G. H. ELMORE.

JIG.

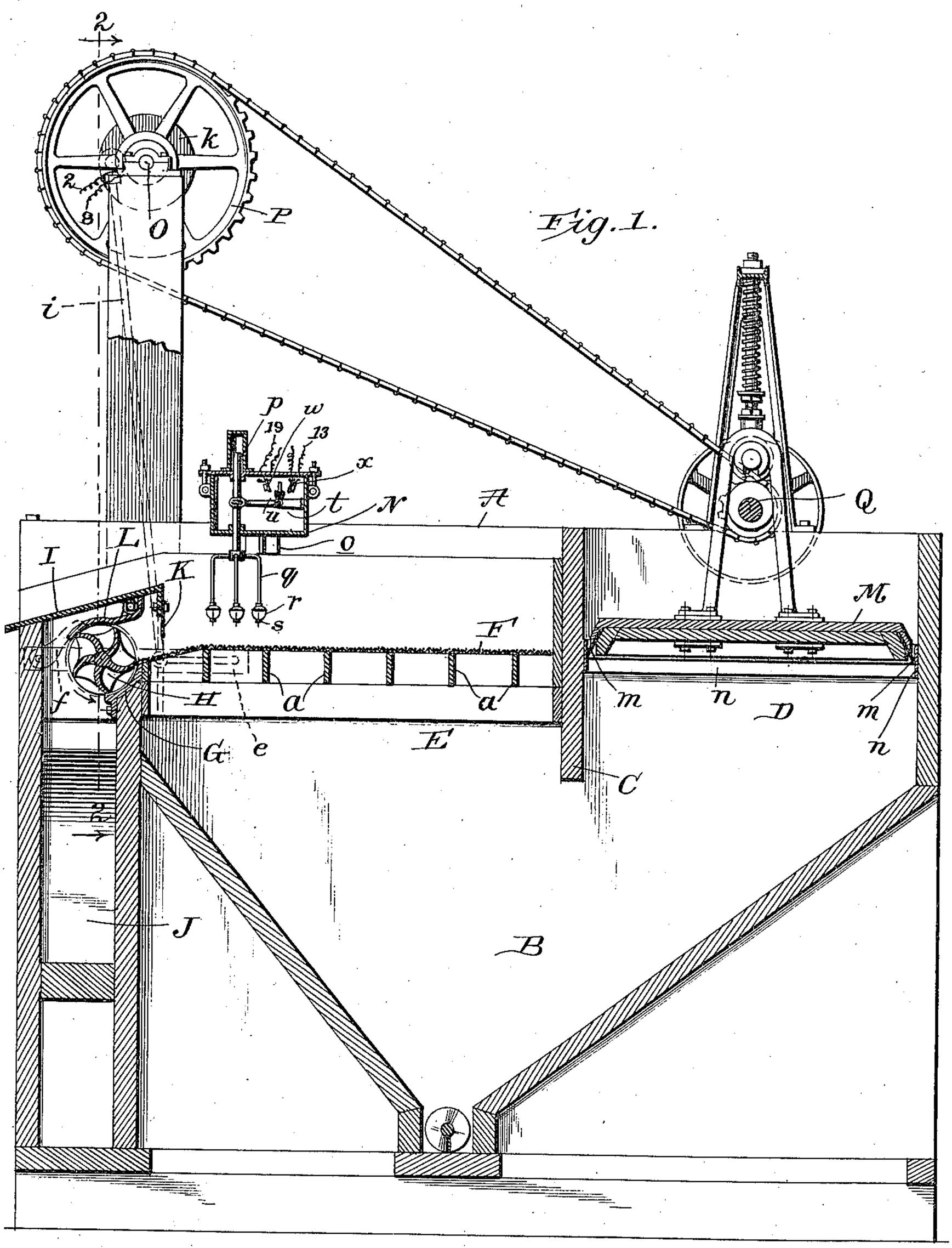
APPLICATION FILED OCT. 29, 1910.

997,609.

Patented July 11, 1911.

3 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

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3 SHEETS—SHEET 2.

Fig. 2.

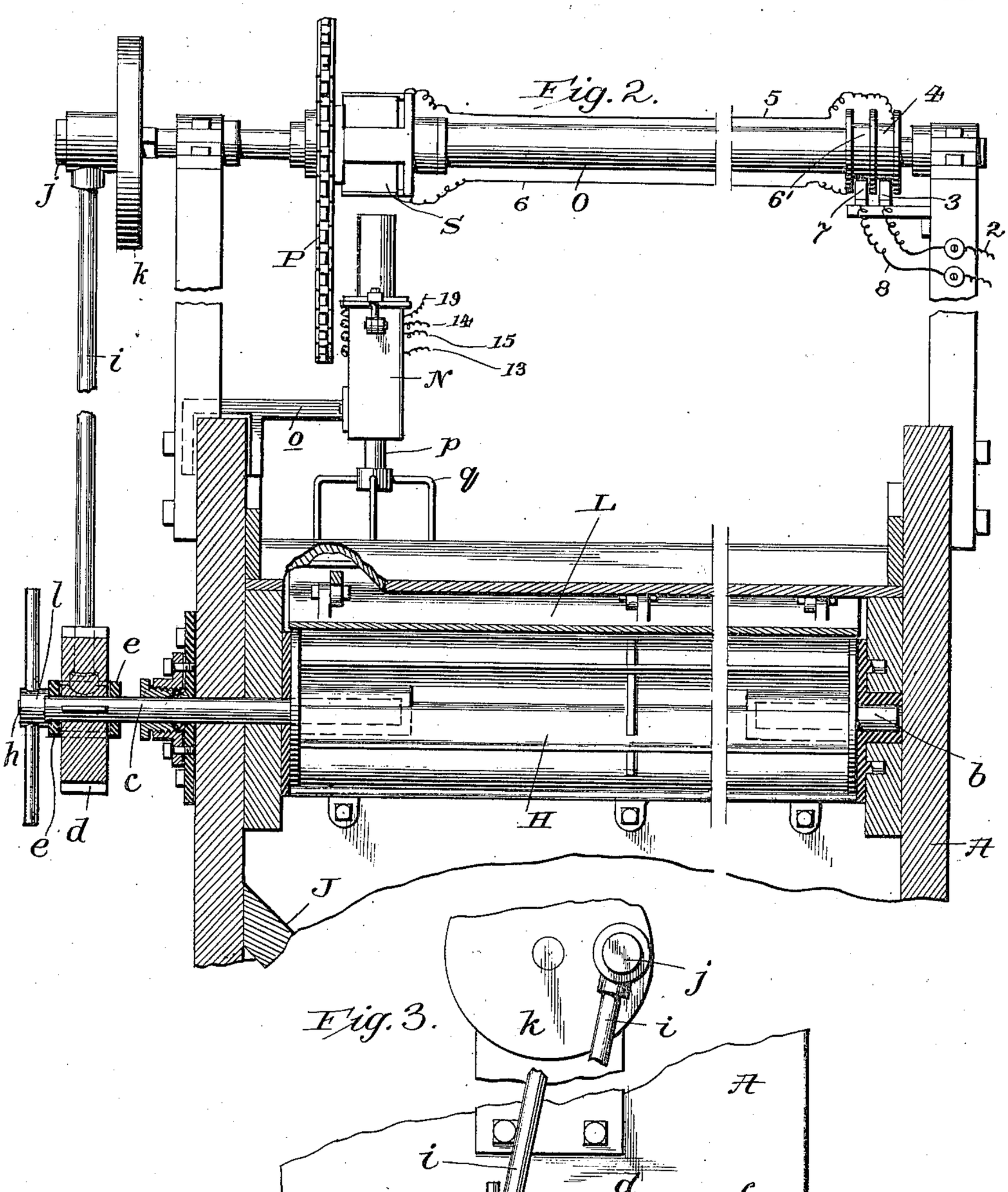

Fig. 3.

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3 SHEETS—SHEET 3.

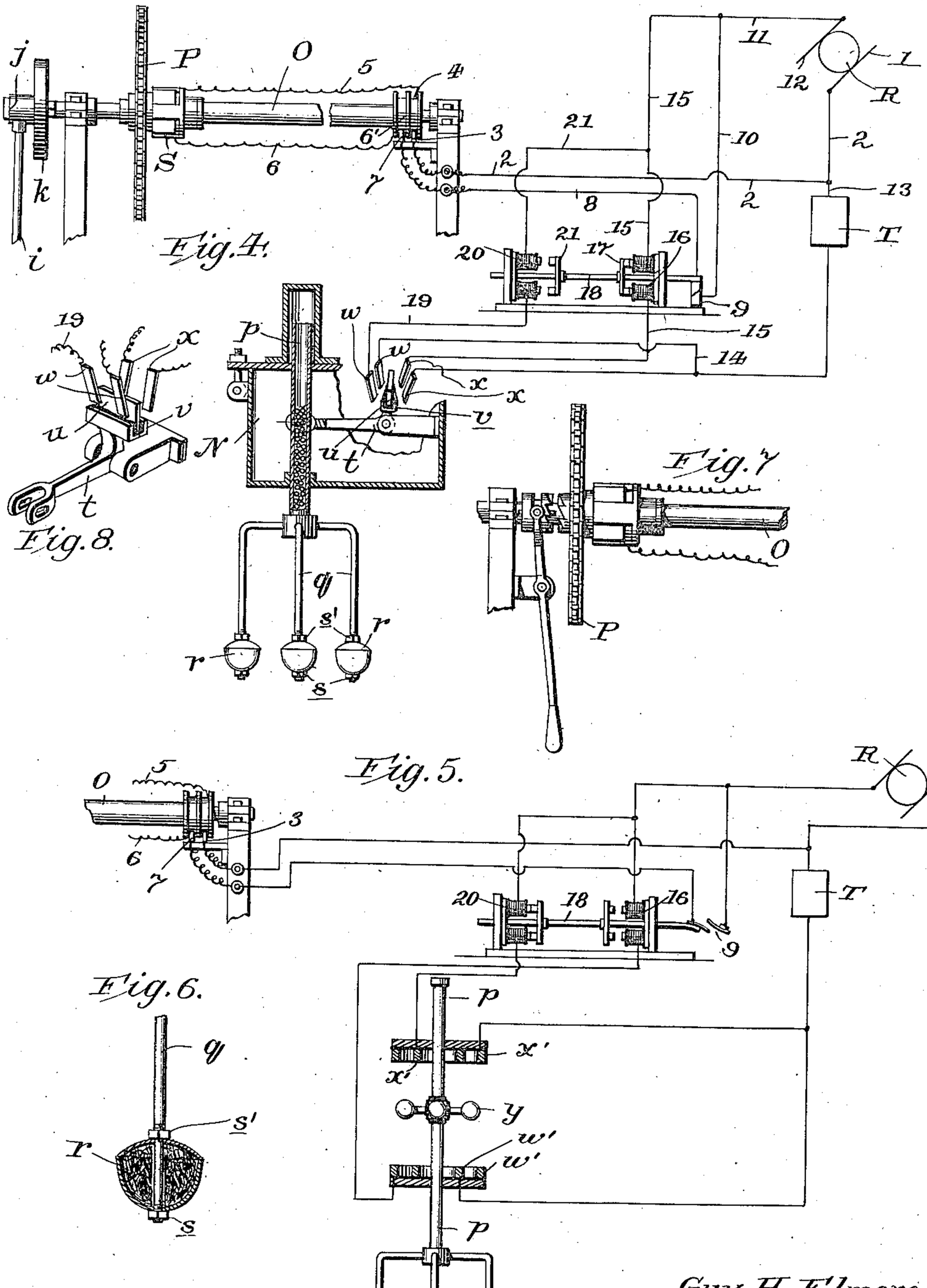

Fig. 4.

Fig. 8.

Fig. 7

Fig. 5.

Fig. 6.

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UNITED STATES PATENT OFFICE.

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JIG.

997,609. Specification of Letters Patent. Patented July 11, 1911.

Application filed October 29, 1910. Serial No. 589,742.

To all whom it may concern:

Be it known that I, GUY H. ELMORE, a citizen of the United States, residing at Swarthmore, in the county of Delaware and State of Pennsylvania, have invented certain new and useful Improvements in Jigs, of which the following is a specification.

My invention relates to that class of machines commonly known as "jigs" or "jiggers," employed to effect a separation of mineral substances of differing specific gravities and characters.

The present invention is designed primarily for use in connection with the treatment of coal, where the heavier portion, consisting mainly or wholly of slate, settles at the bottom of the mass, and lies directly upon the sieve or screen. In the case of metal-bearing ores, this heavier and lower stratum consists of the concentrates. In both cases it is desirable to retain upon the screen a practically uniform depth of concentrates, which form a bed through which the water is forced upward during the operation of the machine. It is, however, difficult under existing conditions, to preserve such uniformity, and the invention about to be described has for its object the attainment of this end.

Briefly stated, it consists in combining with the jig a delivery mechanism, which is intermittently brought into and thrown out of action through the rise and fall of a float lying in and supported by the material on the screen or sieve, and which serves, when raised or lowered to a given maximum or minimum level, to establish connections, preferably electrical, whereby the delivery mechanism is brought into or thrown out of gear.

The invention is illustrated in the accompanying drawings, in which:

Figure 1 is a longitudinal vertical section of a jig embodying my invention; Fig. 2, a transverse section on the line 2—2 of Fig. 1, looking in the direction of the arrows; Fig. 3, a detail view of the pawl and ratchet mechanism for rotating the discharge or delivery roll; Figs. 4 and 5, diagrammatic views illustrating the arrangement of circuits; Fig. 6, a sectional view of one of the float members; Fig. 7, a view illustrating the employment of a simple mechanical clutch, for use in case of failure of current of the magnetic clutch; Fig. 8, an enlarged view of the circuit closer illustrated in Figs. 1 and 4.

The general construction of the jig may be of any approved type or character. In the drawings I have illustrated a construction which is set forth and claimed in an application filed in my name on the seventh day of July, 1905, and designated by Serial No. 268,647, but the present invention is applicable to jigs generally, and to machines of like nature; hence it is to be understood that the particular type of jig here represented is not essential or material, and is made use of merely for purposes of illustration.

In the drawings, A indicates a structure comprising primarily a hopper-shaped chamber B, divided in its upper portion by a partition C into two chambers D and E, which, below the partition, are in free communication with each other. Chamber E is provided with a screen F of suitable mesh and character, supported at intervals by cross bars *a*, to enable it to support the weight of material brought upon it. At its outer end the screen is preferably inclined somewhat downward to facilitate the discharge of material therefrom. Bolted or otherwise made fast to the upright wall of the chamber B at the delivery end of the screen, is a concave plate or casting G, having a radius of curvature slightly greater than the radius of a discharge roll or valve H, the axis of which is coincident with that of the concave plate G.

Above the delivery roll or valve H there is an inclined discharge plate or chute I, having about the same inclination as the delivery end of the screen, said plate extending across the upper end of a vertical trunk, hopper, or elevator boot J, into which the delivery roll or valve H discharges, said plate I extending inward somewhat over or beyond the delivery end of the screen, and being bent or extended sharply downward to make a vertical supporting face to which to attach an adjustable gate or gage K. This gage-plate is held by clamping bolts, or in any other usual or convenient way, and its lower edge is set to determine the vertical measurement of the discharge outlet of the screen or sieve. The delivery or discharge roll or valve H is made with longitudinal buckets or blades, which may be radial, but are preferably curved as indi-

cated in Fig. 1, better to receive and retain the material delivered into the buckets from the sieve or screen. In order that said material may not, under the forward flow of the water, be carried over the top of the delivery roll or valve H and discharged when said roll is not rotated, a curved shield or guard L is provided, which, like plate G, a little more than spans the distance from the edge of one bucket or longitudinal rib of the roll or valve to the next, thus effectually cutting off any escape of material from the roll or valve except as the roll itself carries the same forward, and discharges it on the down-going side. The roll or valve H is represented as furnished with gudgeons or short shafts *b* and *c*, the latter of which, as shown in Fig. 2, is carried out through a side of structure A and through a suitable stuffing gland, and is furnished with a ratchet wheel *d* of rather wide peripheral face, said wheel being keyed or otherwise made fast to the shaft *c*, so that the two shall turn together. The shaft *c* is secured in any convenient way to the roll or valve H, so that the two shall rotate in unison.

Pivotally supported upon the shaft *c* and straddling the wheel *d*, is a lever *e* carrying at one end a series of hook-shaped pawls *f*, adapted to engage with the teeth of the ratchet wheel *d*. These pawls are so spaced that on very slight movement of the lever *e*, one or another of said pawls will ride over a tooth of the ratchet wheel and engage the same, the several pawls insuring such engagement even though the vibration of the lever move any one pawl only a portion of the distance from the point of one tooth of the ratchet to that of the next. On the opposite side of the shaft or fulcrum *c* the lever *e*, which may conveniently be bent up out of a piece of heavy strap or hoop iron, is provided with a slot *g* through which is passed a threaded pin or bolt *h*, carried at one end of a pitman *i*, the opposite end of which is connected with a crank pin *j* of a crank disk *k* on a driven shaft of the machine. By setting the pin *h* nearer to or farther from the fulcrum of the lever *e*, a longer or a shorter travel of the dogs or pawls *f* for each movement of said lever may be secured, and, as a consequence, the delivery or discharge roll or valve H may be turned through a varying number of degrees of a circle at each stroke of the crank. A nut *l*, tapped to fit the threaded end of the shouldered pin or bolt *h*, serves to clamp or bind it at any point in the length of the slot *g*, said pin or bolt being loose in the pitman head, so that the pitman may freely swing or turn about said pin though the latter be clamped rigidly to the lever *e*.

In the chamber or compartment D of the jig is arranged a plunger M, preferably of rectangular form, and provided at its edges with outwardly flaring, flexible strips *m*, which, upon the sudden descent of the plunger, are pressed outward by the water, and caused to make close contact with the walls of the compartment, or with a wearing plate *n* with which said compartment is provided, and which is preferably made of enameled metal. During the upstroke, the flexible strips *m*, which normally stand slightly away from the wearing plate *n*, tend to swing or bend inward, owing to the weight and travel of the water above them, and owing to the clearance thus afforded, little or no tendency to produce suction is occasioned. The water in chamber B hence remains practically still during the upstroke of the plunger, but is suddenly forced downward before the descending plunger, and caused to pass beneath the partition C into chamber or compartment E, and upward through the screen or sieve F and the mass of material lying thereon. The effect of this action is, as is well known, to lift up and separate one from another the pieces or particles of coal, slate, bone, etc., or other mineral substances lying on the screen, and these, on the upward or return stroke of the plunger, settle back toward the sieve or screen. In thus settling through the water, which is momentarily at rest, the particles arrange themselves according to their dimensions and their specific gravities, the heavier particles gradually descending to the surface of the screen, and the progressively lighter particles arranging themselves in strata above this first layer. In the case of coal, the slate gradually reaches the lower level and forms the lowermost stratum; the bone lies next above the slate; and the fine impurities of greater specific gravities descend through the meshes of the screen, and are caught in the hutch below.

As the present invention is not concerned therewith, it is unnecessary to describe the double construction of the apparatus whereby a second separation is effected within the same structure, though that is done in practice in those cases in which, by reason of the presence of considerable bone as well as slate, such second separation is found advantageous.

The depth of the slate stratum on the screen F is determined by the rate at which the impurities reach the sieve, and by the rate of discharge or delivery through the action of the discharge roll or valve H, and this in turn is controlled by the automatic clutch mechanism, which will now be described.

N indicates a shell or casing, which is advisably provided with a bracket or supporting arm *o*, designed to be hung or supported upon a wall or portion of the framework

of the structure A, as shown in Figs. 1 and 2, or in any other convenient manner, so that it may be bodily removed or replaced quickly and without inconvenience. Moving in suitable guideways in the bottom and cover of said shell or casing N is a vertical spindle *p*, the upper portion at least of which is preferably made tubular in form to serve as a receptacle for shot or other weighting material, whereby to determine the buoyancy of the float as a whole. The lower extremity of the spindle *p* is provided with a hub or boss from which a series of arms or rods *q* extend first radially and then downward, each carrying at its lower extremity a float *r*, preferably of the form better indicated in Figs. 4, 5 and 6. In the last mentioned figure it will be noted that the lower end of the rod *q* is threaded, and that between two nuts thereon is placed the float *r*, comprising a cup-shaped bottom portion and an arching top or cover, with an intermediate filling of cork or other light and relatively non-absorbent material. The float is clamped between two nuts *s* and *s'*, which serve to retain the cover upon the cup, and to retain both upon the rod. This construction, however, is suggestive rather than essential, the material points being that the float shall be sufficiently light or buoyant, yet strong enough to withstand the action of the rough material in which it is used. By properly proportioning the floats, and weighting the spindle according to the character of the material under treatment, the float may be caused to find its level at the top of any stratum in the mass of material lying on the screen F. This will preferably be at or about the line of meeting of the heavier or lowermost stratum with the one next above it, or in the case of coal, at the line where the top of the slate layer and the bottom of the coal layer meet, which would be in the bone zone. If, now, through the operation of the machine the lowermost or slate layer build up higher, the floats *r* and their rod *p* will be lifted proportionately higher. If on the other hand, through the action of the delivery roll or valve, the slate be discharged more rapidly than it accumulates, its level will be lowered, and the floats and their spindle will descend accordingly.

Pivotally supported within the shell or casing N is a lever *t*, one end of which is slotted to receive a pin carried by the spindle *p*, so that as the floats and their spindle rise and fall, the lever will be raised and lowered at its free end, and insulated metallic circuit-making bar *u*, carried by an upstanding arm *v* of the lever, will be caused to bridge and connect one or another pair of electric contacts *w*, *w* or *x*, *x*. The bridging of the contacts *x*, *x*, completes a circuit through which the circuit of a magnetic clutch is completed, and the clutch is caused to lock to its shaft O a normally loose sprocket wheel P, which receives motion through a sprocket chain from a continuously rotating shaft Q, provided with a sprocket pinion. The shaft O carries the crank disk *k* hereinbefore referred to, which, through the interposed pitman *i*, lever *e*, and pawls *f*, gives rotary motion to the discharge roll or valve H.

Referring now to Fig. 4, the circuits will be traced, and the operation of bringing into and throwing out of action the discharge roll or valve, will be explained. R indicates a dynamo, or electric generator of any suitable character, from which current is taken by a suitable brush or contact 1 and line or conductor 2, to a brush or spring finger 3, making contact with a ring 4 mounted upon, but insulated from, the shaft O. From the ring 4 current passes by an insulated conductor 5 to the magnet coils of a magnetic clutch S, thence by a conductor 6 to a second insulated ring 6', thence by a spring finger or brush 7 and conductor 8 to one member of a circuit closer 9, and, when said members are in contact, by the second member and a conductor 10, 11, back to the second brush 12 of the generator R.

From the conductor 2 a branch 13, including variable resistance T, leads to one contact *x*, and by a derivation or branch wire 14, to one of the contacts *w*. From the second contact *x* a return wire 15 passes to the coils of an electro-magnet 16, and thence by a continuation of said wire 15, joining the return wire 11, passes by brush 12 back to the generator R. From this it follows that when the floats *r* rise sufficiently to cause the contact bar *u* to bridge the contacts *x*, magnet 16 will be energized, and will attract its armature 17, thereby moving longitudinally a rod 18 which carries one member of the circuit closer 9, thus effecting a closure or completion of the circuit through the contact of the two members of the circuit closer 9, and bringing into action the magnetic clutch S, and consequently the discharge roll or valve H. Should, now, the floats and their spindle descend and break the circuit of magnet 16, this would not, in itself, open or break the circuit of the magnetic clutch, because there would be nothing to move rod 18 longitudinally, or to separate the armature 17 from the poles of the magnet 16. In fact there would, on the contrary, be, for a considerable time at least, sufficient residual magnetism to tend to retain these parts in contact, even though the circuit were interrupted at the contacts *x*, *x*. When, however, the lower stratum of material on the screen F lessens in thickness sufficiently to cause a lowering of the floats *r*, until the insulated contact bar *u* bridges the contacts *w*, *w*, current will pass by brush 1, conductors 2 and 13, branch 14, contacts *w*, and insulated bridging bar

u to a wire or conductor 19, and by said conductor to the coils of an electro-magnet 20, and thence by the wire 21, connecting with the return wire 15, back by conductors 11 and brush 12 to the generator. In this condition of contacts and circuits, the magnet 20 will be energized, and attracting its armature 21, secured, like the armature 17, upon the rod or bar 18, will move said bar longitudinally in a direction to separate the members of the circuit closer 9. Hence the supply of current to the magnetic clutch S will be cut off, and wheel P will be free from shaft O and thus will cease to turn. Discharge roll or valve H will likewise cease to rotate, and the discharge of slate, or other heavy material constituting the lower stratum on the screen F, will for the time being, cease, and the lowermost stratum will again build up until it reaches the predetermined maximum. These reversals will occur in exact accordance with the building up or depletion of the bed, or its lowermost layer, and thus the necessary or desirable thickness of underlying bed will be maintained practically constant, while all liability of the slate passing over, or the coal passing under, the discharge chute is precluded.

In Fig. 5 I have shown an alternative construction of the electric mechanism, wherein the spindle *p* is represented as provided with radial arms carrying insulated spherical contact members *y*, which bridge the space between two upper concentric rings *x'*, *x'*, or two similar lower concentric rings *w'*, *w'*, thereby completing the circuits of one or the other of the electro-magnets 16—20. In all other respects the mechanism and its operation will, or may, remain unchanged.

By means of the variable resistance or rheostat T, the current sent to the magnets 16 and 20 may be reduced to whatever extent desired, it being only necessary that said magnets should possess strength sufficient to move the bar 18 longitudinally, and carry the members of the circuit closer 9 into or out of contact. The magnetic clutch S, however, requires much stronger current, since the requisite power for moving the clutch members into, and maintaining them in locking relation, is furnished by the magnets. For this reason the clutch circuit is carried around or clear of the rheostat, under the arrangement shown, though this is not essential, and it may in some cases be deemed advantageous to provide a rheostat in its circuit as well.

It is obvious that the details of the apparatus generally may be varied considerably without departing from the spirit of the invention, as, for instance, in the form of delivery or discharge valve, the running of the electric circuits, and other minor matters. The invention consists, broadly, in governing or controlling the discharge of material from the screen F, in accordance with the rate of increase or decrease in the thickness of the lower stratum or layer of material thereon, and this idea may be carried out in a variety of ways falling within the general principles of my invention, and the disclosures thereof here made.

A manually controllable clutch may be provided, as shown in Fig. 7, to connect the sprocket P to shaft O, in the event that the current is cut off or the magnetic clutch fails for any reason.

Having thus described my invention, what I claim is:

1. In an apparatus for grading or separating mineral substances and the like, the combination of a sieve or screen; means for producing upward pulsations of water through said screen; a discharge device at the tail of said screen; driving gear for imparting motion to said discharge device; a clutch included in said driving gear; and a float adapted to rest within the material on the sieve or screen, and by its rise and fall therein, to bring about actuation of the clutch, and thus to put the drving gear into, or to throw it out of, operation.

2. In a jig, the combination of a water chamber comprising two communicating compartments; a sieve or screen extending across one of said compartments; a plunger in the other of said compartments; means for reciprocating said plunger; a discharge device at the tail of the screen; driving gear for imparting motion to said discharge device; a clutch included in said driving gear; and a float adapted to rest in the material lying upon the screen, and by its rise and fall therein, to actuate said clutch, and cause the same to throw the gear into or out of action.

3. In a jig, the combination of a chamber having communicating compartments, one provided with a plunger and the other with a screen; a bucket valve located at the tail of the screen, and provided with a ratchet wheel; a shaft provided with a crank; a lever provided with a pawl adapted to engage the teeth of the ratchet wheel; a connection between said lever and said crank; a band wheel normally loose upon said shaft; a clutch adapted to lock said wheel to the shaft; a float arranged to stand in the material on the screen; and a connection between said float and said clutch, whereby the latter is caused to lock the wheel to, or unlock it from the shaft, in accordance with the rise or fall of the float.

4. In combination with the screen of a jig, a delivery device at the tail of said screen; a continuously driven shaft; gearing interposed between said shaft and the delivery device, including a normally loose wheel, and a clutch for connecting said wheel to

and disconnecting it from its shaft; and a float adapted to rest in the material lying upon the jig screen, and by its rise and fall to bring about the actuation of the clutch, and the consequent locking and unlocking of the loose wheel.

5. In a jig, the combination of a sieve or screen; a delivery valve at the tail of said screen; driving gear for imparting motion to said valve, including a normally loose wheel for actuating said valve, a magnetic clutch adapted, when energized, to lock said loose wheel to its shaft; a float adapted to rest in the material lying upon the screen; and a circuit closing device connected with and adapted to be actuated by said float, whereby the circuit of the magnetic clutch is closed or opened in accordance with the rise and fall of the float.

6. In an apparatus for grading or separating mineral substances and the like, the combination of a sieve or screen; a discharge device at the tail of the screen, adapted when actuated to remove material from the tail thereof, but when at rest to prevent the escape of material therefrom; a float adapted to rest within the material on the sieve or screen; a power shaft provided with a loose wheel; connections between said wheel and the discharge device; and a clutch connected with and adapted to be brought into action by the float, and serving to connect and disconnect the loose wheel with and from the driving shaft.

7. In an apparatus for sorting and grading mineral substances and the like, the combination of a sieve or screen; a discharge device at the tail thereof serving when at rest to prevent escape of material, but when actuated, to deliver material from the sieve or screen; a float adapted to rest within the material on the sieve or screen; driving gear for said discharge device including means for connecting and disconnecting the discharge device with the prime mover; and connections between the float and the connecting and disconnecting device, whereby the latter is controlled in accordance with the varying movements of the float.

8. In combination with the sieve or screen of a separating apparatus, a discharge device at the tail of said sieve adapted normally to prevent escape of material therefrom, but when actuated, to effect such discharge; driving gear for actuating said discharge device; a magnetic clutch included in said driving gear, and serving to establish driving relation therewith or to interrupt such relation; a float normally resting within the material on the sieve or screen; and a circuit closer connected with and controlled by said float, and serving to make and break circuits, whereby the magnetic clutch is energized and deënergized, according to the positions of the float.

9. In combination with a separating apparatus of the character described, comprising a sieve or screen, and a discharge device at the tail thereof; driving gear for said discharge device including a shaft, a wheel loose on said shaft, and a magnetic clutch adapted to clutch and unclutch said wheel to and from said shaft; an electric generator; conductors serving to convey current from one terminal of the generator to the magnet of the clutch, and back to the other terminal of the generator; a circuit closer included in the clutch circuit; electro-magnets for actuating said circuit closer; branch conductors connecting the terminals of the generator with each of said magnets independently; a float adapted to rest normally in the material lying upon the sieve or screen; and a circuit closer connected with and operable by said float, and serving when the float reaches a predetermined elevation, to complete the circuit of one of the circuit closer controlling magnets, and when the float falls to a predetermined depth or level, to close the circuit of the other of the circuit closer controlling magnets, substantially as described.

10. In combination with a separating apparatus of the character described, having a mechanical discharge device; a driving shaft for actuating said device; a magnetic clutch interposed between the driving shaft and said discharge device; an electric generator; conductors for supplying current from said generator to the magnets of the clutch; a circuit closer included in the clutch magnet circuit; electro-magnets for opening and closing said circuit closer; branch circuits connecting the generator with said circuit closer controlling magnets; a variable resistance included in the circuits of said controller magnets; a float adapted to rest within the material upon the separating screen or sieve; and a circuit closer actuated by said float, and serving to complete one or the other of the controller magnet circuits when the float reaches a predetermined high or low level, whereby the clutch is caused to connect the discharge device with the power shaft whenever the float reaches the high level, and is caused to disconnect said parts when the low level is reached, without disturbing such connection during the time that the float remains above the predetermined low level.

11. In combination with separating apparatus of the character described, having a mechanical discharge device, and a driving shaft; a clutch for connecting and disconnecting the discharge device and the driving shaft; and a float for controlling said clutch, comprising an upright guiding stem, and a hollow receptacle filled with light and comparatively non-absorbent material.

12. In combination with separating appa-

ratus of the character described, having a mechanical discharge device, and a driving shaft therefor; a clutch interposed between the discharge device and the driving shaft; and a float for controlling said clutch, said float comprising a hollow stem and a buoyant vessel or body, the stem serving to receive material for weighting the float according to the requirements of the material under treatment.

13. In apparatus for grading or separating mineral substances and the like, the combination of a sieve or screen; means for producing upward pulsations of water through said screen; a discharge device at the tail of said screen; electrically-controlled means for actuating said discharge device; a float adapted to rest within the material on the sieve or screen and to rise and fall with increase and decrease in depth of a lower stratum thereof; and means actuated by said float to cause the electrically-controlled discharge device to effect or to prevent discharge of material, according to the depth of said stratum.

14. In apparatus for grading or separating substances of differing specific gravity, the combination of a sieve or screen; means for producing upward pulsations of water therethrough; a discharge device at the delivery point of said screen; means for moving said discharge device; and a float adapted to rest within the material under treatment and to rise or fall as a lower stratum of said material rises or falls, and by its movements to bring into or throw out of action the discharge-actuating mechanism.

15. In apparatus for separating and grading substances of differing specific gravity, the combination of a separating bed or support provided with an outlet, and with an overflow above said outlet; a device for normally preventing escape of material through said outlet; means for actuating said device; and a float adapted to rest within the material under treatment, to be raised and lowered thereby, and by its rise and fall to bring into and throw out of action the said actuating means.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

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