No. 622,641. Patented Apr. 4, 1899.

A. TEN WINKEL.

ORE CONCENTRATOR.

(Application filed May 11, 1898.)

(No Model.) 3 Sheets—Sheet 1.

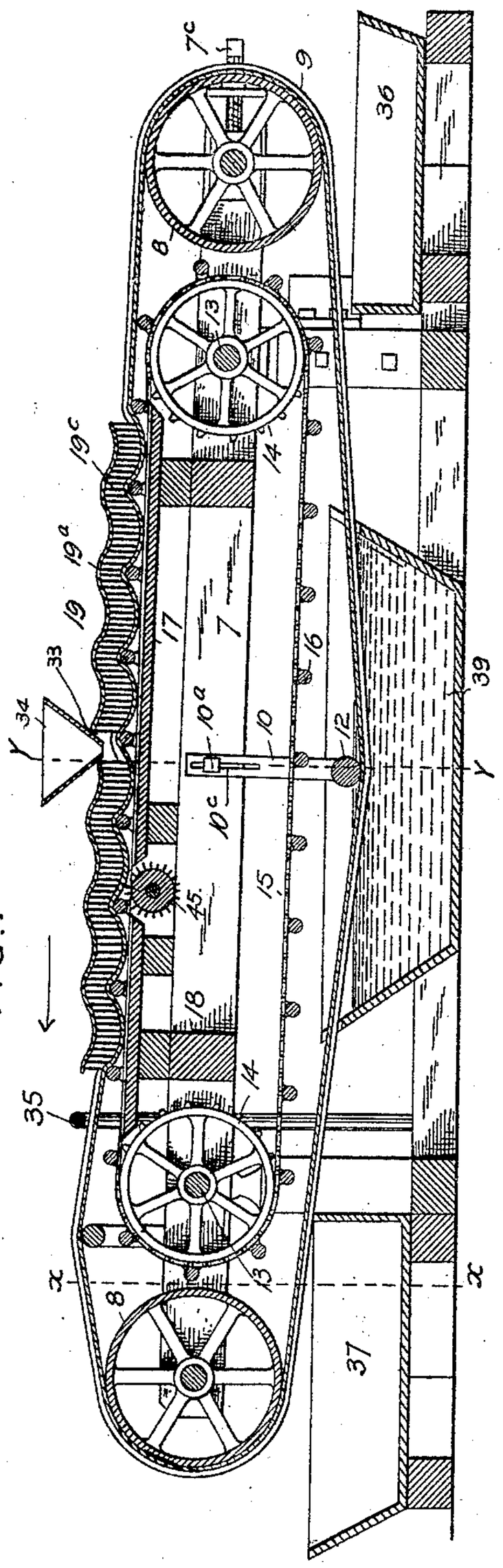

FIG. 1

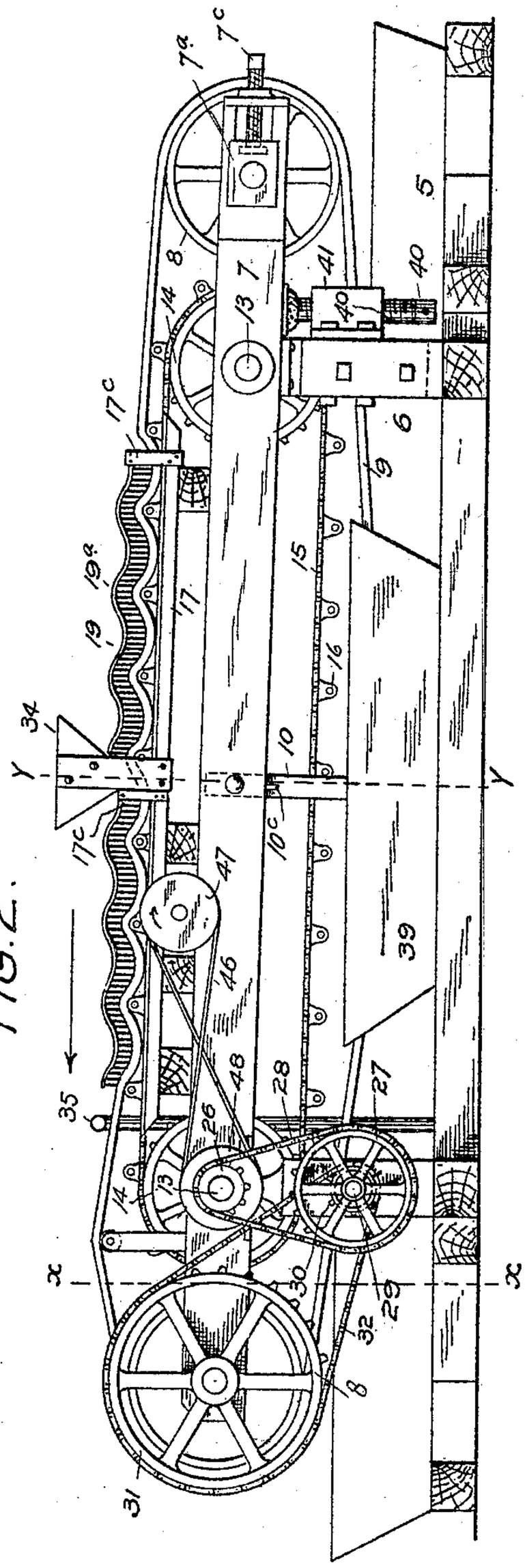

FIG. 2.

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No. 622,641. Patented Apr. 4, 1899.

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ORE CONCENTRATOR.

(Application filed May 11, 1898.)

(No Model.) 3 Sheets—Sheet 2.

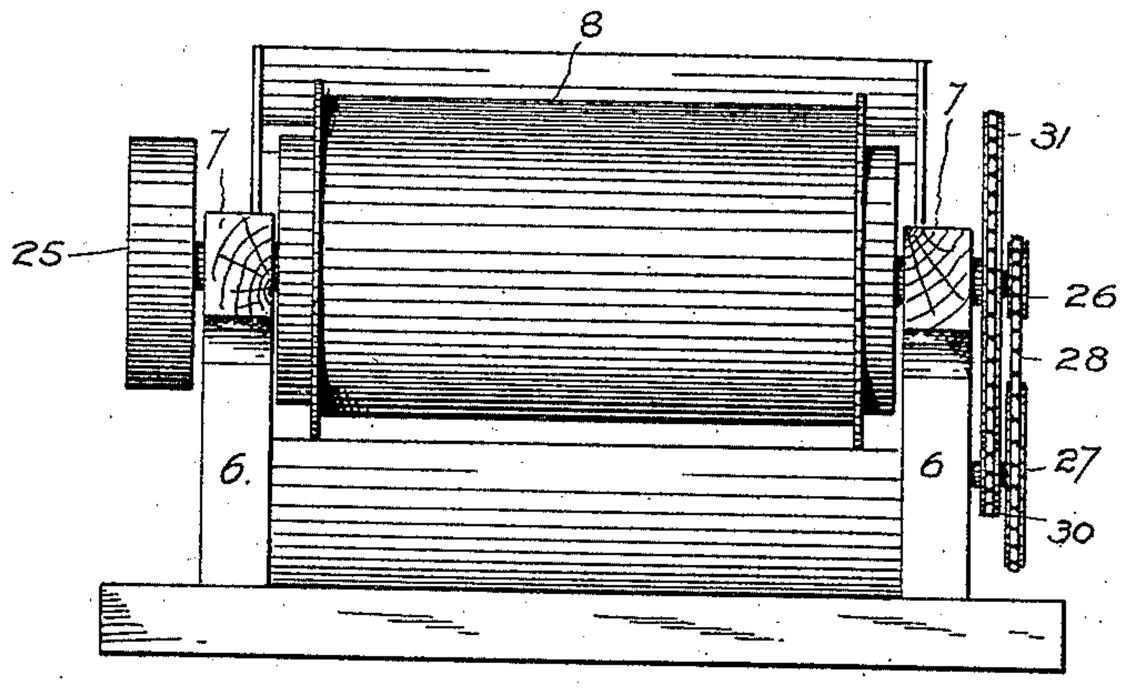

FIG. 3

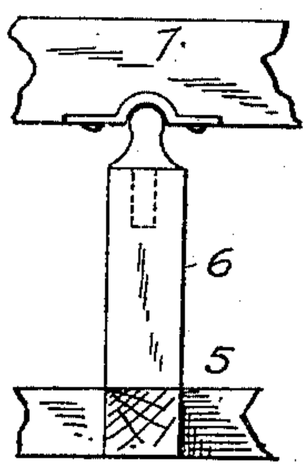

FIG. 13.

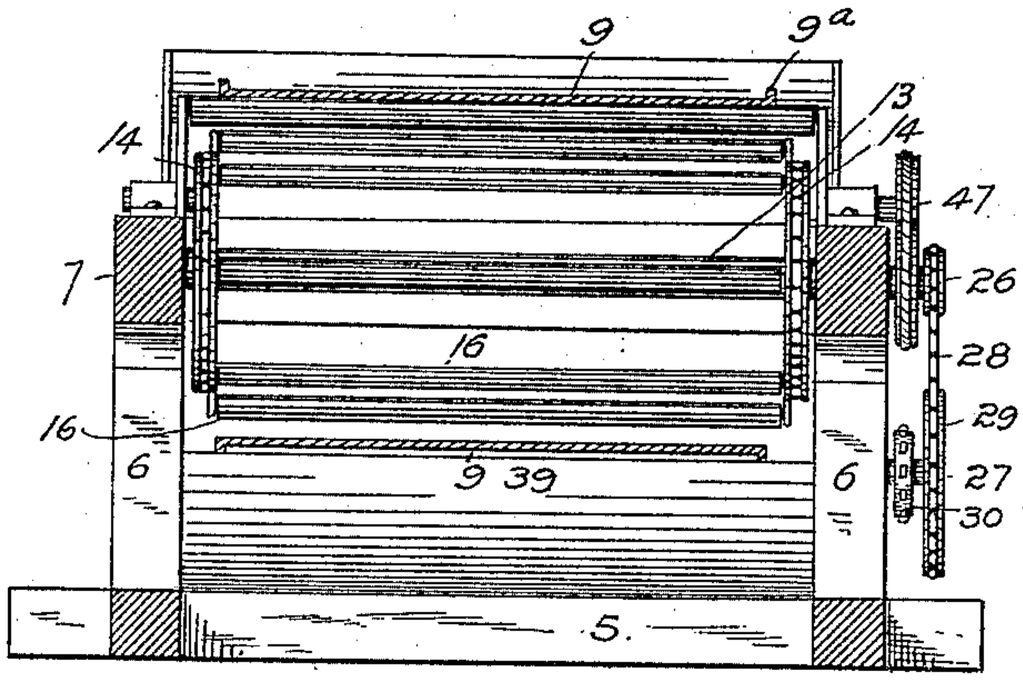

FIG. 4.

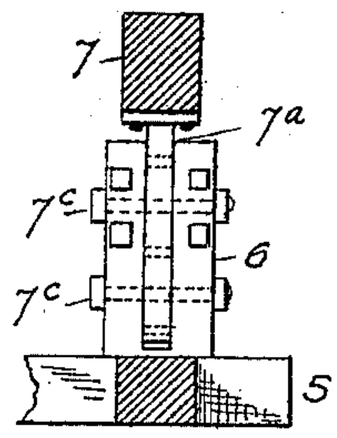

FIG. 12.

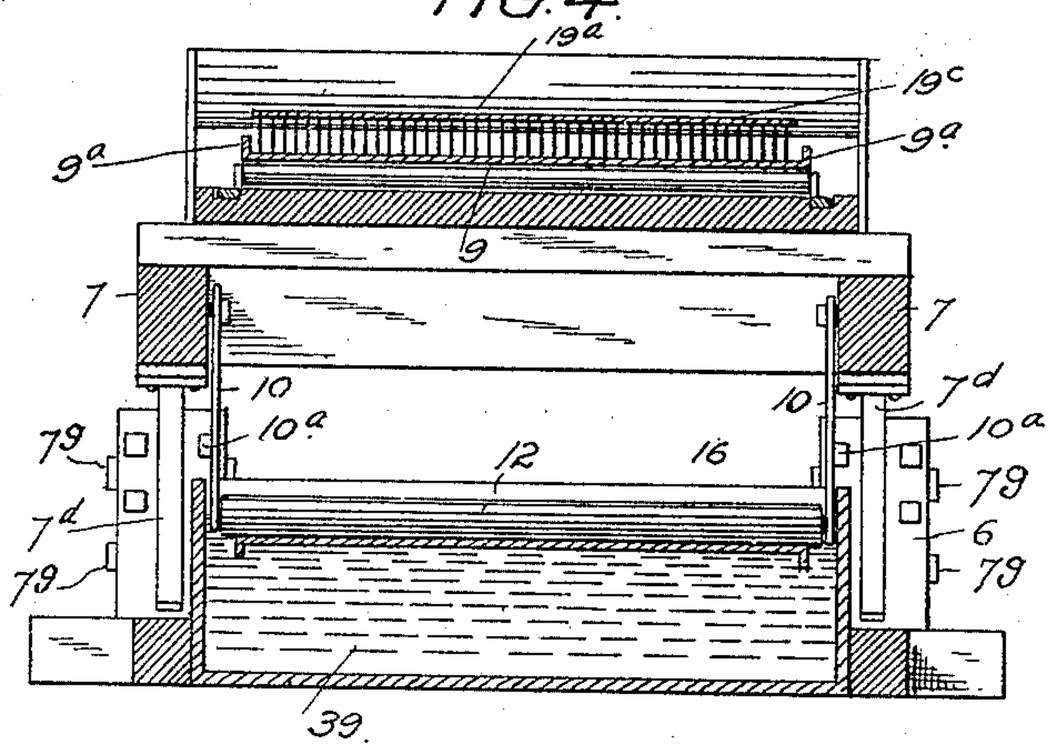

FIG. 5.

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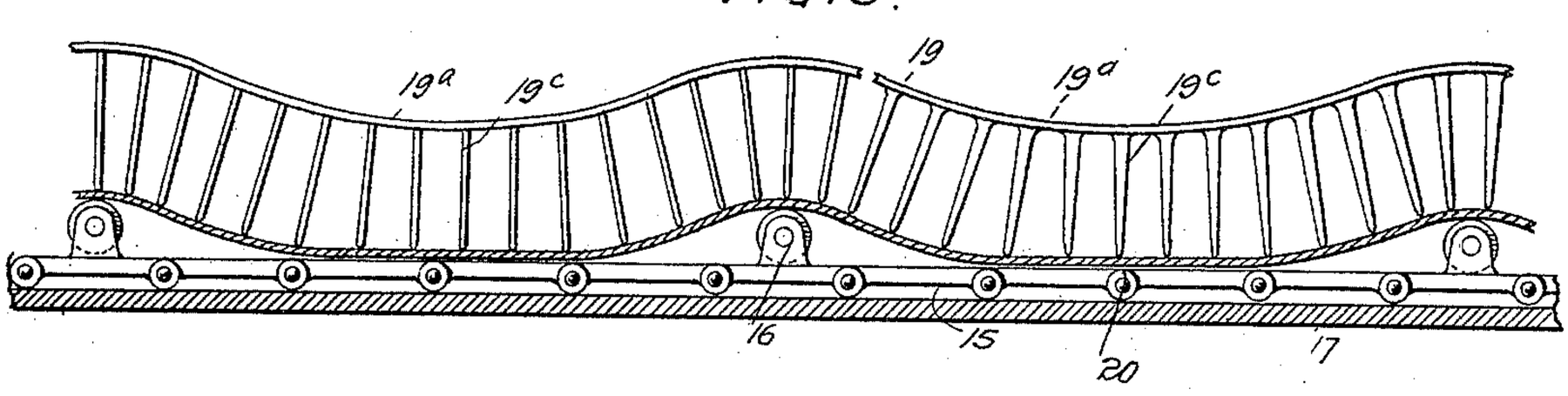
ORE CONCENTRATOR.

(Application filed May 11, 1898.)

(No Model.) 3 Sheets—Sheet 3.

FIG. 6.



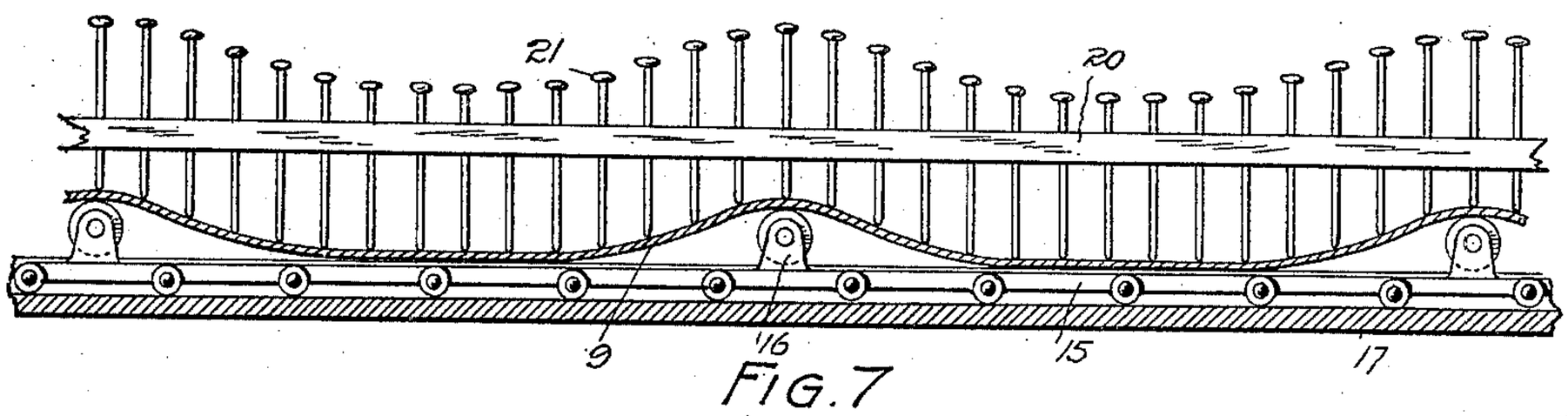


FIG. 7

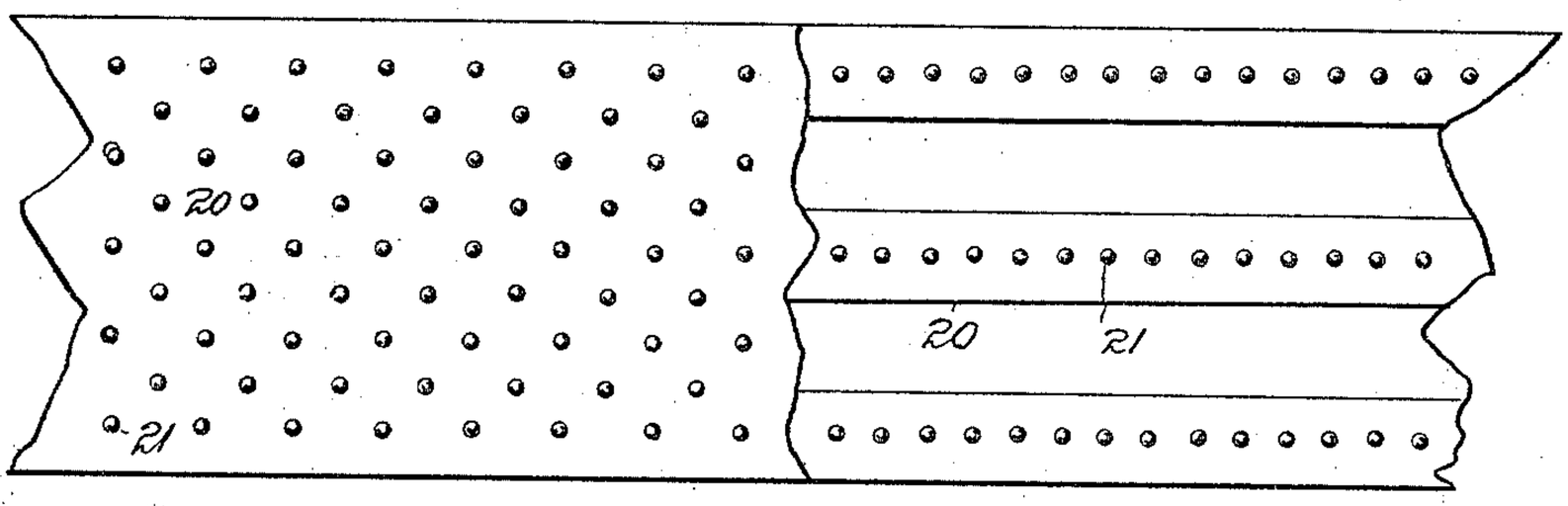


FIG. 8.

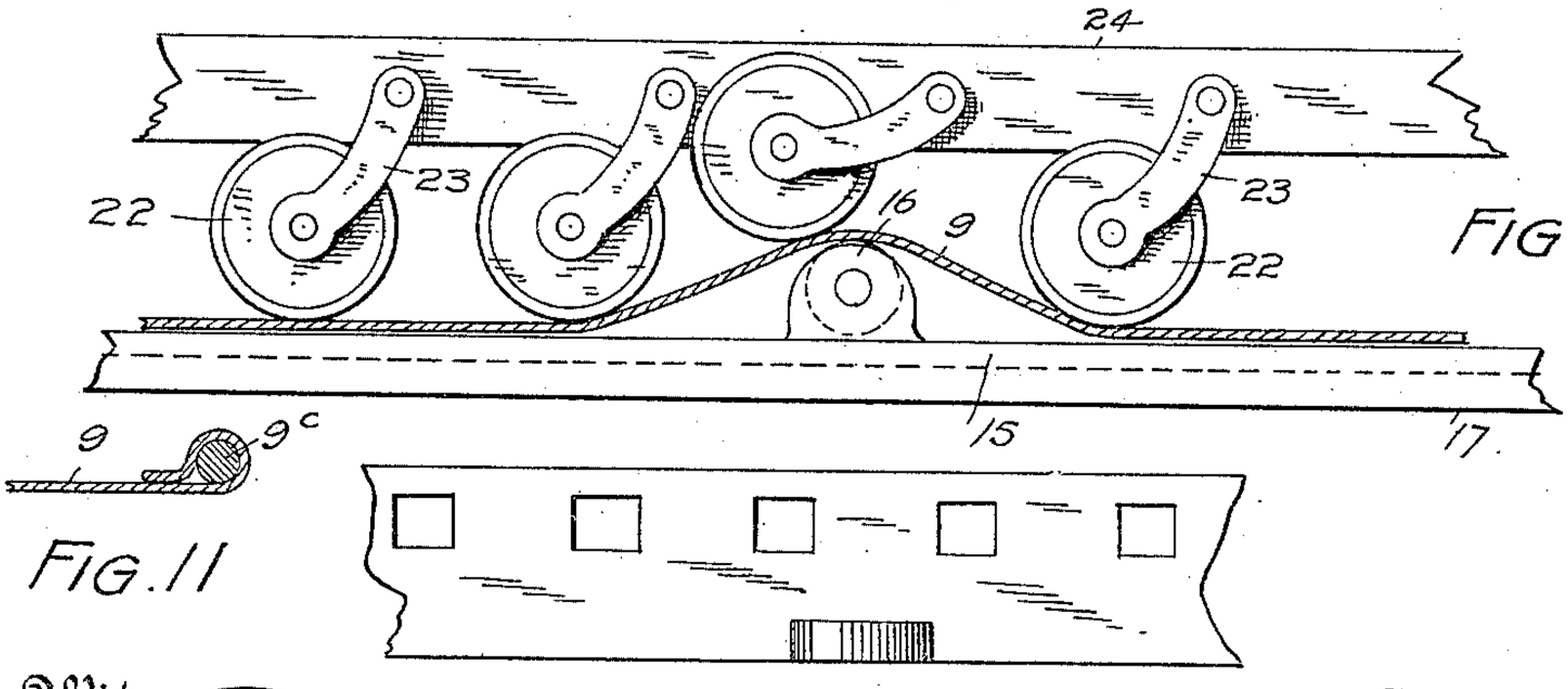


FIG. 9

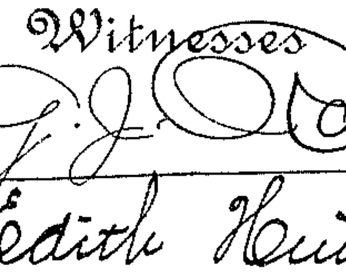


FIG. 11

FIG. 10.

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By his Attorney
[signature]

UNITED STATES PATENT OFFICE.

AUGUST TEN WINKEL, OF DENVER, COLORADO, ASSIGNOR OF ONE-FOURTH TO HERMAN TEN WINKEL, OF SAME PLACE.

ORE-CONCENTRATOR.

SPECIFICATION forming part of Letters Patent No. 622,641, dated April 4, 1899.

Application filed May 11, 1898. Serial No. 680,423. (No model.)

To all whom it may concern:

Be it known that I, AUGUST TEN WINKEL, 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 Ore-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 ore-concentrators; 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 my improved machine. Fig. 2 is a side elevation of the same. Fig. 3 is a front end elevation of the machine. Fig. 4 is a cross-section taken on the line $x\,x$, Figs. 1 and 2. Fig. 5 is a section taken on the line $y\,y$, Figs. 1 and 2. Fig. 6 is a fragmentary view illustrating the table, the agitator, the endless traveling apron, and the auxiliary apron, the parts being shown on a larger scale. In this view the left half of the figure shows one form of the auxiliary apron and the right half another form of the same. Fig. 7 is a similar view showing another form of construction. Fig. 8 is a top view illustrating two different forms of construction, the one being shown at the left and the other at the right. Fig. 9 illustrates still another form of construction. Fig. 10 is a fragmentary view illustrating a rubber belt which may be employed with the agitators instead of the sprocket-chains. Fig. 11 is a fragmentary section taken through the endless apron, showing a modified form of construction. Figs. 12 and 13 are fragmentary views illustrating details of construction.

Similar reference characters indicating corresponding parts in the views, let the numeral 5 designate the base, and 6 the uprights or standards, of a stationary frame. Upon these standards are mounted two longitudinal beams 7. In the extremities of these beams are journaled two drums 8. The journal-boxes 7^a, mounted on one extremity of the beams, are adjustable. The drums 8 are engaged by an endless apron 9, whose tension is controlled by the adjustable boxes and a vertically-adjustable depending arm 10, carrying a roller 12, engaging the inner surface of the apron. The journal-boxes 7^a are adjusted by means of screws 7^c. Between the drums 8 are located two shafts 13, also journaled in the beams 7. To the extremities of these shafts are made fast sprocket-wheels 14, which are engaged by chains 15, connected by transverse slats or bars 16, forming agitators which travel on the table 17 and beneath the endless apron 9. This table is supported by and made fast to cross-beams 18, located between the longitudinal beams 7, to which they are made fast and above which they project. The apron 9 is made sufficiently slack to form transverse valleys or depressions between the agitators 16 as the latter pass under the apron.

On top of the endless apron 9 is an auxiliary apron 19, composed of a flexible piece of material 19^a, to which are attached depending fingers 19^c, whose lower extremities engage the endless apron. This auxiliary apron is held in place by means of short arms 17^c, secured to its rear extremity and attached to the edges of the table. It is of sufficient weight to maintain the transverse valleys between the agitators of the endless apron. The part 19^a of the auxiliary apron may be composed of flexible leather or rubber, while the fingers 19^c may consist of nails or metal pins suitably applied to the part 19^a, (see left half of Fig. 6,) or the auxiliary apron may consist of rubber, the parts 19^a and 19^c being formed integral. (See right half of Fig. 6.) The function of the auxiliary apron, at least in part, may be performed by various other constructions. (See, for instance, the construction shown in Fig. 7, consisting of a stationary plate 20, supported on the frame of the machine and apertured to receive pins 21, which are free to move up and down in the plate and maintain the valleys in the apron 9. Also see Fig. 9, in which disks 22 are piv-

oted upon arms 23, whose upper extremities are pivoted upon stationary bars 24, mounted on the frame of the machine. It is believed that three rows of disks 22 will be sufficient for the purpose—that is to say, one on each side of the apron 9 and one in the middle. The apron 9 is provided with side flanges 9^a to prevent the concentrates from working over its sides.)

When the machine is in operation, the agitators 16 travel rapidly as compared with the endless apron upon which the mineral values are caught.

Power is applied to the machine by connecting a pulley 25 on one of the shafts 13 with any suitable motor. To the opposite extremity of the shaft 13 is attached a small sprocket-wheel 26, which is connected with a larger wheel 27 by means of a chain 28. The wheel 27 is fast on a shaft 29, journaled in one of the standards 6. A small sprocket 30 is also fast on the shaft 29. This sprocket 30 is connected with a larger sprocket 31, fast on the journal of one of the drums 8, by means of a chain 32. By this arrangement it is evident that a relatively rapid movement will be given the agitators when the machine is in motion.

The auxiliary apron 19 is divided about midway into two parts, leaving a space 33, through which the pulp to be treated is passed to the apron 9 from a hopper 34. The endless apron and the agitators travel in the direction indicated by the arrows in Figs. 1 and 2 at relatively different rates of speed, as heretofore explained.

The table is downwardly inclined from its left hand or head extremity, referring to Figs. 1 and 2. Pure water is discharged upon the endless apron above the auxiliary apron from a transverse perforated pipe 35. This water cleans the mineral on the apron above the hopper, the gangue being washed downwardly and discharged from the apron into a receptacle 36, located at the tail of the machine, while the mineral is carried upwardly by the endless apron and discharged into a receptacle 37 at the head of the machine. The apron 9 passes through a water-tank 38, supported underneath the tension-roller 12. The finer mineral particles not caught by the receptacle 37 being of insufficient gravity to cause them to drop from the apron, will be washed off and caught in the tank 39. The roller 12 is adjustable by means of a set-bolt 10^a passing through a slot 10^c in the vertical arms 10.

The inclination of the table is regulated by means of screws 40, attached to the beams 7. These screws engage nuts 41, fast on the standards 6. The screws are connected with the beams 7 by ball-and-socket joints. The forward standards 6 are vertically slotted to receive tongues 7^d, attached to the beams 7. These tongues are provided with a series of apertures adapted to receive bolts 7^g, passed transversely through the standards. The beams 7 are fulcrumed on the forward standards 6. (See Fig. 13.) When it is desired to change the inclination of the table, the bolts 7^c are removed from the forward standard 6, and the screws 40 are turned in the one direction or the other, as may be desired, until the table is properly adjusted. In this case other holes in the tongues 7^d are made to register with the holes in the standards, and the bolts 7^c are then reinserted.

A roller 45 is journaled in the beams 7 underneath the table and extends upwardly into an opening formed in the table. This roller is provided with agitating-teeth and is adapted to engage the endless apron. It coöperates with the agitators 16. This roller is turned in the direction indicated by the arrow in Fig. 2, or contrary to the direction of the movement of the agitators 16. This movement of the roller is effected by means of a crossed belt 46, connecting a pulley 47, fast on the roller-spindle, with a pulley 48, fast on the forward shaft 13.

While I prefer to make the endless apron 9 of rubber, it may, if desired, be formed of canvas. (See Fig. 11.) In this case the edges of the apron are turned over cords 9^c and sewed, forming longitudinal pockets in which the cords lie. These cords form the retaining-flanges of the apron.

From the foregoing description the operation of my improved machine will be readily understood. The material to be treated is fed in the form of pulp from the hopper 34 to the slowly-traveling apron 9 at a point about midway of the auxiliary apron 19. The separation of the mineral from the gangue is effected on the endless apron through the combined action of the rapidly-traveling agitators 16 below and the auxiliary apron 19 above. The gravity of this apron 19 maintains the valleys in the traveling apron between the agitators and at the same time acts on the material through the agency of the fingers 19^c. These combined influences effect the separation of the mineral from the gangue, the latter being carried downwardly by the pure water from the pipe 35 and deposited at the foot of the table, while the mineral is caught in the valleys of the endless apron and carried upwardly thereby and finally discharged into the receptacles 37 and 39, as heretofore explained.

Having thus described my invention, what I claim is—

1. In an ore-concentrator, the combination with a suitable table, of an endless apron traveling above the table, agitators traveling between the table and the apron and engaging the latter underneath, the apron being sufficiently slack to form valleys or depressions between the agitators, and means engaging the endless apron from above for maintaining the valleys or depressions in the apron between the agitators.

2. In an ore-concentrator, the combination with a suitable table, of an endless apron traveling above the table, agitators traveling between the table and the apron and engaging the latter underneath, the apron being suf-

ficiently loose to permit the formation of valleys or depressions therein between the agitators, and means engaging the endless apron from above for maintaining the valleys or depressions in the apron between the agitators, said means comprising a flexible piece of material provided with depending fingers.

3. In an ore-concentrator, the combination with a suitable table, of an endless apron traveling above the table, agitators traveling between the table and the apron and engaging the latter underneath, the movement of the agitators being in the same direction but more rapid than that of the apron, the apron being sufficiently loose or slackened to allow the formation of transverse valleys or depressions between the agitators, and means engaging the endless apron from above for maintaining the valleys or depressions in the apron between the agitators.

4. In an ore-concentrator, the combination of an inclined table, an endless apron traveling above the table, agitators traveling between the table and the apron and engaging the latter underneath, the agitators and apron traveling up the inclination of the table, and means for discharging water upon the upper end of the apron whereby the gangue is carried downwardly and discharged at the tail of the machine while the mineral is carried upwardly by the apron.

5. In an ore-concentrator, the combination with a suitable table, of an endless apron traveling above the table, agitators traveling between the table and the apron and engaging the latter underneath, the apron being sufficiently slack to form valleys or depressions between the agitators, an auxiliary apron attached to the table and engaging the endless apron from above for the purpose of maintaining the transverse valleys in the endless apron, and facilitating the separation of the mineral from the gangue, the auxiliary apron being divided to permit the material to be fed to the endless apron at a suitable point between the extremities of the auxiliary apron.

6. In an ore-concentrator, the combination with a suitable stationary frame, of longitudinal beams mounted on the frame, suitable means for regulating the inclination of said beams, a table attached to the beams, drums journaled in the extremities of the beams, an endless apron mounted on said drums and traveling above the table, shafts journaled in the beams between the drums, sprocket-wheels fast on said shafts, chains engaging the sprocket-wheels, transverse bars attached to the chains to form agitators which engage the endless apron underneath, the latter being sufficiently slack to form transverse valleys or depressions between the agitator-bars, and suitable means substantially as described engaging the endless apron from above and adapted to maintain the valleys or depressions between the agitators, and at the same time facilitate the separation of the mineral from the gangue.

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

AUGUST TEN WINKEL.

Witnesses:

A. J. O'BRIEN,

EDITH HIMSWORTH.