(No Model.) 3 Sheets—Sheet 1.

O. L. FARNHAM.

ORE SEPARATING MACHINE.

No. 284,401. Patented Sept. 4, 1883.

Fig. 1.

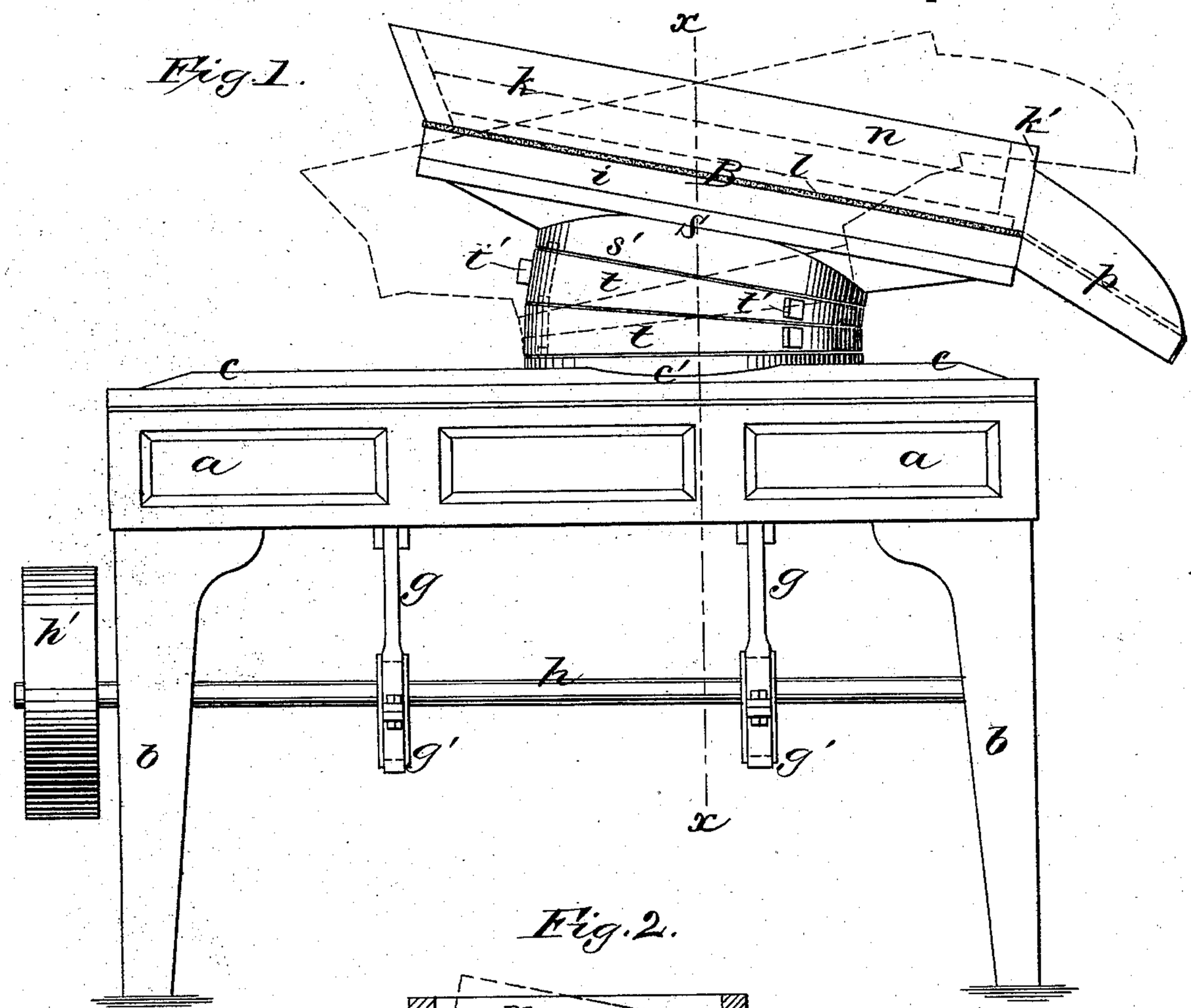
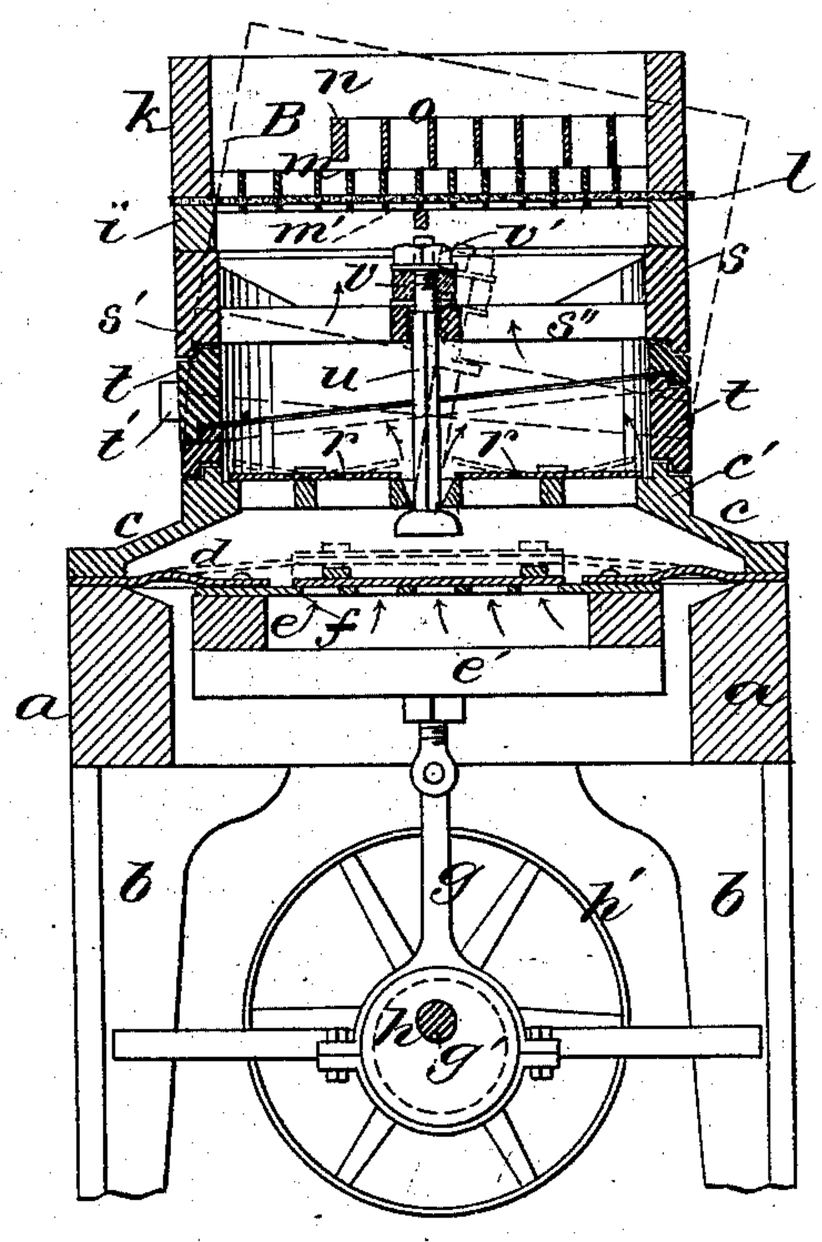


Fig. 2.



Witnesses:
Henry F. Parker.
Jno. Elwin

Inventor:
O. L. Farnham
by Chas. M. Higgins
Attorney.

N. PETERS, Photo-Lithographer, Washington, D. C.

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Fig. 3.

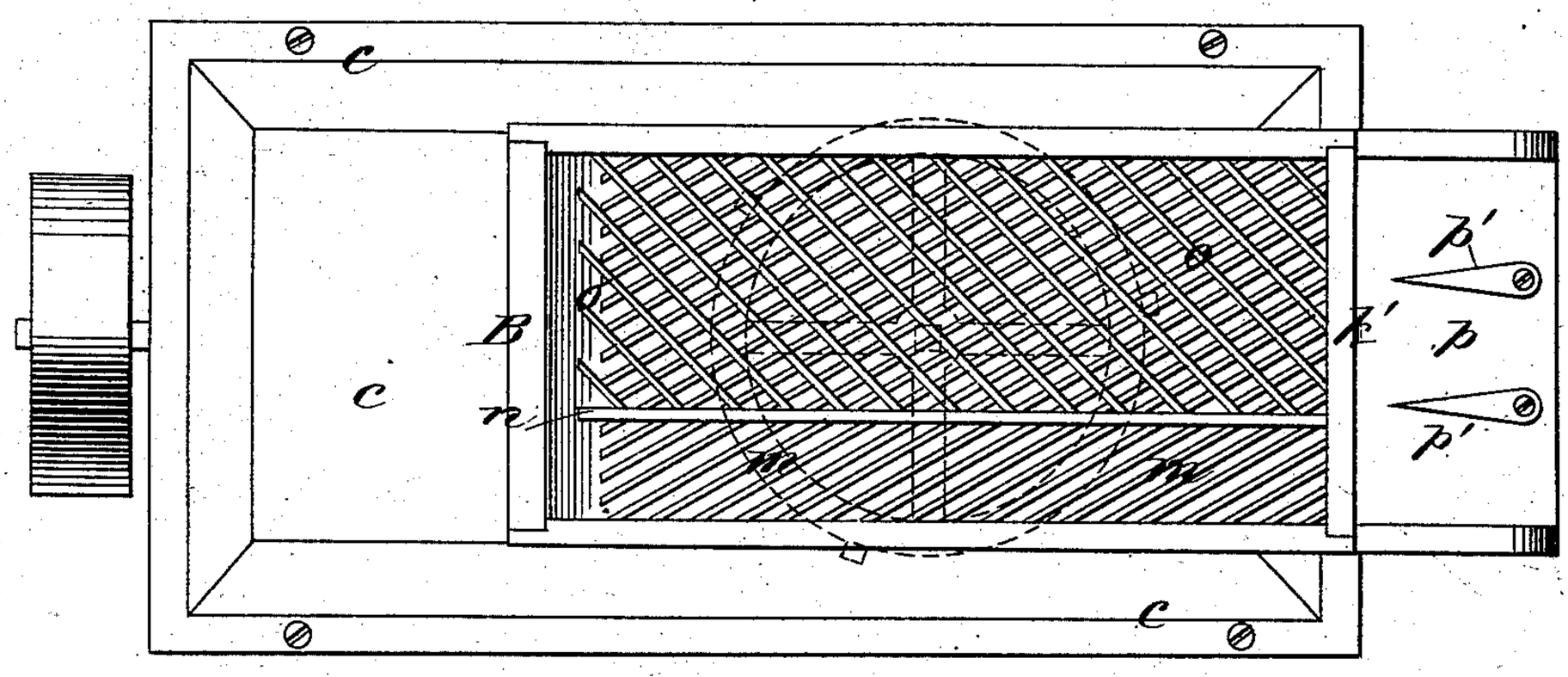
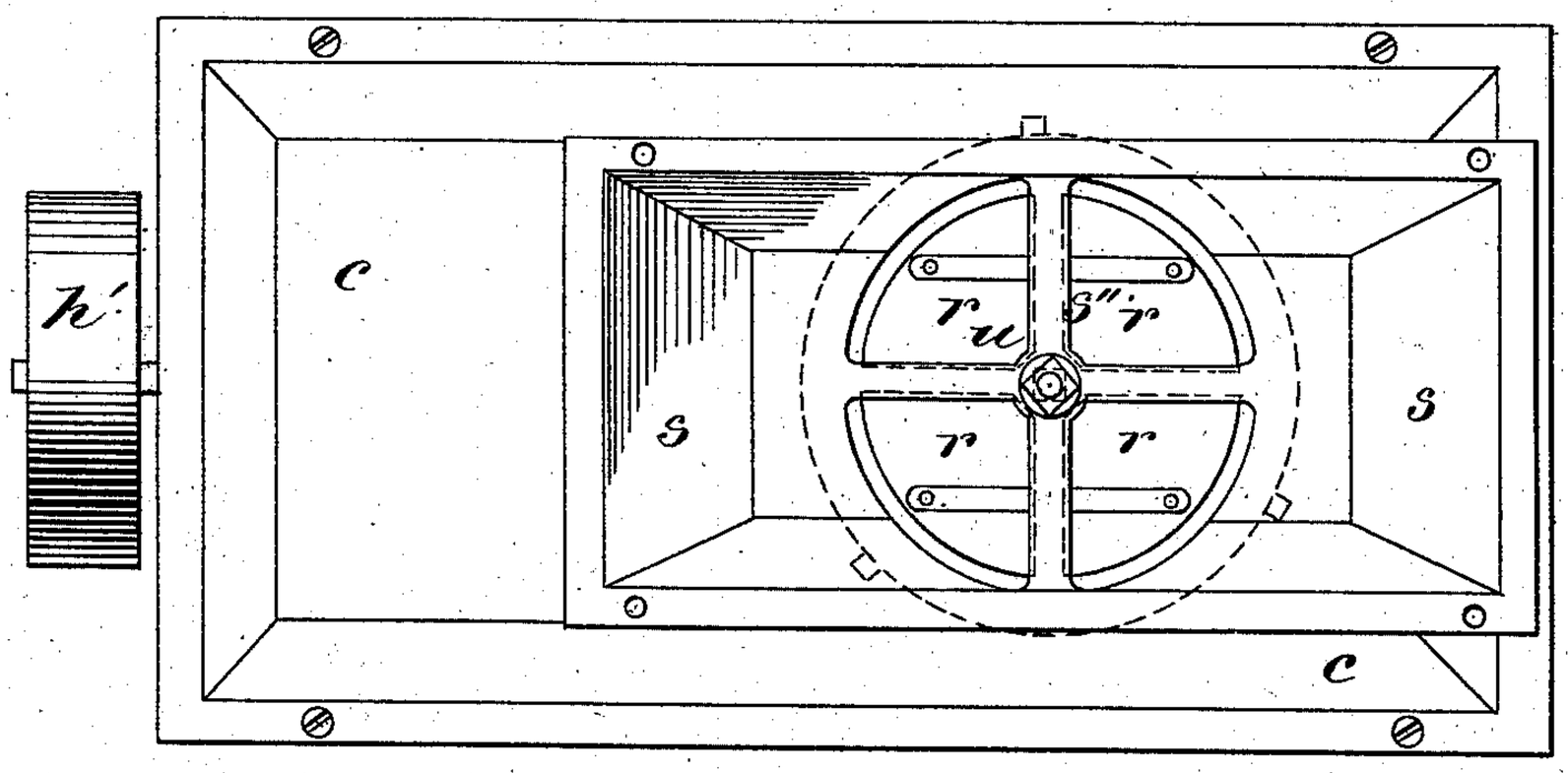


Fig. 4.



Witnesses:
Henry F. Parker.
Jno. E. Gavin

Inventor:
O. L. Farnham
by Chas. M. Higgins
Attorney.

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 3 Sheets—Sheet 3.

O. L. FARNHAM.

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Fig. 5

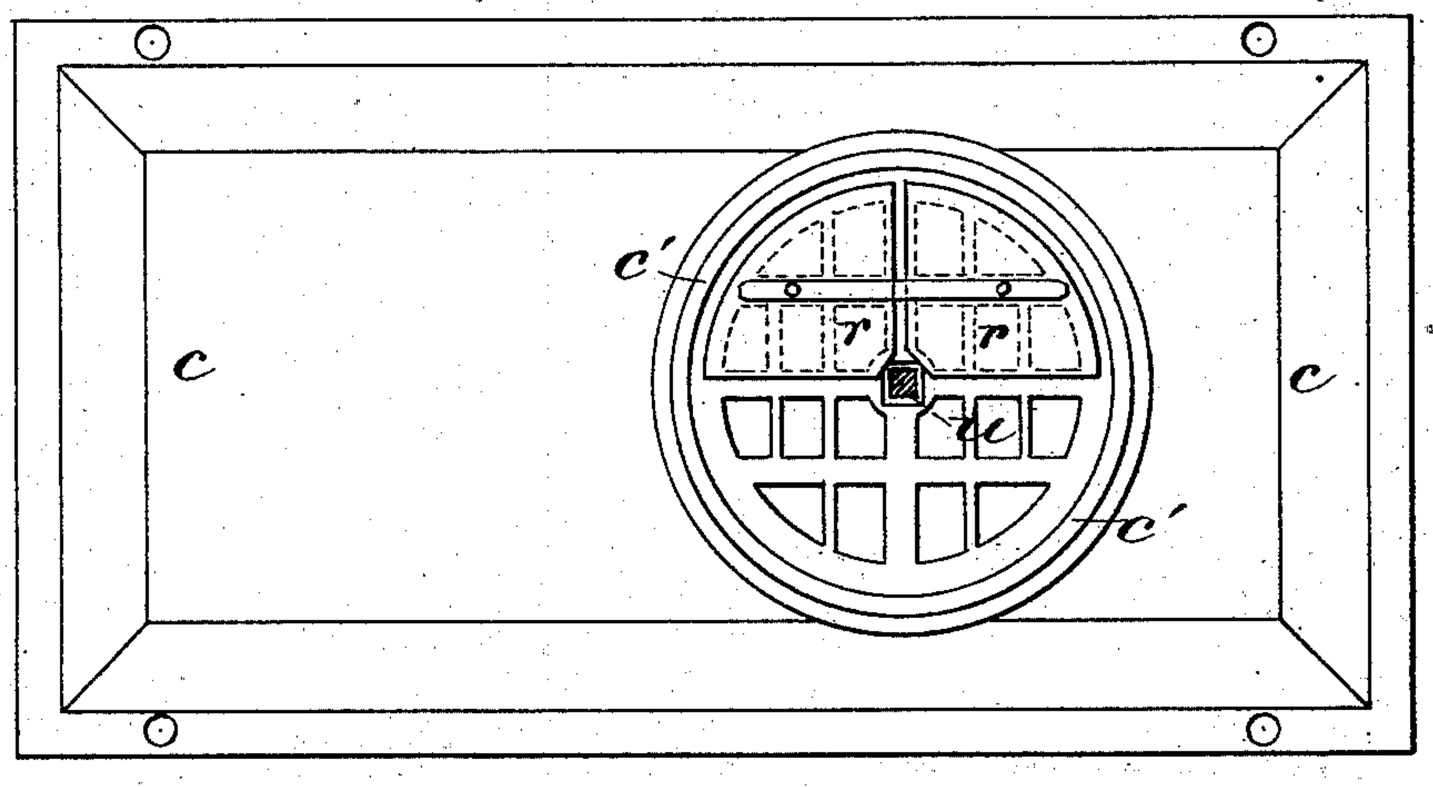
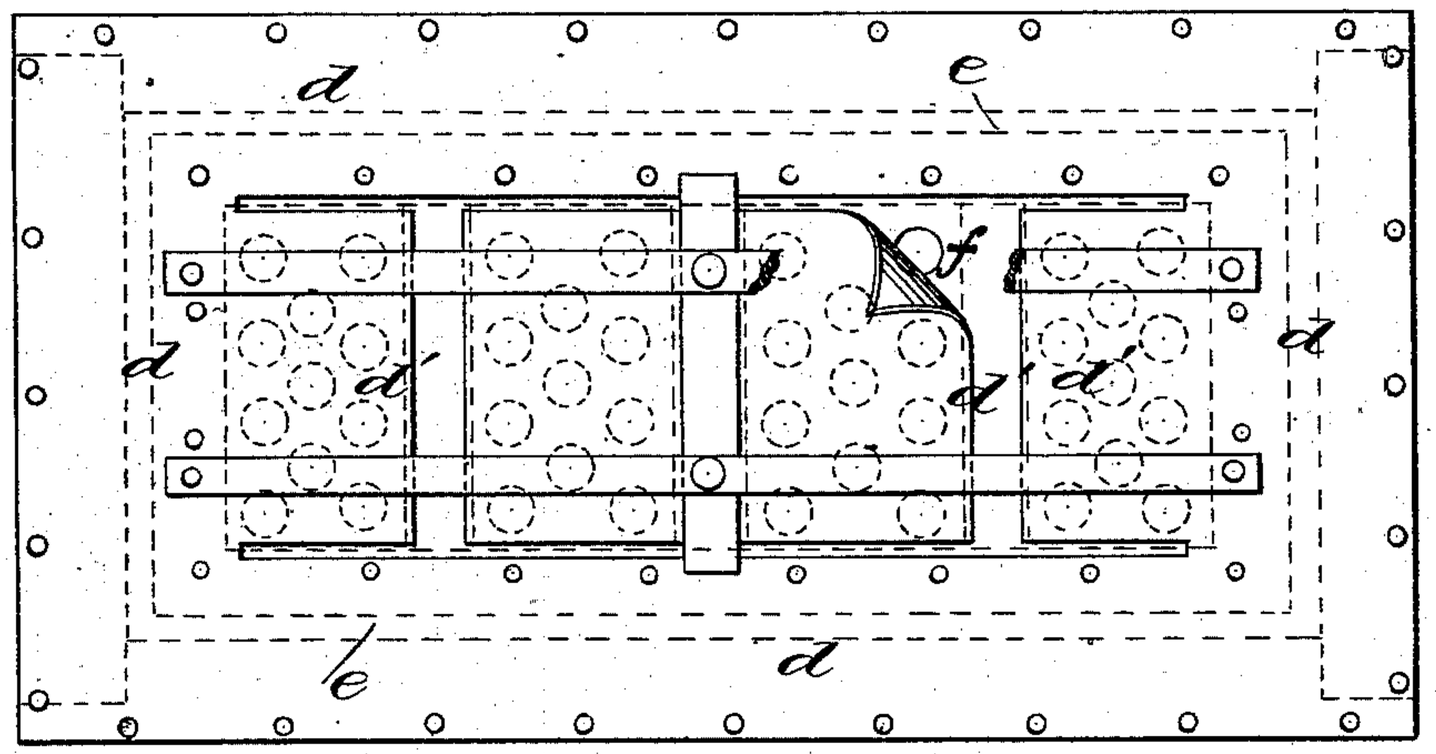


Fig. 6.



Witnesses
Henry F. Parker
Jno. E. Travis

Inventor:
O. L. Farnham
by
Chas. M. Higgins
Attorney.

N. PETERS. Photo-Lithographer. Washington, D. C.

UNITED STATES PATENT OFFICE.

ORISON L. FARNHAM, OF ST. JOHNSBURY, VERMONT, ASSIGNOR TO JOHN H. PADDOCK, OF SAME PLACE.

ORE-SEPARATING MACHINE.

SPECIFICATION forming part of Letters Patent No. 284,401, dated September 4, 1883.

Application filed May 14, 1883. (No model.)

To all whom it may concern:

Be it known that I, ORISON L. FARNHAM, of St. Johnsbury, Caledonia county, Vermont, assignor to JOHN H. PADDOCK, of the same place, have invented certain new and useful Improvements in Ore-Separating Machines, of which the following is a specification.

My invention applies more especially to that class of pneumatic ore-separators, such as shown in the Patent No. 218,896, issued to John H. Paddock, August 26, 1879. In these machines the pulverized ore is fed onto a separating table or trough which is both longitudinally and laterally inclined, and provided with a diagonally-ribbed sieve or grating resting on a permeable web or blanket through which a pulsating current of air is forced. The pulsations of air cause the particles of ore to frequently rise and fall during their gradual descent down the longitudinal incline of the trough, and this has the effect of separating them in layers arranged according to their relative specific gravities, the heavier metallic particles remaining at the bottom and being discharged at the lower end of the lateral incline, while the lighter earthy particles appear at the top and are delivered at the higher end of the lateral incline.

My improvements lie in the connection between the separating-trough and the bellows or air-forcing device, and in the means for adjusting the lateral and longitudinal inclinations of the trough, which involve several important novel features which greatly conduce to the efficiency of the machine, and render its management and operation more easy and accurate, as hereinafter fully set forth in the claims.

In the drawings annexed, Figure 1 presents a side elevation of my improved machine, and Fig. 2 a cross-section thereof on line *x x*. Fig. 3 is a plan view of the machine, and Fig. 4 a similar view with the separating-trough removed. Fig. 5 is a plan view of the deck of the machine, with the upper parts removed. Fig. 6 is a plan view of the bellows-diaphragm, with the deck-plate and all upper parts removed.

In the drawings, *a a* indicate the main frame of the machine, which is similar to the top frame or casing of an ordinary table, and rests at each of the four corners on the legs *b b*. The frame and legs may be made of metal or wood; but the latter is presumed in the drawings.

Over the top of the frame *a* is fixed the top plate or deck, *c*, which is preferably a strong light plate of cast-iron, formed in a flat doming or dish shape, with its concave side undermost, and screwed at its flat margins to the margin of the wooden frame *a*, as fully shown in Figs. 3, 4, 2, and 1.

Within the frame *a*, under the deck-plate *c*, is arranged the usual bellows, or rather diaphragm-bellows. This consists, as usual, of a sheet, *d*, of rubber cloth or other suitable material, (see Figs. 2 and 6,) which in this case, however, is clamped at its edges between the deck-plate *c* and the top of the frame *a*, while its middle portion within the fixed frame *a* is attached to a light wooden frame, *e*, having fixed over its top a perforated sheet-metal plate, *f*, which directly underlies the rubber sheet *d*. The middle portion of the rubber sheet is slit or cut, so as to form free valve-flaps, as indicated at *d'* in Figs. 2 and 6, which flaps overlie the perforations in the metal plate *f*, and form the suction-valves of the bellows, which open, in the usual manner, inwardly, as indicated by dotted lines in Fig. 2. Two cross-bars, *e'*, are fixed across the bellows-frame *e*, near each end thereof, and these are connected by eccentric-rods *g* with eccentrics *g'* on a central shaft, *h*, which is mounted in bearings supported on the legs *b*, and provided at one end with a driving-pulley, *h'*, whereby power may be applied to revolve the shaft, and thus vibrate the diaphragm, to thus produce the desired pulsating air-current in about th[e] usual manner, as will be understood.

The deck-plate *c* forms, as shown best in Fig. 2, the roof or cover to the bellows *d*, and it is solid or imperforate over its top, except near one end, where it is formed with a raised rim, *c'*, (see Figs. 1 and 2,) within which rim the plate is perforated with several openings, forming a circular grating divided into four segments by central cross-bars crossing at right angles, as shown fully in Figs. 5 and 2. Over these segments of the grating are clamped

four corresponding segments of rubber cloth, *r*, or similar material, (see Figs. 2, 4, and 5,) which form valves opening upwardly in the same direction as the bellows suction-valve. Two of these valves *r* are removed in Fig. 5.

B indicates the separating trough or table, which is of the usual construction, but its hollow under side is secured to an underlying supporting-tray or disk-shaped metal plate, *s*, the base of which is formed with a projecting circular rim, *s'*, of the same diameter as the rim *c'* on the deck-plate, and between this rim on the tray *s* and the rim *c'* on the deck-plate *c* are fitted two overlying beveled rings, *t t*, so that the space inclosed by said rims and rings forms an air throat or passage which connects the bellows with the separating-trough, as will be understood from Figs. 1 and 2. The rims *s' c'*, as well as the beveled rings *t*, are all formed with intermeshing rabbeted edges which engage with each other, as shown in Fig. 2, and thus hold the said parts in firm connection and prevent the lateral displacement thereof, and these rabbeted edges are all ground together, making their joints air-tight, so that the pulsating air-current from the bellows is forced to pass through the blanket of the separating-trough, and does not escape at said joints, as will be understood. The bottom of the tray *s* is solid or imperforate outside of the rim *s'*, but is perforated within the rim with four segmental openings, (see Figs. 4 and 2,) leaving a central cross-bar, *s''*, so as to form a free passage for the pulsating air-current from the bellows through the trough, and the center of these cross-bars *s''* is connected with the center of the grating in the deck-plate *c* by a central bolt, *u*, as seen best in Fig. 2, which thus clamps the tray and beveled rings to the deck-plate and supports the separating-table thereon, so as to prevent the said parts from rising out of place, yet will permit the table to be set at any desired inclination, while preventing it from being turned around, as will hereinafter appear.

As before stated, the separating trough or table B is presumed to be of the usual construction set forth in former patents on machines of this class, and involves no novel part of the present invention; but for a better understanding of the entire machine its general construction may be here briefly described. It therefore consists of an underlying frame, *i*, which forms the base of the trough, and an overlying frame, *k*, forming the inclosing hopper sides thereof. The under frame, *i*, is fastened air-tight upon the top edge of the tray *s*, and between the frame *i* and the upper frame, *k*, is clamped the blanket *l*, forming the floor of the trough, which blanket is composed of a flat taut web of cloth or other strong, smooth, closely-woven fabric. The upper frame, *k*, is provided with a grating of parallel diagonal ribs, *m m*, which overlie the blanket, as seen in Figs. 3 and 2, while the under frame is provided with a similar set of ribs, *m'*, which underlie the blanket directly beneath the upper ribs, as seen in Fig. 2, so that the blanket is thus clamped smooth and taut between said ribs, and the pulsations of air are forced through the blanket in the spaces between said ribs, as will be understood.

Above the upper ribs, *m*, is placed a longitudinal bar, *n*, at about one-third of the width of the trough, which bar is raised somewhat above the ribs *m*, as seen in Fig. 2. Now, from the bar *n* to the opposite side of the trough a more widely-spaced set of diagonal ribs, *o*, extend at an opposite inclination over the lower ribs, as shown best in Fig. 3, these ribs being deeper than the lower ribs, as seen in Fig. 2. The end of the trough under the narrow end board, *k'*, is open, allowing the channels between the ribs to discharge or open freely over the inclined tail-board *p*, which overhangs the end of the machine, and over which the ore is discharged in three streams, directed by the pivoted guide-fingers *p'*, the valuable ore or metallic particles being discharged at one corner, the tailings or earthy particles at the other corner, and the middlings at the center.

Now, in the practical operation of these machines, it is found that different kinds of ore require a different inclination of the trough, both longitudinally and laterally, and hence machines of this class have been heretofore provided with adjusting devices for thus adjusting the inclinations of the trough, and so retaining it during operation on that kind of ore.

Now, in my improvement, it will be noted that the beveled rings *t t*, which are free to revolve, and on which the trough is supported, form a most simple and efficient means for thus adjusting the inclination of the trough, for by rotating one or both of said rings to a certain extent in either direction the trough may be inclined to the required extent in any direction, either lengthwise or crosswise, or both combined, and with great ease and nicety, as will be readily understood from the full and dotted lines in Figs. 1 and 2, thus presenting a great improvement in the adjusting feature of these machines. In order to better admit of this adjustment, the peripheries of the rings are provided with projections *t'*, to engage with a spanner-wrench, whereby the rings may be easily grasped and turned by an easy effort of the operator, as will be understood.

It will be also understood that when the rings are thus turned to the desired adjustment they will remain firmly at such adjustment, and without any tendency to alter by the vibrations of the machine, for the friction on the rings will act, in the same manner as the friction on an acute wedge or a fine-pitched screw, to retain the parts firmly in any position to which they may be set, thus requiring no locking devices to hold the parts at the desired adjustment.

It may be also noted, by referring to Fig. 2, that the desired adjustment of the rings and consequent inclination of the trough will in no way disturb the air connection or passage

through the cavities of the rings between the bellows and trough; but it may be observed that such adjustment will cause a slight contraction or elongation at the axis of the adjustable system, which is represented by the bolt *u*. This axial contraction and elongation are, however, allowed by an elastic wabbling connection of the bolt with its attached parts, as will now appear.

Referring to Fig. 2, it will be seen that the body of the bolt *u* is square, and is passed through a square flaring hole in the center of the grating in the deck-plate *c*, and that the head of the bolt underlies the plate, and is slightly rounded or spherical; consequently the bolt cannot rotate, but it can wabble or incline to a limited extent in all directions. The upper end of the square bolt passes through a square hole in the center of the cross-bar *s''* in the tray *s*, and hence the tray is prevented from turning on the bolt, although the beveled rings may be freely turned beneath it to set the trough at any desired inclination, as before described. Above the cross-bar *s''* a rubber cushion or spring, *v*, is slipped over the threaded end of the bolt, and upon this is placed a washer, over which is screwed the nut *v'*, so as to compress the cushion somewhat. It will therefore be seen that the elastic pressure of the cushion *v* will hold the several parts in firm contact, and yet will yield sufficiently in an axial direction to allow the slight axial contraction and elongation which occurs when the system is inclined, as represented by dotted lines in Fig. 2.

It will be seen that while the tray *s* and its attached trough cannot rotate after the parts are clamped together by the bolt and nut *v v'*, yet if the trough is removed and the nut *v'* and cushion *v* detached the tray may be lifted off, turned around one-quarter of a revolution, and again set upon the rings and engaged with the bolt and clamped by the cushion and nut, as before. The tray and its attached trough will then lie at right angles to the deck-plate, so that the tail of the trough will discharge over the side of the machine, which may be desirable in some cases.

It may be observed from the drawings that the rim *c'* on the deck-plate *c* and the rim *s''* on the tray *s* are both made level, and that two beveled rings, *t*, are introduced between the rims. If desired, however, either or both of the rims *c' s'* may be beveled slightly, and a less amount of bevel will then be required on the rings *t;* or, if preferred, but one of the beveled rings *t* may be used between the rims, if the latter are themselves beveled to match with the ring.

In the construction which I have illustrated the interior of the beveled rings forms the air-passage between bellows and trough; but, if desired, the air-passage may be entirely separate from the rings, in the form of a flexible tube or throat, while the rings will serve simply to support the trough and adjust its inclinations, as before. The beveled rings, as will be understood, are simply rotary wedges, and in the aforesaid modification these rotary wedges need not be in the form of rings, but in the form of plates or disks perforated at the center to allow the passage of the bolt *u;* but the construction which I illustrate is considered preferable.

The machine shown in the patent of Paddock, before referred to, was not provided with any valve or check in the passage between the bellows and the blanket of the separating-trough, and hence each downstroke or inspiration of the bellows caused a slight inspiration of air through the blanket, which sucked down the light dusty portion of the ore into the rich layer of heavy metallic particles upon the surface of the blanket, and also drew portions of this dust into the bellows, which, as will be readily understood, was quite objectionable for several obvious reasons. In the present machine, however, this defect is entirely obviated by reason of the check-valves *r* in the air-passage, as before described, which freely allow the expiration of air from the bellows through the blanket, but prevent any inspiration through the blanket, as will be readily appreciated by reference to Fig. 2; and hence by this feature the metallic portions of the ore are delivered from the trough at the appropriate point in a much cleaner and richer state than heretofore, and the separating action of the machine is thus rendered more accurate.

What I claim is—

1. The combination, in a machine substantially such as set forth, with the separating-trough and a supporting-base, of a rotary wedge or beveled ring introduced between the two, and forming the means of adjusting the inclinations of the trough, substantially as herein set forth.

2. The combination, with the bellows and a separating-trough mounted over the same, of a rotary wedge or beveled ring introduced between the two, and forming the means of supporting the trough above the bellows and of adjusting its inclinations, substantially as herein set forth.

3. The combination, with the bellows and the overlying separating-trough, with a communicating passage between them, of one or more rotary beveled rings introduced between the trough and bellows, with air-tight joints, and inclosing the said passage, substantially as herein shown and described.

4. The combination, with the separating-trough and a supporting-base on or over which it is mounted, of one or more rotary wedges or beveled rings introduced between the two, and a central bolt connecting the trough with the supporting-base, and having a non-rotating wabbling or yielding connection therewith, substantially as and for the purpose set forth.

5. The combination, with the separating-

trough provided with its base-plate or tray *s*, having a circular rim, *s'*, with the deck-plate *c*, having a similar rim, *c'*, and one or more rotary beveled rings or wedges, *t t*, introduced between said rims, and a central fastening-bolt, *u*, substantially as and for the purpose set forth.

6. In a machine of the described kind, the deck-plate *c*, provided with the valves *r*, having the grating for supporting the said valves formed integral with the mass of the plate, substantially as herein shown and described.

7. In a machine such as described, the combination, with the separating-trough, the underlying bellows or air-forcing device, and the top or deck plate of the machine, of one or more beveled rings, *t*, introduced between the separating-trough and the deck-plate, and engaging by means of intermeshing rabbeted edges, substantially as and for the purpose set forth.

ORISON L. FARNHAM.

Witnesses:
WALTER P. SMITH,
J. G. CUSHMAN.