

No. 736,309.

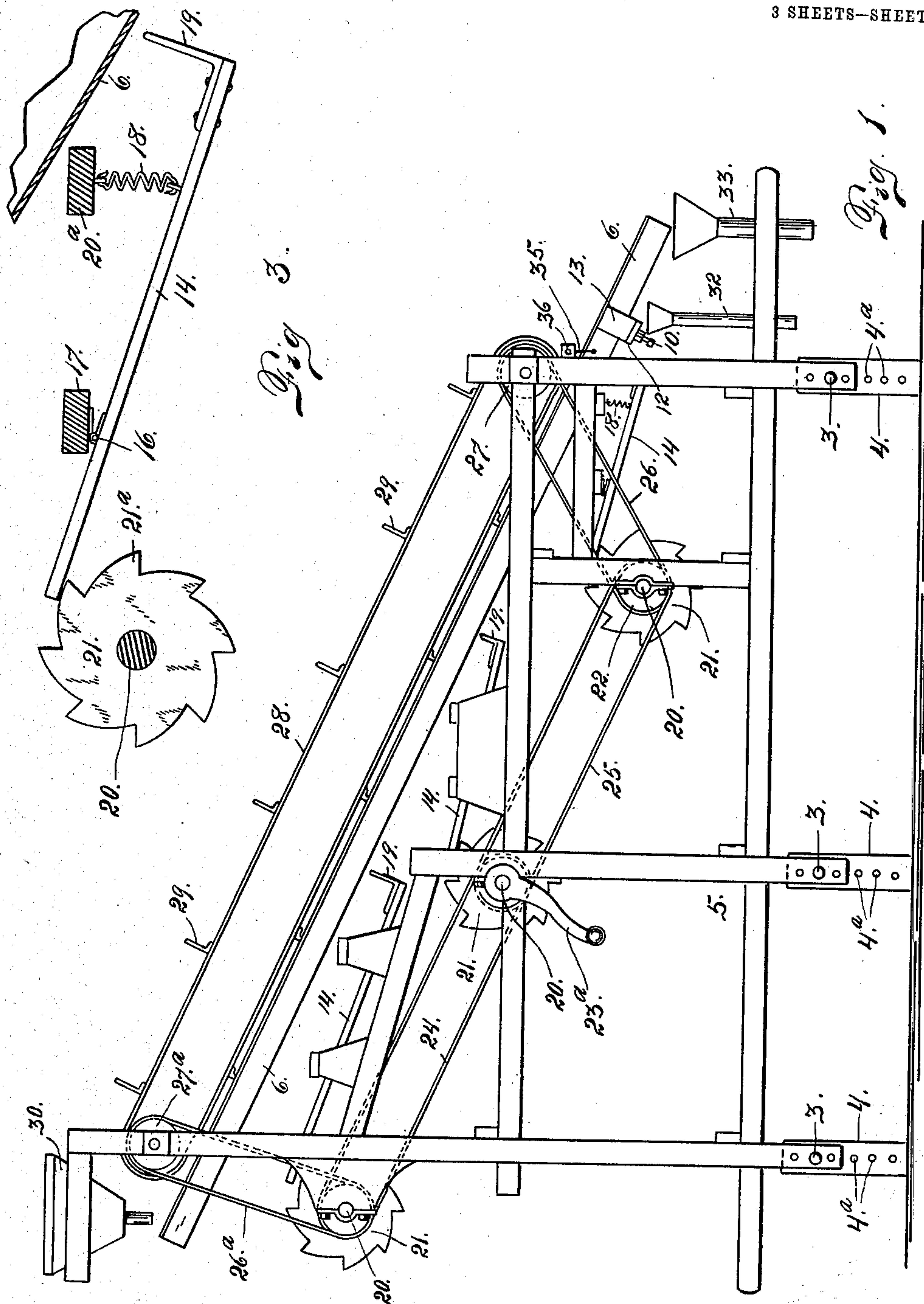
PATENTED AUG. 11, 1903.

I. SUTTON.  
CONCENTRATOR.

APPLICATION FILED NOV. 3, 1902.

NO MODEL.

3 SHEETS—SHEET 1.



Witnesses  
Otto E. Hoddick.  
Dena Nelson.

Inventor  
Isaac Sutton.  
By *[Signature]* Attorney

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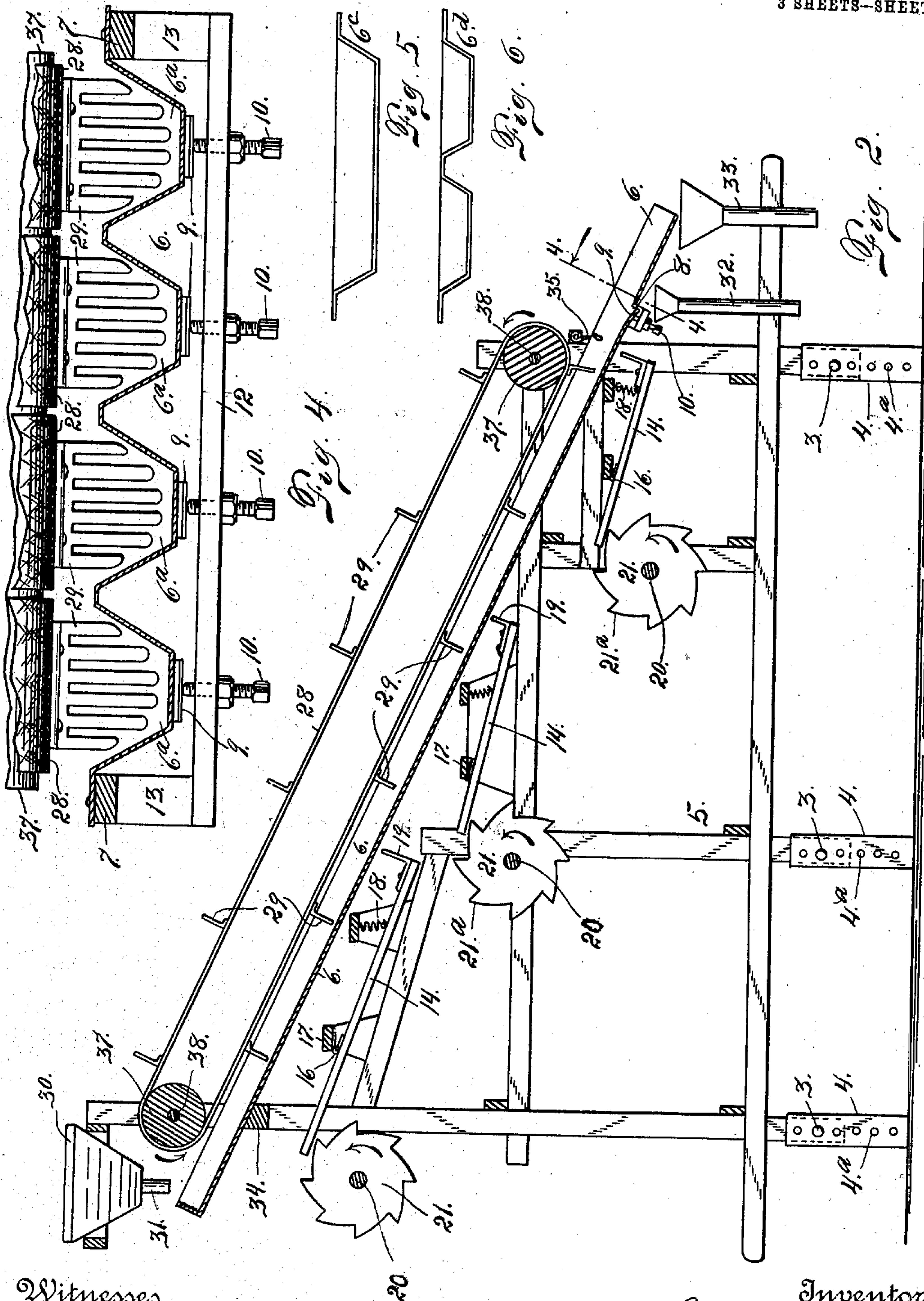
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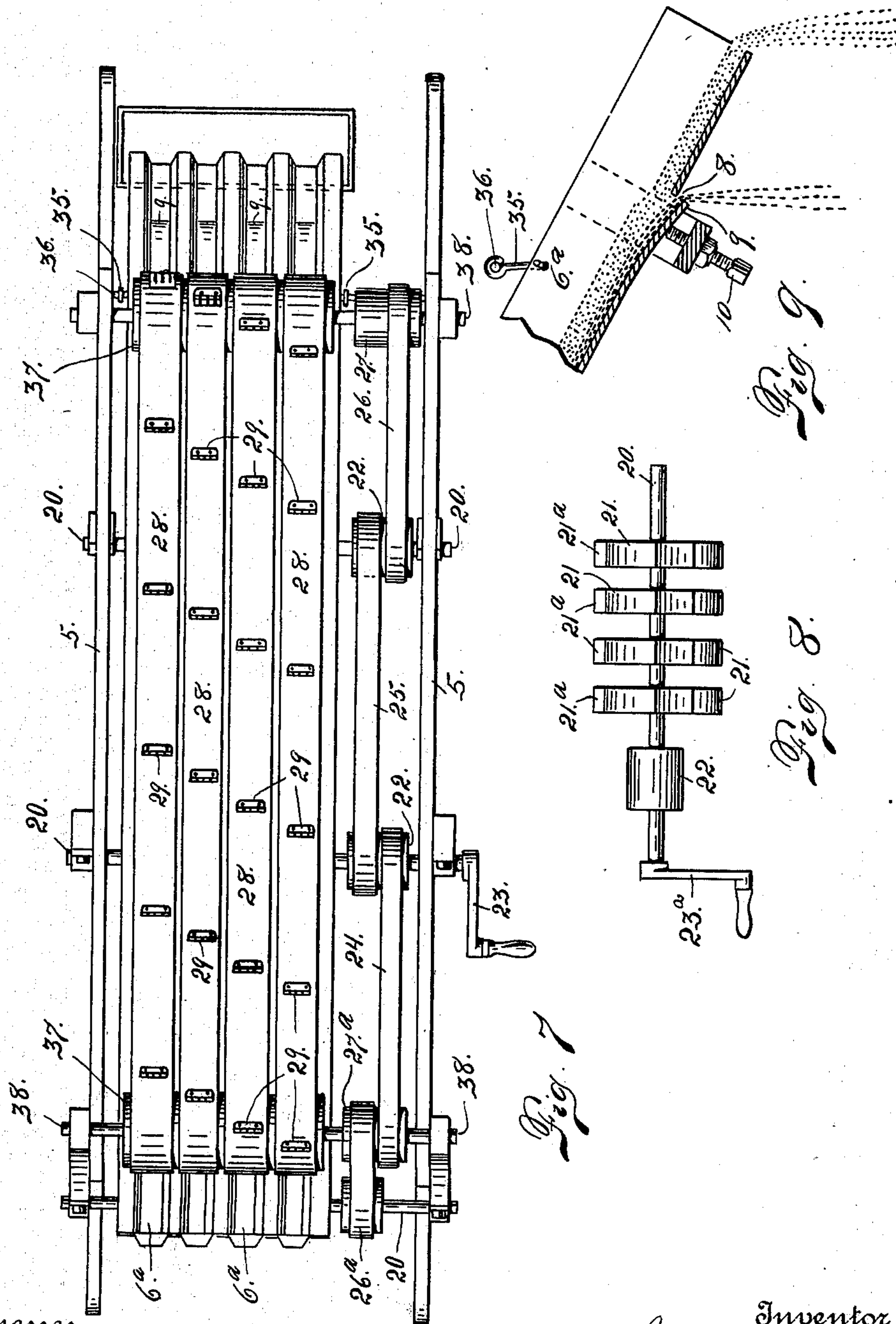
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# UNITED STATES PATENT OFFICE.

ISAAC SUTTON, OF DENVER, COLORADO.

## CONCENTRATOR.

SPECIFICATION forming part of Letters Patent No. 736,309, dated August 11, 1903.

Application filed November 3, 1902. Serial No. 129,979. (No model.)

*To all whom it may concern:*

Be it known that I, ISAAC SUTTON, a citizen of the United States of America, residing at Denver, in the county of Arapahoe and State of Colorado, have invented certain new and useful Improvements in Concentrators; 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; reference being had to the accompanying drawings, and to the figures of reference marked thereon, which form a part of this specification.

My invention relates to improvements in concentrating apparatus, my object being to produce a construction of this class which shall be adapted for use either with or without water, though the device is more especially intended as a dry machine, and its operation will be described in this specification with special reference to the last-named views; and to these ends the invention 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 side elevation of the apparatus. Fig. 2 is a side view, partly in section. Fig. 3 is an enlarged detail view illustrating the means for imparting the vibratory or jarring motion to the concentrating-pan. Fig. 4 is an enlarged cross-section taken through the pan on the line 4 4, Fig. 2. Figs. 5 and 6 are end elevations of modified forms of pan construction. Fig. 7 is a top or plan view of the machine. Fig. 8 is a detail view of one of the shafts, showing a set of cam-wheels for actuating the beaters. Fig. 9 is a fragmentary longitudinal section taken through the concentrating-pan, shown on a larger scale.

The same reference characters indicate the same parts in all the views.

Let the numeral 5 designate a suitable framework, which may be of any desired construction. This feature of the apparatus will not be described in detail, as it may be varied at will and as circumstances may require. The posts 5<sup>a</sup> of this frame telescope in hollow supports 4, each of which is provided with a

series of openings 4<sup>a</sup>. Each post is also provided with an opening. The framework is supported at any desired elevation by passing pins 3 through the opening in the supports and the registering opening of the post. By changing the position of this pin the elevation of the frame may be varied at will. Upon this framework is mounted in an inclined position a pan 6, which, as shown in the principal views of the drawings, consists of a number of compartments 6<sup>a</sup>, having inclined sides and best shown in Fig. 4. Each pan-compartment is provided near its lower extremity with a transverse opening 8, which, as shown in the drawings, is formed by cutting a transverse slit in the bottom and pressing the material of the pan outwardly, forming a lip 9. The pan is constructed, preferably, of sheet metal in order that when it is acted on by the beaters, as hereinafter described, the material therein may be subjected to a jarring or vibratory movement by virtue of the vibrating capacity of the metal. The bottom of this sheet-metal pan forms a sort of diaphragm, which under the influence of beating or striking devices vibrates very rapidly, and these vibrations are communicated to the material in the pan and cause the separation of the metallic values, which by virtue of their greater specific gravity settle to the bottom and pass out of the pan through the openings 8 near the lower extremities of the compartments. The width or depth of the opening 8 is regulated by set-bolts 10, which are threaded in the bar 12, extending transversely beneath the pan and connected with pieces 7 by upright parts 13. The pieces 7 are secured to the outer edges or horizontal flanges of the pans by means of suitable fastening devices.

Mounted on the frame underneath the pan are beating or striking devices 14, which may be of any suitable construction and actuated in any suitable manner whereby they are caused to strike the under surface of the bottom of the pan in rapid succession during the operation of the machine. As shown in the drawings, each beater consists of a bar hinged at 16 to a suitable support 17. One extremity of each bar is provided with a projection 19, normally extending upwardly and occupying a position in contact with or in suit-



able proximity to the under surface of the pan's bottom. A coil-spring 18 is connected at one extremity with the bar 14, between the hinge and the projection 19, while its opposite extremity is connected with a stationary part 20. The extremity of the bar 14 remote from the projection 19 and on the opposite side of the hinge from the spring is arranged to be engaged by a cam-wheel 21, mounted on a shaft 20. This wheel is provided with a series of cams or teeth 21<sup>a</sup>, arranged to act successively on the adjacent extremity of the bar 14, whereby its opposite extremity is drawn outwardly, placing the spring 18 under tension. As soon as the cam-engaging extremity of the bar is released the recoil of the spring acts to throw the projection 19 at its opposite extremity against the bottom of the pan. This operation is repeated in rapid succession while the machine is in use. There may be any desired number of spring-held cam-actuated beaters, depending on the length of the pan. As shown in the drawings, three sets of these beaters are employed for each compartment 6<sup>a</sup> of the pan, and there are three shafts 20, carrying the cam-wheels 21. Assuming that the pan is divided into four compartments 6<sup>a</sup>, as shown in Fig. 4, there are three transverse series of beaters, each series consisting of four beaters, which act on the pan in the same cross-sectional plane. The cams may be so arranged that no two of these beaters in the same series will strike the bottom of the pan at the same time. The cams may also be arranged so that no two of the beaters in the same longitudinal plane will strike the pan at the same time. Hence the pan is actuated by several transverse series of beaters, and the separation of the concentrates is effected not by a shaking action, but by the vibration imparted to the pan by the several series of striking devices, whose blows may be so arranged as to produce the best results in performing the concentrating function. As shown in the drawings, each of these shafts is provided with a pulley 22. The central shaft has a crank 23<sup>a</sup> for hand use; but it will be readily understood that any power may be employed for operating the machine. The central shaft is connected with the other two shafts by belts, which engage the pulleys of the shafts. Each pulley is of sufficient length to receive two belts. The pulley of the central shaft is engaged by belts 24 and 25, while the pulley of each of the other shafts is engaged by one of these belts and by another belt 26 or 26<sup>a</sup>, leading to a pulley 27 or 27<sup>a</sup> for operating a number of endless conveyers 28, provided with comb-shaped drags or projections 29. These conveyers are mounted on rotary drums 37, carried by shafts 38, suitably journaled in the frame. There is one of these conveyers for each compartment 6<sup>a</sup> of the concentrating-pan. They travel in the direction indicated by the arrows in Figs. 1 and 2. Their function is to retard or facilitate and there-

fore regulate the downward travel of the material in the pan according to its inclination. If the pitch or inclination is quite steep, these conveyers or carriers will have a retarding tendency on the material, whereby it is held in place long enough to permit a thorough separation of the concentrates from the gangue, thus allowing the concentrates to settle to the bottom and pass out of the opening therefor near the lower extremity of the pan. These conveyers also stir the material and in this manner facilitate concentration. In order to cause the concentrates to travel downwardly with sufficient speed, it is often found in practice necessary to tilt the pan to such an inclination that the upper stratum of material will travel too fast to permit clean concentration. In this event the travel of the carriers retards the travel of this stratum of the material, which is thereby retained long enough in the pan for the purpose stated. Attention is called to the fact that the travel of the concentrates is retarded by the pressure of the upper stratum of the material thereon, as well as by the friction incident to their travel along the bottom of the pan, while the upper stratum of material has a tendency to roll down more rapidly. The normal tendency would be for the outermost particles to travel fastest and the other particles slower as their distance below the surface increases; but by the aid of the conveyers or carriers the travel of the material is made uniform and regulated as desired.

The material to be treated is fed from a hopper 30 and is discharged into all of the compartments of the pan from outlets 31, there being a series of these outlets, one only being shown. As the material is discharged into the pan the cam-shafts and the conveyers are set in motion by virtue of the construction and arrangement of parts heretofore described. The cams acting on the bars 14 deliver blows upon the bottom of the pan in rapid succession, and the movement of the material downwardly in the pan is regulated by the conveyers 28, whose projections 29 also stir the pulverized ore or placer material and facilitate the separation of the mineral values from the gangue. The blows delivered by the bars 14 impart to the bottom of the pan vibrations, which are communicated to the material in the pan and under whose influence the mineral values are caused to settle to the bottom of the pan as the material travels downwardly therein. When near the lower extremity of the pan, these mineral values pass out of the pan through an opening 8 in each compartment into a discharge-spout 32, while the gangue passes out the lower extremity of the pan into a discharge-spout 33.

The bottom of the pan is supported near its upper extremity by a cross-bar 34 on the frame, while its lower extremity is supported by hooks 35, attached to the pan, one on each side, and connected above with a rod 36.



In the form of construction shown in Fig. 5 a pan (designated 6<sup>c</sup>) is shown with a single compartment, while in Fig. 6 a pan (designated 6<sup>d</sup>) is shown with two compartments.

5 Having thus described my invention, what I claim is—

1. The combination with a pan suitably mounted and having a shallow opening in the lower portion of its bottom, means for vibrating the bottom of the pan without moving the latter bodily, by delivering blows thereon in succession, the bottom of the pan forming a vibratory diaphragm, and a conveyer mounted above the pan for regulating the downward travel of the material thereon.

2. In a concentrator, the combination with a suitable frame, of a pan mounted thereon and occupying an inclined position, the said pan having a shallow opening in the lower portion of its bottom, beaters mounted below the pan whose bottom forms a vibratory diaphragm having no body movement, means for actuating the beaters whereby they are caused to deliver blows on the pan's bottom from below in regular succession, and a conveyer mounted above the pan and having projections adapted to engage the material in the pan to regulate its downward travel, substantially as described.

3. In a concentrator, the combination with a suitable frame, of a longitudinally-inclined pan mounted thereon and composed of sheet metal forming a vibratory diaphragm having no body movement, the pan having an opening near its lower extremity, spring-held bars hinged or pivoted below the pan, cam-wheels acting on the bars and cooperating with the action of the springs to cause the bars to deliver blows on the bottom of the pan, and a conveyer traveling downwardly in said pan to regulate the downward travel of the material therein.

4. In a concentrator, the combination with a suitable frame, of a longitudinally-inclined pan mounted thereon and having an opening near its lower extremity, means for vibrating the pan by delivering blows on the lower sur-

face of its bottom in rapid succession without moving the pan bodily, said means consisting of a number of transverse series of beaters, and a separate cam engaging each individual beater of each transverse series, and a conveyer mounted above the pan and comprising an endless belt having comb-shaped projections or drags adapted to regulate the downward travel of the material in the pan.

5. In a concentrator, the combination with a suitable frame, of a longitudinally-inclined vibratory pan mounted thereon and having an opening in its lower portion for the escape of the concentrates, a lip projecting below said opening, said lip being formed by cutting slits in the bottom of the pan and bending a part of the latter downwardly, and adjustable means adapted to engage each lip for regulating the size of the opening.

6. In a concentrator, the combination with a suitable frame, of a longitudinally-inclined non - bodily - movable concentrating - pan mounted thereon and having an opening in its lower portion near the gangue-discharge end, for the escape of the concentrates, said opening being formed by cutting slits in the bottom of the pan and bending a portion of the latter downwardly to form a lip, the bottom of the pan comprising a vibratory diaphragm, and a set-bolt threaded in a suitable support and engaging said lip for controlling the size of the opening, substantially as described.

7. In a concentrator, the combination with a suitable frame, of a longitudinally-inclined pan mounted thereon and having an opening in its lower extremity for the discharge of the concentrates, means for vibrating the pan, and a conveyer traveling downwardly in the pan whereby the downward travel of the outer stratum of material is retarded, substantially as described.

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

ISAAC SUTTON.

Witnesses:

DENA NELSON,  
A. J. O'BRIEN.