

(No Model.)

2 Sheets—Sheet 1.

R. E. & E. WAUGH & C. S. OLDER.
DRY ORE CONCENTRATOR AND SEPARATOR.

No. 570,831.

Patented Nov. 3, 1896.

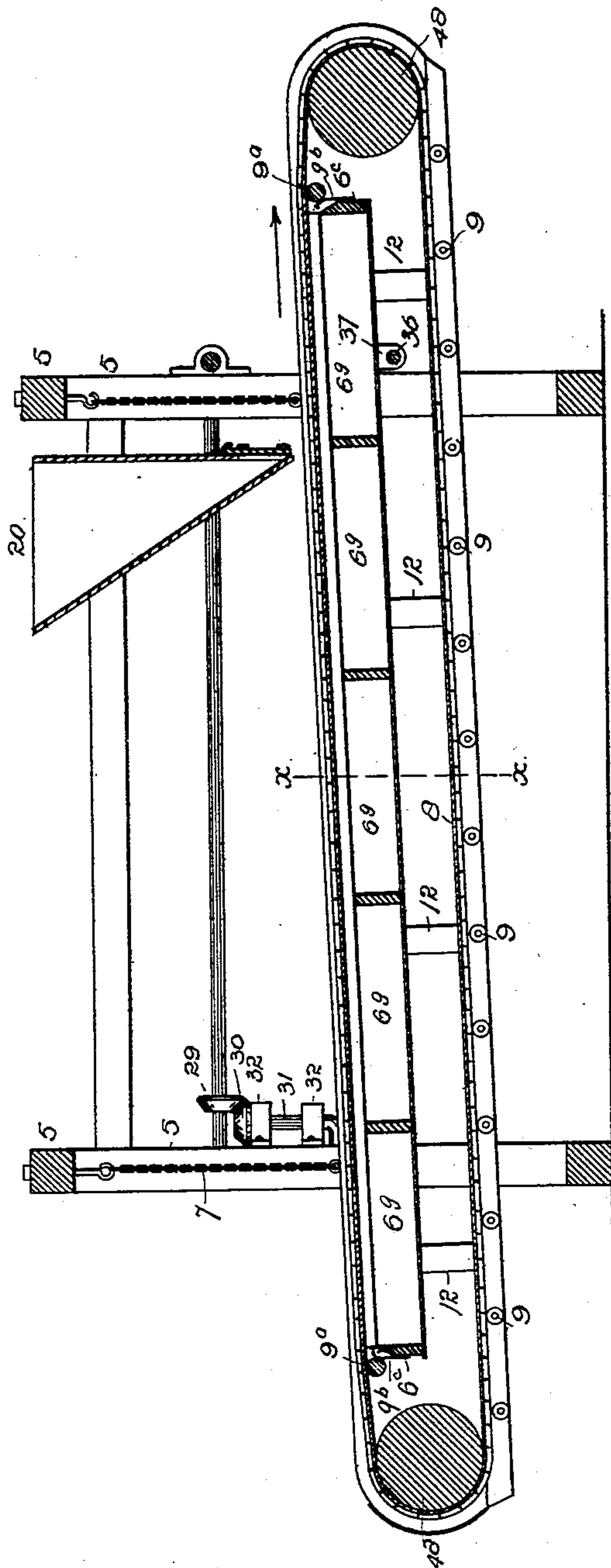


FIG. 1.

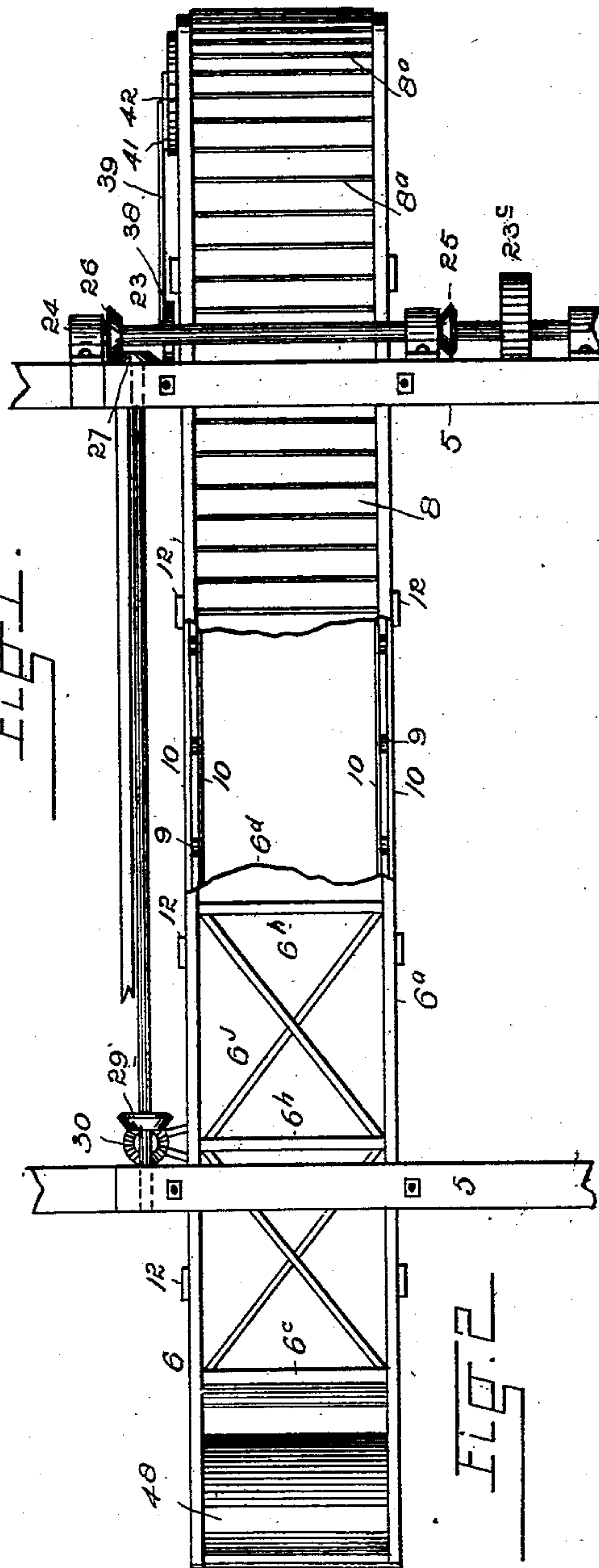


FIG. 2.

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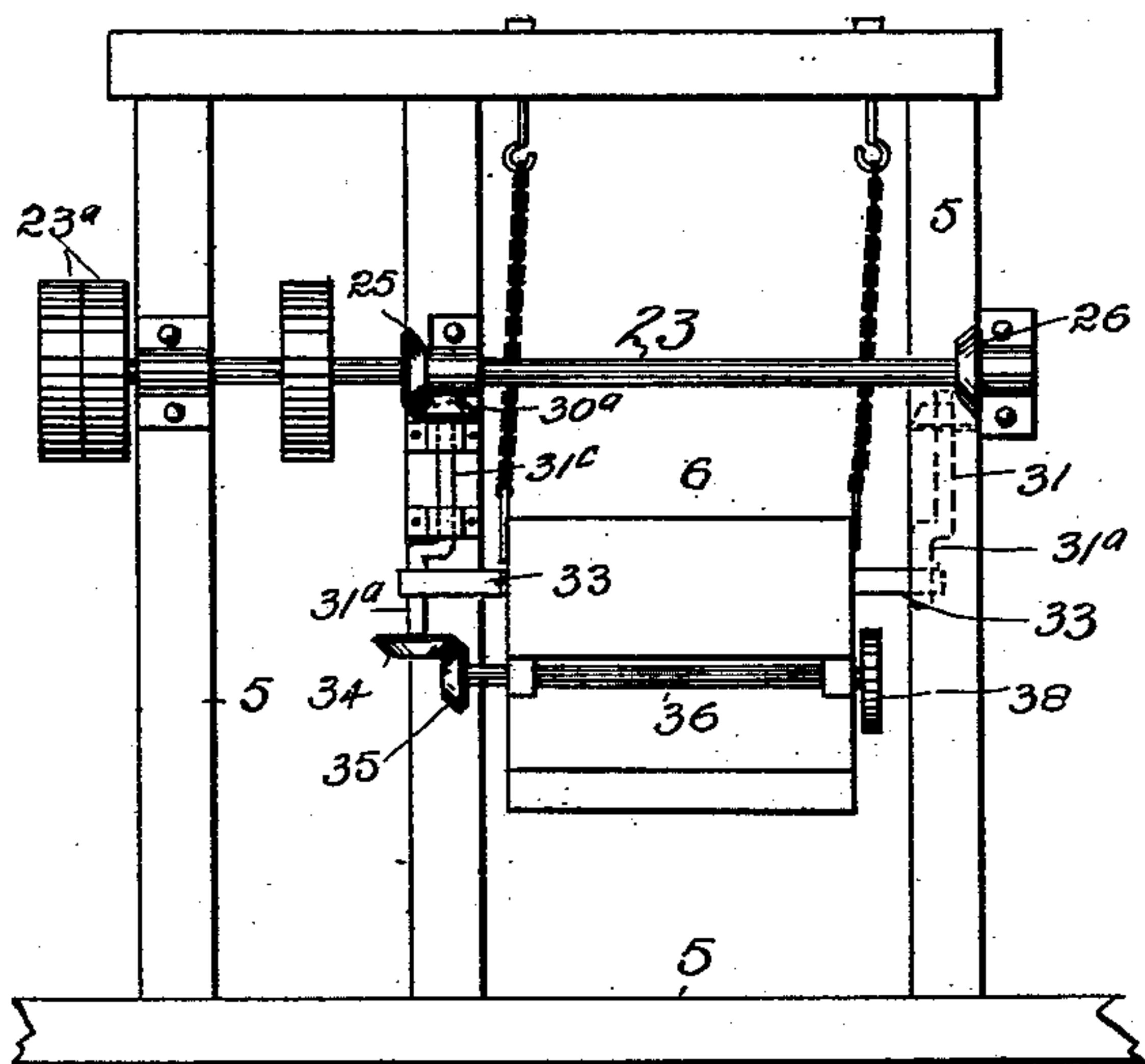
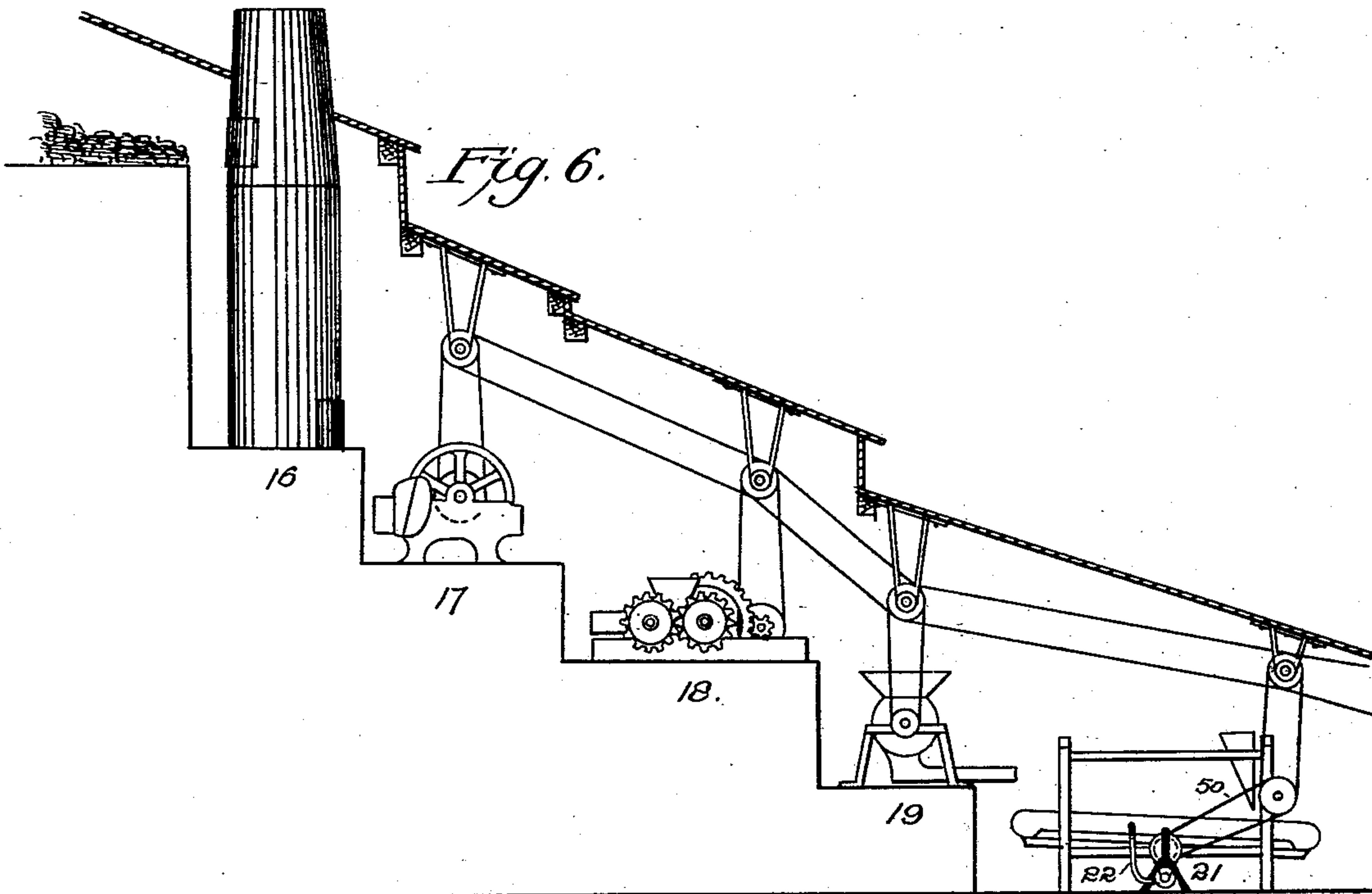
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WITNESSES:

Fig. 3.

Chas. E. Dawson

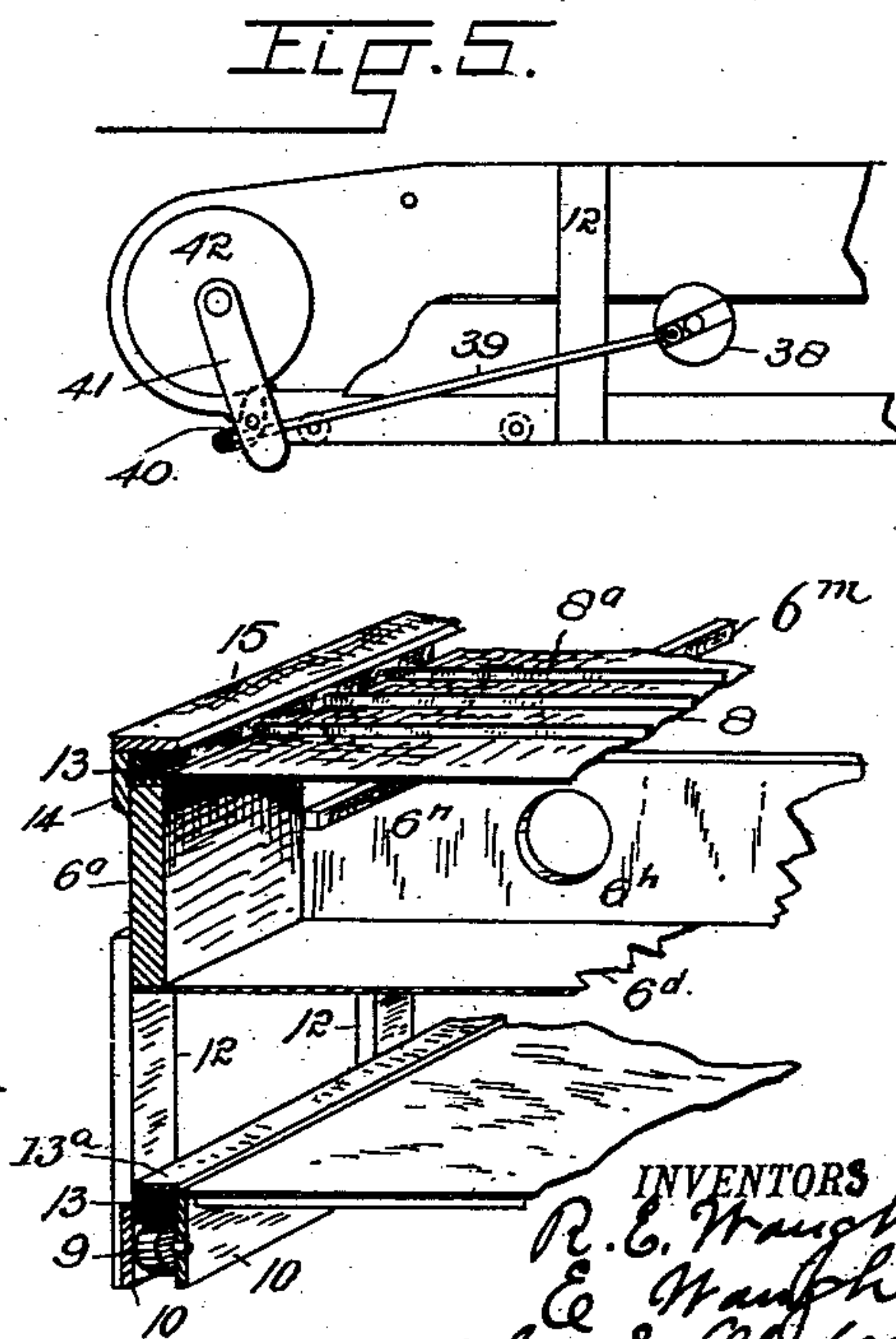


Fig. 4.

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UNITED STATES PATENT OFFICE.

ROBERT E. WAUGH, EUGENE WAUGH, AND CHARLES S. OLDER, OF COLORADO SPRINGS, COLORADO, ASSIGNORS OF NINE-TWENTY-ETHS TO JESSE S. WAUGH AND WILLIAM E. HITCHCOCK, OF OMAHA, AND MERRIWEATHER J. WAUGH AND FREEMONT A. WARREN, OF LINCOLN, NEBRASKA, AND N. C. ROBBINS, OF ST. LOUIS, MISSOURI.

DRY ORE CONCENTRATOR AND SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 570,831, dated November 3, 1896.

Application filed December 1, 1894. Renewed May 1, 1896. Serial No. 589,913. (No model.)

To all whom it may concern:

Be it known that we, ROBERT E. WAUGH, EUGENE WAUGH, and CHARLES S. OLDER, citizens of the United States of America, residing at Colorado Springs, in the county of El Paso and State of Colorado, have invented certain new and useful Improvements in Dry Ore Concentrators and Separators; and we 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, reference being had to the accompanying drawings, and to the figures of reference marked thereon, which form a part of this specification.

Our invention relates to improvements in a dry ore concentrator and separator; and it consists of the features, arrangements, and combinations hereinafter described and claimed, all of which will be fully understood by reference to the accompanying drawings, in which is illustrated an embodiment thereof.

In the drawings, Figure 1 is a vertical longitudinal section taken through the center of the machine. Fig. 2 is a top or plan view of the same, partly broken away. Fig. 3 is an end elevation of the machine. Fig. 4 is a fragmentary sectional view in perspective, the section being taken on the line *xx*, Fig. 1, and the parts shown on a larger scale. Fig. 5 is a fragmentary side elevation of the machine, illustrating the means for propelling the endless apron. Fig. 6 illustrates the machine, on a smaller scale, shown in connection with a series of well-known mechanisms for drying and otherwise preparing the ore for treatment in the machine.

Similar reference-characters indicate corresponding parts or elements in the views.

Let the numeral 5 designate a stationary framework on which is suspended or hung a box 6 by means of chains 7. These chains are attached to the upper part of the frame at one extremity and to the box at the oppo-

site extremity. As shown in the drawings, the chain extremities are made fast to eye-bolts made fast in the respective parts.

The extremities of the side boards 6^a of the box are carried beyond the ends 6^c of the box proper and form supports for the drums 48, whose extremities are journaled therein. The sides 6^a, together with the ends 6^c and the bottom 6^d, of the box inclose an air-chamber 6^e, which is closed at the top by the endless apron 8, to which is attached transverse strips 8^a, forming riffles. This apron is composed of canton-flannel or some other suitable fibrous material capable of allowing air to pass therethrough to a limited extent when subjected to suitable pressure. This material is especially preferred because it has a long nap which lies flat upon the warp and weft threads and forms a trap or check-valve to the air-blast from below, the nap rising and falling flat, as will be readily understood.

The apron 8 engages the large end rolls or drums 48 at the extremities of the box and the small rollers 9, located between the end rolls. The box is braced and strengthened by the transverse partitions 6^b, located within the air-chamber. The box is further strengthened by the diagonal strips 6^j, whose extremities are secured to the transverse partitions. These partitions are apertured, (see Fig. 4,) whereby the air-chamber 6^e becomes continuous. Moreover, the tops or upper edges of these partitions are not engaged by the apron, since the latter rests upon longitudinal strips 6^m, secured to the upper edges of the partitions. Hence the air has a free circulation in the chamber above the partitions.

The rollers 9, which support the apron below the air-chamber, are journaled between longitudinal strips 10, which are attached to the box by hangers 12. The apron is further supported by two small rolls 9^a, having their extremities journaled in the sides 6^a of the box, one of these rolls being located at each end of the air-chamber and engaged by springs

9^b, attached to the ends of the box. (See Fig. 1.) In order that the apron may tightly close the top of the box and prevent the escape of air except through the meshes of the apron, the edges of the latter are provided with strips of rubber 13 13^a, and these edges engage grooves formed in the sides of the box above the air-chamber. As shown in the drawings, (see Fig. 4,) these grooves are formed by the upper edges of the box, an outer strip 14, and a cap 15. Each groove is of sufficient depth to receive the edge of the apron to which the rubber packing is applied.

The material to be treated is first dried in a kiln 16 and subsequently fed successively to the rock-breaker 17, a pair of Cornish rolls 18, and a disintegrator 19, whereby it is pulverized, comminuted, and triturated to the desired degree of fineness. This finely ground or powdered material is then fed to a hopper 20, from which it passes to the upper surface of the apron 8.

The necessary air for treating the material is supplied by a blower 21, connected with the air-chamber by a flexible conduit or hose-pipe 22. The air in this chamber may be compressed to any extent desired or which may be found necessary in the treatment of the material. The air under suitable pressure is forced through the meshes of the apron and passes up through the material thereon, whereby the particles of value, which are the heavier, are allowed to settle, while the gangue or lighter particles are carried to the top. Besides this agitation, to which the material is subjected through the instrumentality of the air forced through the meshes of the apron, the box 6 is given a gyratory movement through the agency of mechanism which will now be described. A horizontal transverse shaft 23 is journaled in boxes 24, secured to the stationary framework. To this shaft are made fast bevel-gears 25 and 26. The gear 26 engages a similar gear 27, made fast on a longitudinal horizontal shaft 28, also journaled in the stationary framework. This shaft 28 carries another gear 29, which meshes with a similar gear 30, made fast on a vertical shaft 31, on which is formed a crank 31^a. This shaft 31 is journaled in the frame by means of boxes 32, and the crank engages a metal strap or bracket 33, made fast to one side of the box 6. It will thus be seen that as the shaft 31 rotates a gyratory movement will be imparted to the suspended box and its attachments.

On the opposite side of the machine and operated directly from the shaft 23 is located another crank-shaft 31^c, connected with the box by a bracket or metal strap 33. In this case the gear 25 on the shaft 23 meshes with the gear 30^a on the crank-shaft. The lower extremity of the crank-shaft 31^a carries a gear 34, which meshes with another gear 35, made fast to the extremity of a horizontal shaft 36, journaled in hangers 37, made fast to the bottom of the box 6.

In further explanation of the gyratory

movement imparted to the box it may be said that in order to connect the crank with the metal strap on the box the latter is swayed to one side of its normal position when in a state of rest. The crank and metal strap are then coupled. Now when the machine is in operation every point on the box is traveling in a circle whose radius is equal to the length of the crank-arm. Hence the box after being connected with the crank can never while so connected assume its original position, since the suspension-chains cannot assume a vertical position. These chains while the box is in motion describe cones whose apices are the points where the upper extremities of the chains are attached to the stationary frame.

To the opposite extremity of the shaft 36 is made fast a disk 38, carrying an adjustable wrist-pin located to one side of the center of the disk. One extremity of a pitman 39 is connected with the wrist-pin of this eccentric disk, while the opposite extremity of this pitman is connected with one extremity of a cam 40, pivoted in a stirrup 41, loosely mounted on the journal of one of the end drums 48, and straddling a wheel 42, made fast on said journal. One end of the cam 40 engages the periphery of this wheel 42, as the pitman moves in one direction, and imparts to the wheel and roller a partial rotation, while as the pitman moves in the opposite direction the wheel is released. The apron 8 is thus actuated by reason of a series of partial rotations imparted to the end drums 48 at regular intervals.

Power is applied to the machine by connecting the shaft 23 with any suitable prime motor. This may be done by connecting the pulley on the motor with a pulley 23^a on the shaft by means of a suitable belt. Another pulley 23^c of this shaft may then be connected by a belt 50 with the blower 21, whereby the latter also may be operated from the main shaft of the machine. Hence, power being applied to the shaft 23, the gyratory movement is imparted to the swinging box 6 and its connections through the instrumentality of the mechanical parts or elements heretofore described. At the same time the endless apron is actuated through the agency of the shaft 36, the eccentric disk 38, the pitman 39, the friction-cam 40, the stirrup 41, the drum 48, and the wheel 42.

The separation of the particles of value from the gangue is effected through the combined influence of the action of the air on the under surface and through the meshes of the moving apron and the gyratory movement of the box 6.

As shown in the drawings, the material to be treated is fed some distance from the end drum, toward which the apron moves from the point of feed. Hence the material is allowed for separation the time consumed by the apron in traveling a distance equal to the distance from the point of feed to the end of

the machine, whence the concentrates fall from the apron by gravity into any suitable receptacle.

It must be understood that ore in its natural state is never sufficiently dry to be treated successfully by a dry concentrator. Hence the necessity for the drying-kiln as an agency in the preparation of the ore for treatment by our improved machine.

10 An important advantage results from the simultaneous application of the air-blast and the gyratory oscillations, as thereby the material as it is mechanically agitated by the oscillatory motion will be lightened and
15 opened up by the air-pressure.

Having thus described our invention, what we claim is—

1. In an ore concentrator and separator the combination of the endless apron, the end
20 drums or rollers therefor and the frame supporting said rollers and apron, the main frame, a shaft journaled thereto and having a crank connected with the apron-frame, a gear on said crank, a gear on the apron-frame and
25 meshing the gear on the crank and connections between the gear on the apron-frame and the apron drums or rollers whereby to drive the apron substantially as set forth.

2. In an ore-concentrator the combination
30 of a main frame, a box-frame supported in said frame, and having an air-chamber, and an apron extended over said air-chamber and adapted to permit the passage of air through it mechanism for moving said apron, a mech-
35 anism by which to produce air-pressure within the air-chamber and means by which the box is given a circular movement substantially as described whereby the material as it is agitated by the mechanical movement will
40 be lightened and opened up by the air-pressure all substantially as and for the purposes set forth.

3. In a dry ore separator and concentrator an apron through which air may freely circulate means by which said apron may be
45 caused to travel a support for said apron capable of a limited circular movement, mechanism by which to give such apron-support a horizontal circular motion and means by
50 which to produce an air-blast through the apron substantially as set forth.

4. In a dry ore-separator the combination with the apron and its support having a limited oscillatory motion of the gear carried by said support and having operative connection
55 with the apron, the main frame, a shaft journaled to said main frame and having a crank-wrist, a gear on said wrist meshing with the gear on the apron-support and a connection between said support and the crank-wrist
60 substantially as set forth.

5. An apparatus substantially as described comprising suitable supporting devices an apron of fibrous material set at an incline and having its upper ore-supporting surface pro-
65 vided with a nap lying flat upon the surface of the fabric with its free ends toward the lower end of the apron and means by which to produce an air-blast through the apron whereby to form a trap or check-valve for the
70 air-blast from below substantially as set forth.

6. The combination of the main frame, the box suspended therein and provided with apron-supporting drums and with an air-chamber, a transverse shaft journaled to said
75 box and having at one end a gear-wheel and at its other end a crank, connections between said crank and one of the apron-supporting drums a shaft journaled to the main frame and having a crank-wrist, connected with the
80 suspended box, and a gear on said crank-wrist and meshing with the gear on the transverse shaft of the suspended box all substantially as set forth.

7. In a dry ore-concentrator the combina-
85 tion of a suitable support or frame an apron on which to support the ore to be concentrated and having a normally flat lying nap and means by which to produce an air-blast through the apron substantially as described
90 and shown.

In testimony whereof we affix our signatures in the presence of two witnesses.

ROBERT E. WAUGH.
EUGENE WAUGH.
CHARLES S. OLDER.

Witnesses:

H. A. MILLS,
H. E. BASSETT.