the flow of grain between said ridges, and a covered passage for said gate and lower tray-ridge, within which the grain is evenly delivered from the latter, substantially as described.

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

CHARLES CLOSZ.

Witnesses:
MARTIN MOE,
LARS MOE.