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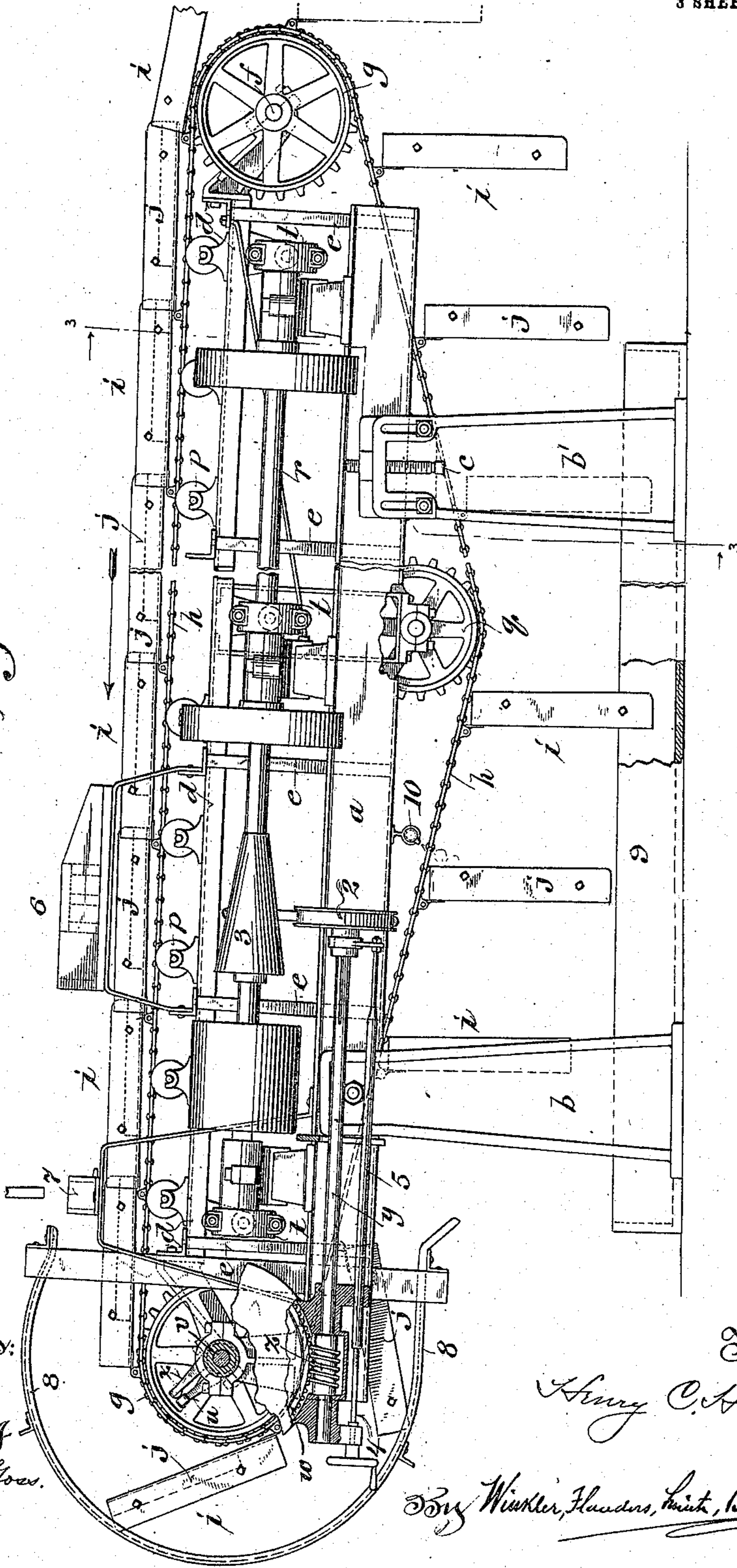
PATENTED JAN. 8, 1907.

H. C. HOLTHOFF.
ORE CONCENTRATING MACHINE.

APPLICATION FILED APR. 22, 1906.

3 SHEETS—SHEET 1.

Fig. 1.



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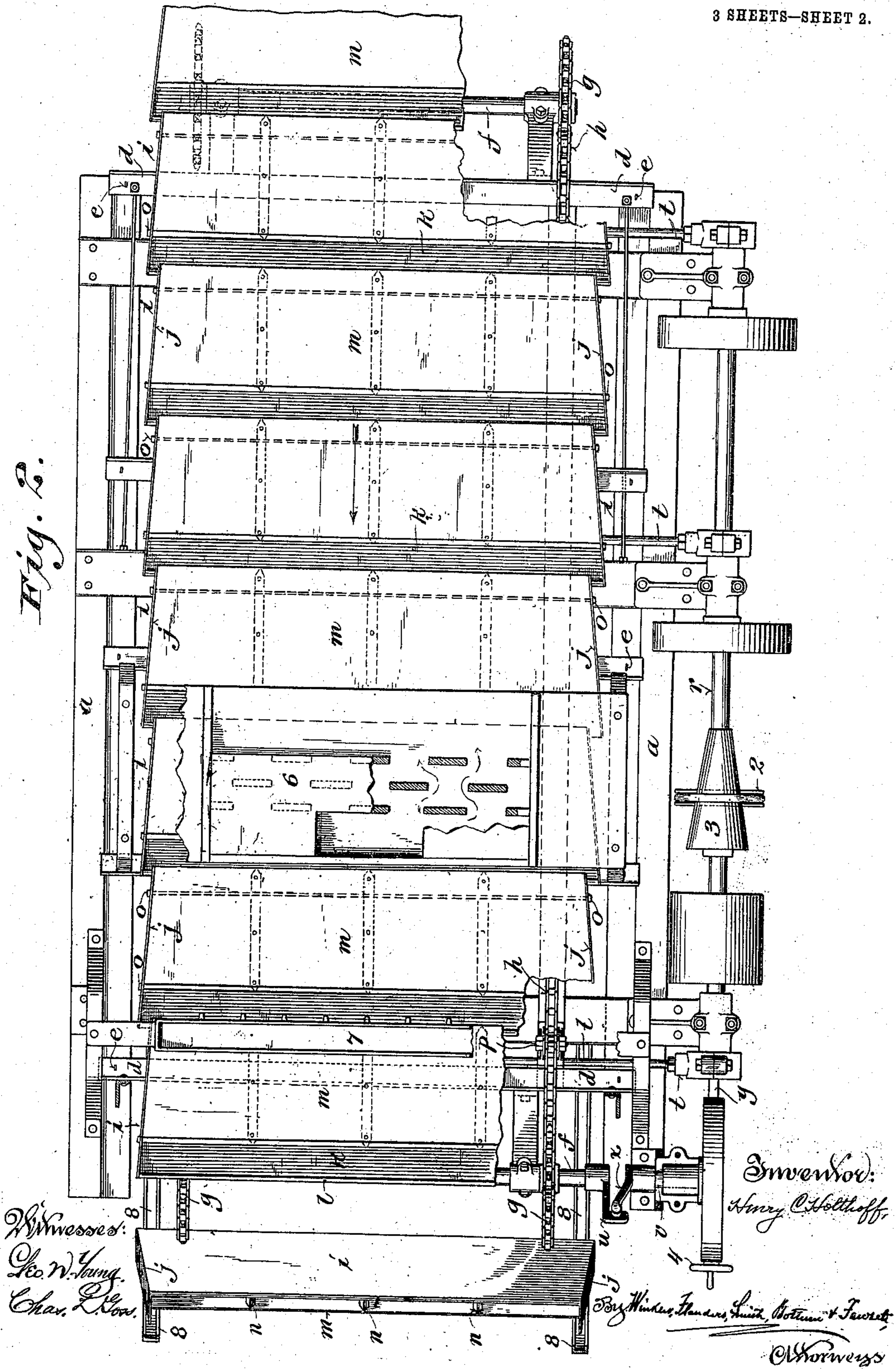
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3 SHEETS—SHEET 2.

Fig. 2.



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3 SHEETS—SHEET 3.

Fig. 6.

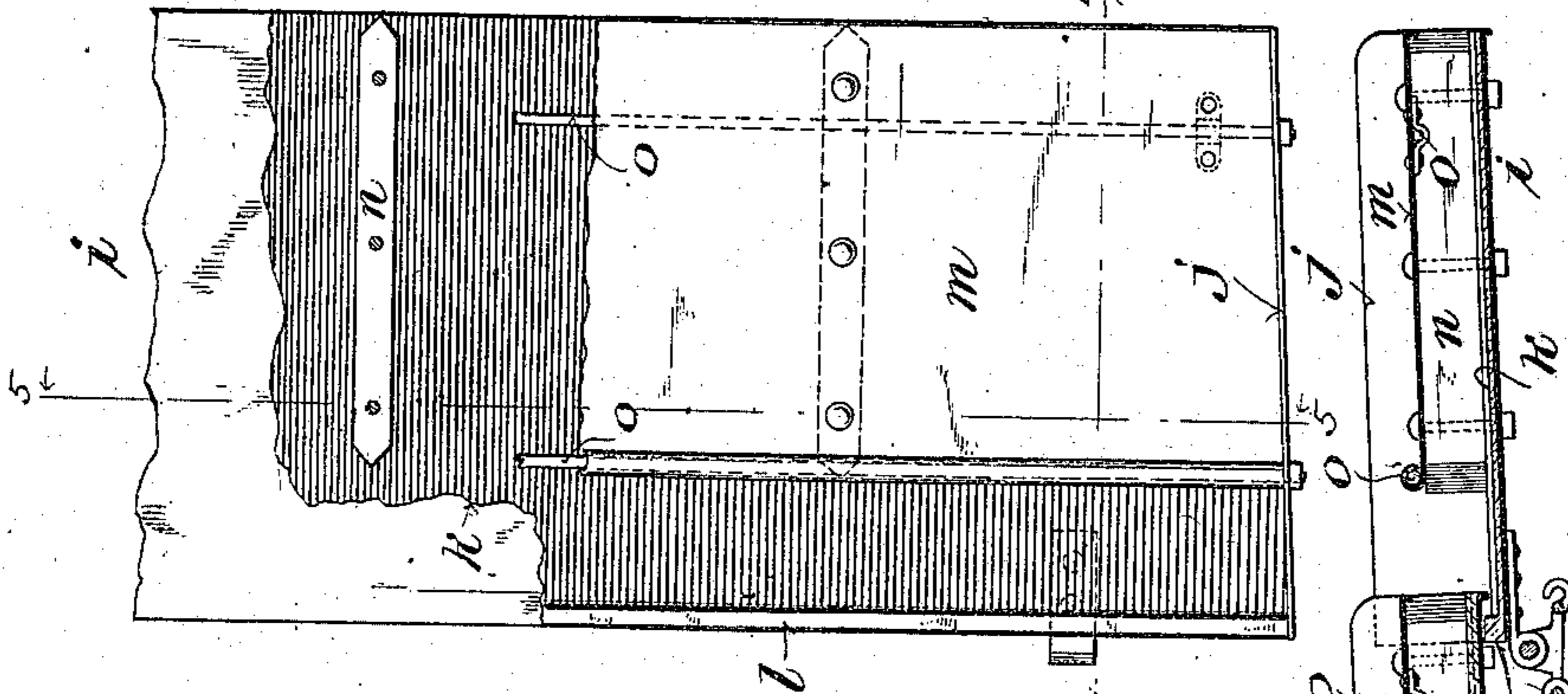


Fig. 5.

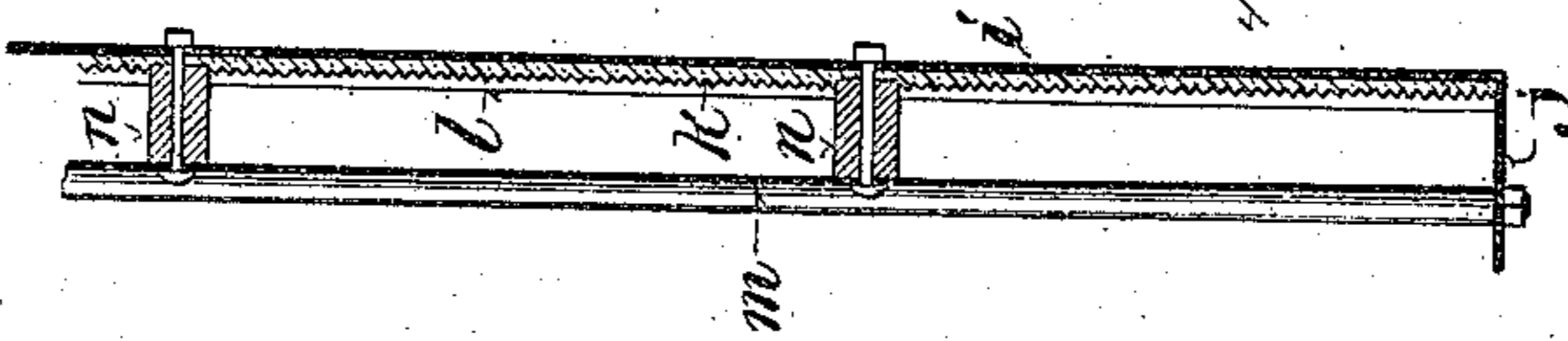


Fig. 3.

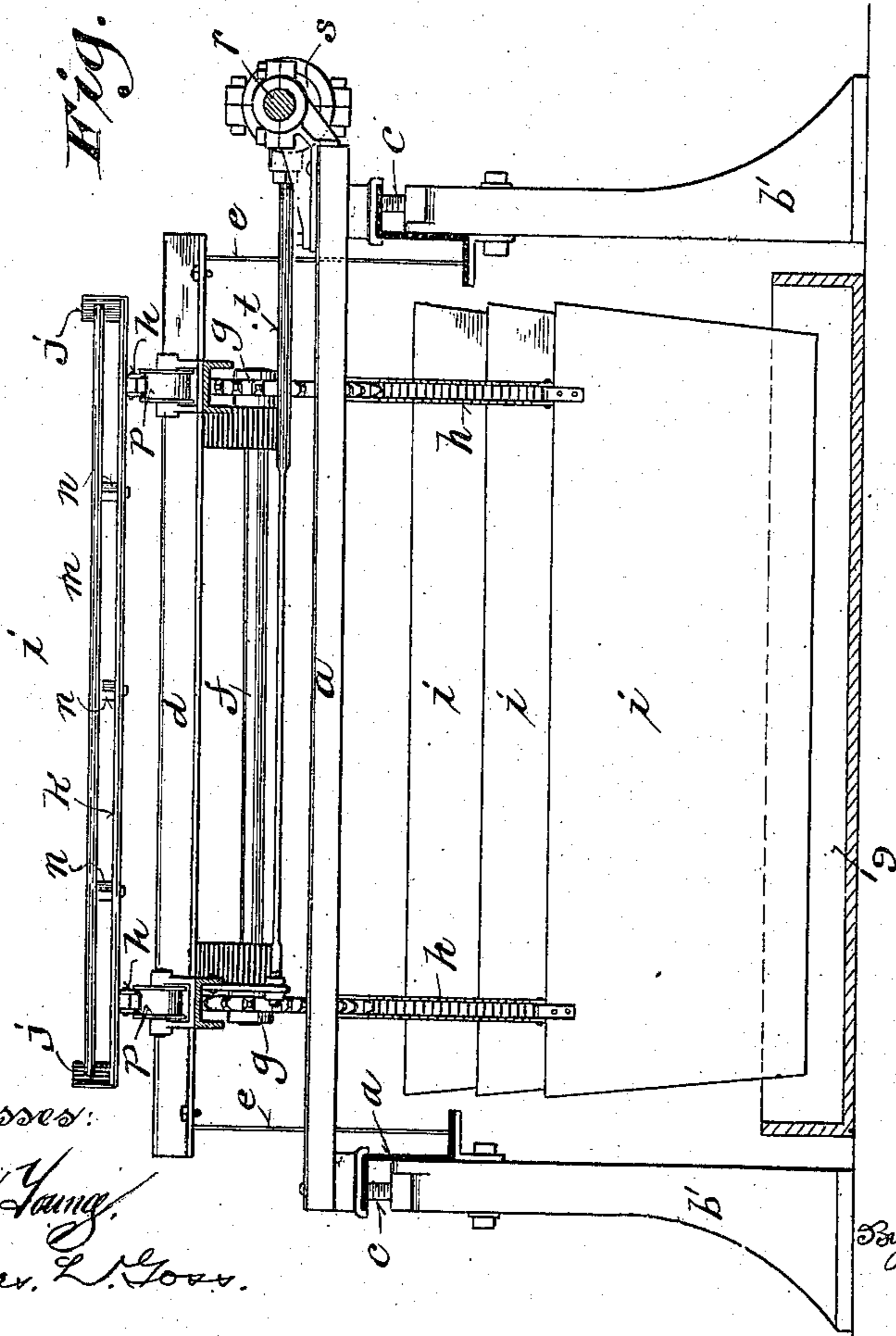
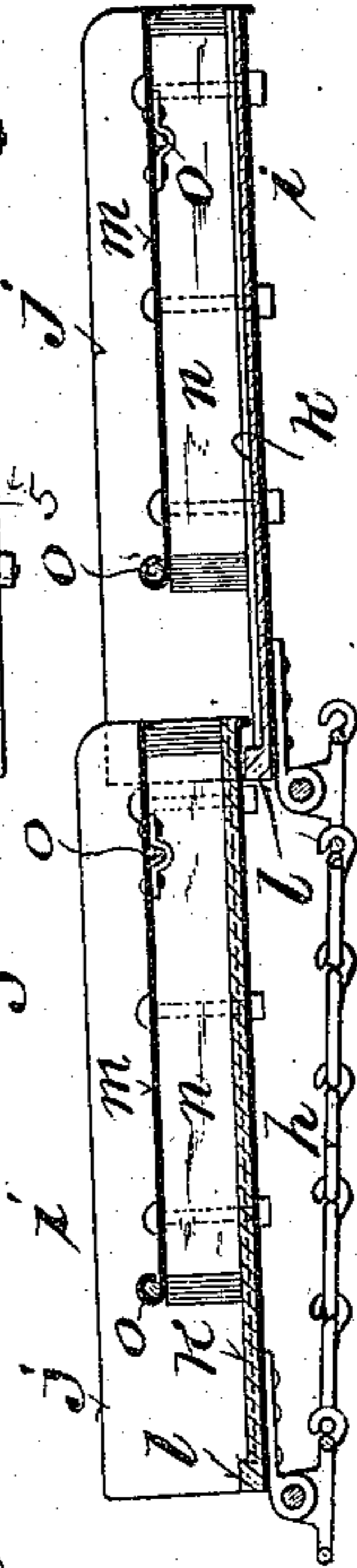


Fig. 4.



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UNITED STATES PATENT OFFICE.

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ORE-CONCENTRATING MACHINE.

No. 840,491.

Specification of Letters Patent.

Patented Jan. 8, 1907.

Application filed April 22, 1905. Serial No. 256,835.

To all whom it may concern:

Be it known that I, HENRY C. HOLTHOFF, 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 Ore-Concentrating Machines, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

10 This invention relates to that class of ore dressing or concentrating machines generally known as "vanners" or "vanning-machines," in which the pulp consisting of pulverized ore mixed with water is fed upon an
15 endless vibrating belt, and the heavier and lighter particles of ore are separated and caused by the vibrating motion of the belt to arrange themselves in strata according to their specific gravity, the heavier and valuable particles or concentrates which settle
20 upon and adhere to the belt being carried over its upper or head end, while the lighter particles of waste rock and sand are washed off at the lower or tail end.

25 The main objects of the present invention are to avoid disturbing the heavier particles of metal and ore and remixing them with the lighter particles of waste rock and sand after they have once arranged themselves in separate strata, to obtain a more perfect separation of mineral from waste, to increase the capacity of machines of this class, and generally to improve their construction and operation.

35 The invention consists in certain novel features of construction and in the peculiar arrangement and combinations of parts, as hereinafter particularly described, and pointed out in the claims.

40 In the accompanying drawings like characters designate the same parts in the several figures.

Figure 1 is a side elevation of a machine embodying the invention. Fig. 2 is a plan view of the same. Fig. 3 is a vertical cross-section of the machine on the line 3 3, Fig. 1; and Figs. 4, 5, and 6 are detail views of the belt-sections or leaves, Fig. 4 being a vertical longitudinal section on the line 4 4, Fig. 6, of
50 two adjoining sections or leaves, Fig. 5, a vertical cross-section on the line 5 5 of a portion of a single section or leaf, and Fig. 6 a fragmentary plan view of a section or leaf.

In ore-concentrating machines of this class
55 the pulp is fed upon the belt from a distribut-

ing-box at a point about one-third of the length of the machine from the upper or head end, and the particles gradually assume toward the lower or tail end a stratified arrangement according to their specific gravity. 60 the heavier underlying stratum of concentrates adhering to the belt being carried back underneath the distributing-box toward the head end, while the overlying stratum of rock and sand, with the water, flows onward
65 toward the tail end. As the pulp is discharged from the distributing-box it falls or strikes with some force upon the returning bed of ore on the belt, causing a disturbance of the stratified arrangement which it has
70 assumed and remixing the heavier particles of metal and ore with the lighter particles of rock and sand, thereby continuously undoing a large part of the work already performed by the machine. 75

One of the main purposes of the present invention is, as above stated, to prevent this disturbance of the stratified bed of ore and the remixing of its heavier and lighter particles. 80

Referring to the accompanying drawings, *a* designates the main frame, the sides of which may be conveniently made of Z-bars, as shown most clearly in Fig. 3. This frame is supported upon legs *b b'*, being pivoted to
85 the legs *b* adjacent to the head end and adjustably connected with the legs *b'* adjacent to the tail end of the machine, the legs *b'* being provided with vertical adjusting-screws *c* for varying the inclination of the frame *a*. 90 A vibratory frame *d*, supported from the main frame *a* by vertical springs *e*, is provided at the ends with cross-shafts *f*, on which are mounted sprocket-wheels *g*. An
95 endless concentrating-belt consisting of carrying-chains or link belts *h* and leaves or sections *i*, hinged transversely at their head ends to said chains, is mounted upon said sprocket-wheels. The leaves or sections *i*
100 are constructed and arranged to lap one over another on the upper side or span of the belt and to drop into an approximately vertical position on the under side or span of the belt, the tail end of each leaf or section overlapping the head end of the next succeeding section toward the tail end of the machine. 105

As shown in detail in Figs. 4, 5, and 6, each leaf or section comprises a flat metal plate which has upturned or closed sides *j*, a mat *k*, of rubber or other material, having a suitable 110

concentrating-surface, and a raised margin *l* at its head end, and a shield *m*, supported on longitudinal cleats *n*, over and partially covering the mat between its upturned sides *j* from its tail end to a point some distance from its head end. The shield, with its supporting-cleats and the underlying mat, are fastened by bolts, rivets, or other means to the metal plate forming the base of the leaf or section. The shield, which may be conveniently made of sheet metal, and the leaf are reinforced and stiffened by transverse tie-rods *o*, passing through and secured at the ends in the upturned sides *j*. The edge of the shield nearest the head or hinged end of the leaf is preferably rolled around one of these rods. The mat may be formed with a longitudinally-corrugated surface, as shown, or with any kind of ribbed, roughened, or plain surface suitable for the purpose. The upper span of the belt is supported and prevented from sagging between the sprocket-wheels at the ends of the machine by rollers *p*, mounted on the upper side of the frame *d*. On the under side the chain or link belts *h* pass between the ends of the machine beneath and around guiding sprocket-wheels *q*, supported by hangers on the frame *d* and taking up the slack in said belts. A transverse vibratory movement is imparted to the frame *d* and the concentrating-belt which it carries from a longitudinal shaft *r*, mounted on the main frame *a* at one side thereof and provided with eccentrics *s*, which are connected by straps and rods *t* with the opposite side of said frame *d*.

The sprocket-wheels at the head or upper end of the machine are turned, and the belt is driven in the direction indicated by arrows on Figs. 1 and 2 from the shaft *r* at any desired rate of speed through the following connections: The shaft *f* at the head of the machine is extended at one end and provided with an arm *u*, and journaled in line with said shaft on the main frame is a short shaft *v*, which is provided at its outer end with a worm-gear *w* and at its inner end with an arm *x*, which is adapted by engagement with the arm *u* to turn said shaft and at the same time permit free endwise movement thereof and transverse vibration of the frame *d* and concentrator-belt. A shaft *y*, journaled on the main frame below and parallel with the shaft *r*, is provided with a worm *z* in engagement with the worm-gear *w* and with a flanged or grooved pulley 2, which is splined upon and movable lengthwise thereof, and is connected by a belt with a cone-pulley 3 on the shaft *r*. An adjusting-screw 4, threaded in one end of a rod 5, which is connected at its other end with a loose collar on the hub of the pulley 2, serves to adjust said pulley lengthwise of the shaft *y* and to vary the speed at which it is driven by the cone-pulley 3, and hence the speed of the concentrator-belt.

A distributing-box 6, mounted upon the frame *d* and extending transversely over the concentrator-belt, is arranged to distribute and feed the pulp which is piped or conveyed thereto upon the shields *m* and the leaves *i* between the shields of the concentrator-belt as they pass underneath said box. One or more wash-water boxes or heads 7, supported from the main frame *a*, are arranged to deliver water across the concentrator-belt between the distributing-box 6 and the head of the machine. Curved guides 8, attached to the frame *d* at the head of the machine, support the leaves *i* as they pass around the adjacent sprocket-wheels *q* and prevent them from dropping at once and straining their hinge connections with the carrying-chains *h*. A box or receptacle 9 is provided underneath the frame *a* to receive the concentrates discharged or washed from the leaves *i* as they pass over it and drop into a vertical position, as shown in Fig. 1. A transverse spray-pipe 10, extending across the under side of the main frame *a*, is arranged to wash the concentrates off from the mats *k*, to which they adhere, into the box or receptacle 9.

The machine operates as follows: The frame being adjusted so that the upper side or span of the concentrator-belt inclines downwardly toward the tail end sufficiently to cause the pulp and water to flow in a direction opposite to the travel of the upper span of the belt, (indicated by arrows on Figs. 1 and 2,) the pulp being supplied to the distributor-box 6 and water to the box or head 7, and the concentrator-belt being set in motion by means of any suitable driving connection with the shaft *r*, the pulp flows in a thin wide stream from the box 6 upon the shields *m* as they pass underneath it and from the lower or tail ends of the shields upon the mats *k* of the following leaves or sections of the belt, some of the pulp being discharged directly from said box upon the mats through the open spaces between the shields. The heavier particles of metal and ore, under the influence of the vibratory motion imparted to the concentrator-belt, sink to the bottom of the bed of pulp distributed over the mats *k* underneath the shields *m* and are not remixed with the overlying stratum of rock and sand as they pass back under the feed-distributing and wash-water boxes 6 and 7. The clear water supplied from the box or head 7 washes off any sand that may remain on the concentrates after they pass the feed-box. The concentrates adhering to the mats covering the bottoms of the leaves or sections of the belt are carried over the upper head end of the machine and are washed off into the box 9 by sprays or jets of water from the pipe 10 as the leaves or sections of the belt are carried in an approximately vertical position below and past said pipe.

By covering and protecting the bed of ore

as it assumes a stratified condition on the concentrating-belt against disturbance and agitation by the fall of the pulp and water from the feed and wash water boxes, the capacity of the machine is materially increased, a more perfect separation and concentration are effected, and waste of valuable material with the tailings is avoided.

Various changes in the details of construction and arrangement of parts may be made without materially affecting the operation of the machine, and without departing from the principle and intended scope of the invention.

I claim—

1. In an ore-concentrating machine, an endless belt having a series of shields attached to and movable with it and arranged with spaces between them over the working-surface of the belt, substantially as described.

2. In an ore-concentrating machine an endless belt provided with a series of hinged leaves or sections having raised sides and adapted to lap one over another on the upper side of the belt, each leaf or section being provided with a shield partially covering its working surface, substantially as described.

3. In an ore-concentrating machine an endless belt provided with a series of hinged leaves or sections adapted to lap one over another on the upper side of the belt, each leaf or section having closed or raised sides converging toward the tail end, a concentrating-mat and a shield supported over and partially covering said mat, substantially as described.

4. In an ore-concentrating machine the combination of a suitable frame provided with wheels, an endless belt mounted on said wheels and provided with a continuous series of leaves or sections adapted to lap one over another on the upper side of the belt, and each having a shield partially covering its concentrating-surface at a distance therefrom, a distributing-box mounted over the upper side of said belt, and means for turning said wheels and moving said belt endwise, substantially as described.

5. In an ore-concentrating machine the combination of a suitable frame provided with belt supporting and driving wheels, an endless belt mounted on said wheels and provided with a continuous series of hinged leaves or sections adapted to lap one over another on the upper span of the belt, each leaf being provided with a shield over and partially covering its concentrating-surface, a distributing-box located over the upper span of the belt and adapted to supply ore thereto upon the shields, and a wash-water box located over the upper span of the belt and between its head end and the distributing-box, substantially as described.

6. In an ore-concentrating machine the combination of a main frame, a vibratory frame mounted on the main frame and pro-

vided with belt supporting and guiding wheels, an endless belt mounted on said wheels with its upper span inclined downwardly toward the tail end and having hinged leaves, each of which is adapted to lap at its tail end over the head end of the next succeeding leaf on the upper span of the belt and has a shield supported over and covering the concentrating-surface of the leaf adjacent to its tail end, means for imparting a vibratory movement to said belt and its carrying frame, means for turning said driving-wheels and moving the upper span of the belt toward its upper head end, and a distributing-box arranged over and adapted to feed pulp upon the upper span of the belt, substantially as described.

7. In an ore-concentrating machine the combination of a main frame, a vibratory frame mounted on the main frame and provided with belt supporting and driving wheels, means for varying the inclination of said vibratory frame, an endless belt having hinged leaves adapted to lap one over another on the upper side of the belt and each provided with a shield covering a portion of its working surface, means for imparting a vibratory movement to said belt and its carrying-frame, means for turning said driving-wheels and moving the upper side of the belt toward its upper end, and means for feeding pulp upon the upper side of the belt, substantially as described.

8. In an ore-concentrating machine the combination of a vibratory frame provided with belt supporting and guiding wheels, an endless belt mounted on said wheels with its upper side inclined downwardly toward the tail end and provided with hinged leaves adapted to lap one over another on the upper side of the belt and each provided with a shield covering a portion of its working surface, means for imparting a vibratory movement to said belt transverse to its longitudinal movement, and means for feeding ore upon the upper side of the belt, substantially as described.

9. In an ore-concentrating machine an endless belt comprising carrying-belts and transverse leaves hinged to said belts, and each consisting of a plate having upturned sides, a concentrating-mat on the bottom having a raised margin at the head end and a shield supported over and partially covering said mat, substantially as described.

10. In an ore-concentrating machine an endless concentrating-belt comprising carrying-belts and leaves hinged at their head ends to said belts and each consisting of a flat plate having raised sides, a concentrating-mat on the bottom having a longitudinally-corrugated surface and a raised margin at its head end, and a shield located at a distance from and partially covering said mat, substantially as described.

11. In a concentrating-machine the combination with suitable belt supporting and carrying wheels, of an endless belt mounted on said wheels and having attached to it at a distance from its concentrating-surface a shield partially covering said surface and movable with the belt, substantially as described.

12. In an ore-concentrating machine the combination with a vibratory frame provided with belt supporting and driving wheels, an endless belt mounted upon said wheels with its upper span inclined downwardly toward the tail end, and having attached to and movable with it at a distance from its working surface a shield partially covering said surface, means for moving said belt on the upper side toward its higher end, means for imparting a vibratory movement to said belt, and means for charging pulp or ore upon the shield from which it is delivered

to the concentrating-surface of the belt, substantially as described.

13. In an ore-concentrating machine the combination with a suitable frame provided with belt supporting and driving wheels, of an endless belt mounted upon said wheels and having attached to and movable with it a shield which is located a short distance from the concentrating-surface of the belt and has openings at intervals, and means for feeding the pulp or ore upon said shield from which it is discharged through said openings upon the concentrating-surface of the belt, substantially as described.

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

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