F. E. MARCY.

MECHANICAL CLASSIFIER.

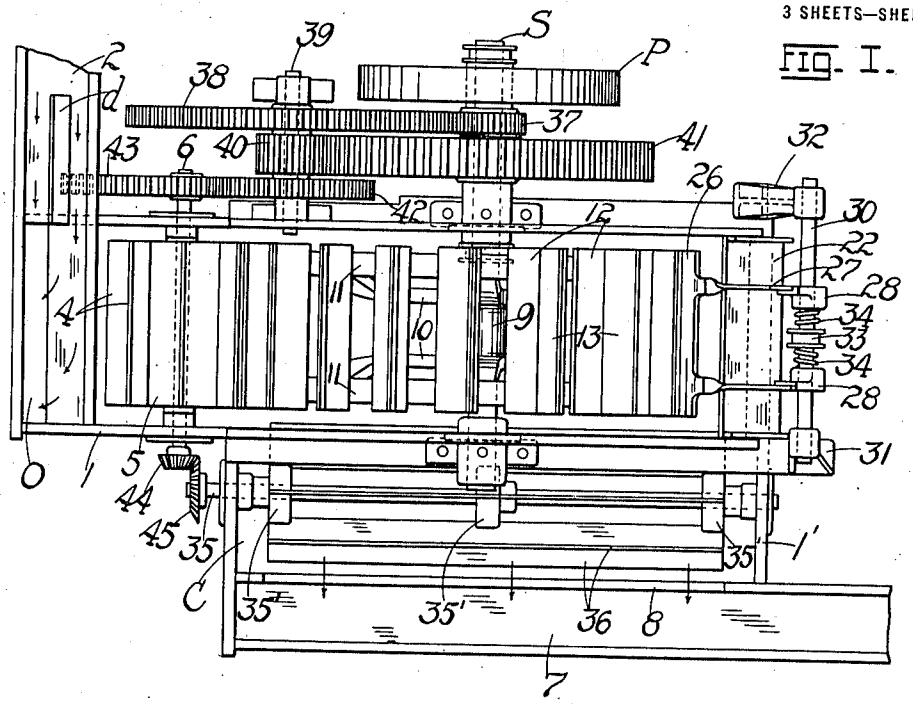
APPLICATION FILED FEB. 20, 1919.

1,316,911.

Patented Sept. 23, 1919.

3 SHEETS—SHEET 1.

FIG. I.



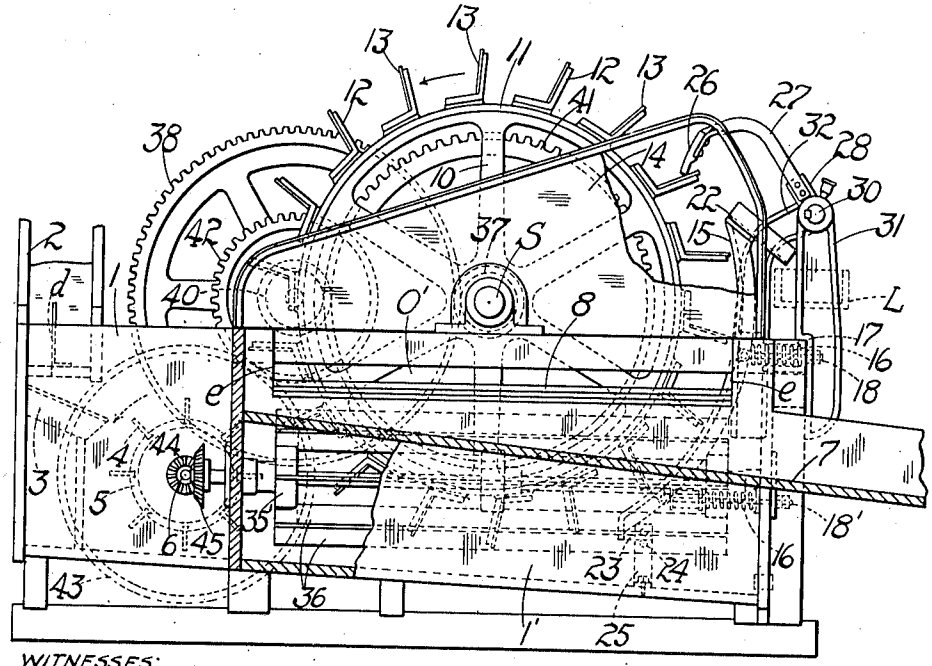


FIG. 2.

WITNESSES:

Harry A. Reimer

Joseph Richey

INVENTOR.

Frank E. Marcy.

BY Emil Starek

ATTORNEY.

F. E. MARCY.

MECHANICAL CLASSIFIER.

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3 SHEETS—SHEET 2.

FIG. 4.

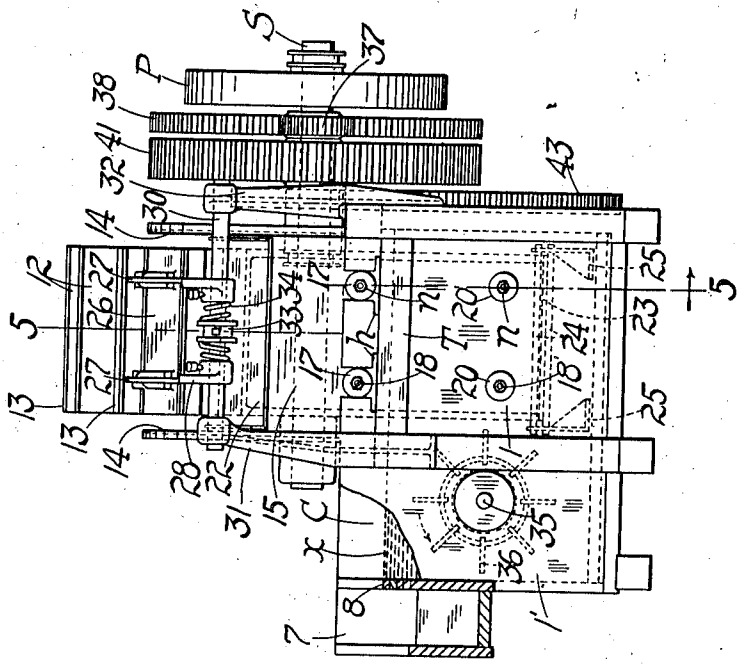
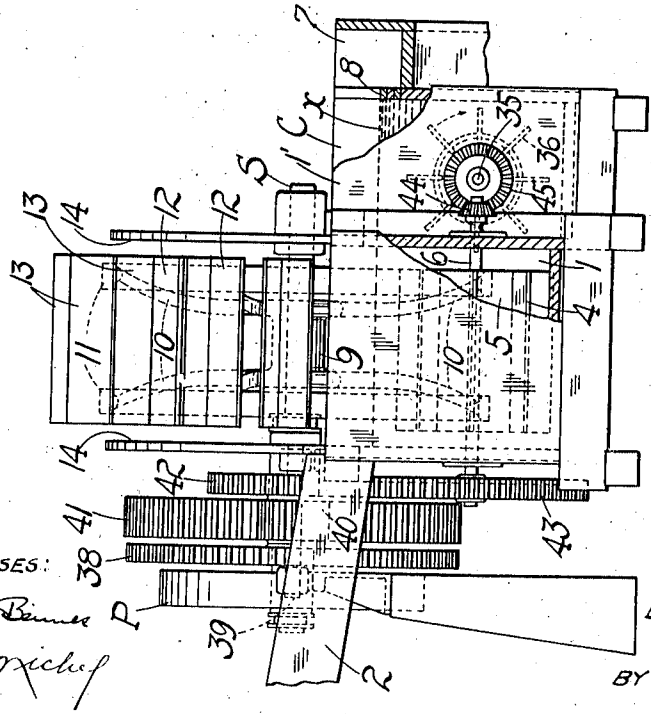


FIG. 3.



WITNESSES:

Harry A. Barnes

Josamichel

INVENTOR.

Frank E. Marcy.

BY Emil Starck

ATTORNEY.

F. E. MARCY.

MECHANICAL CLASSIFIER.

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1,316,911.

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3 SHEETS—SHEET 3.

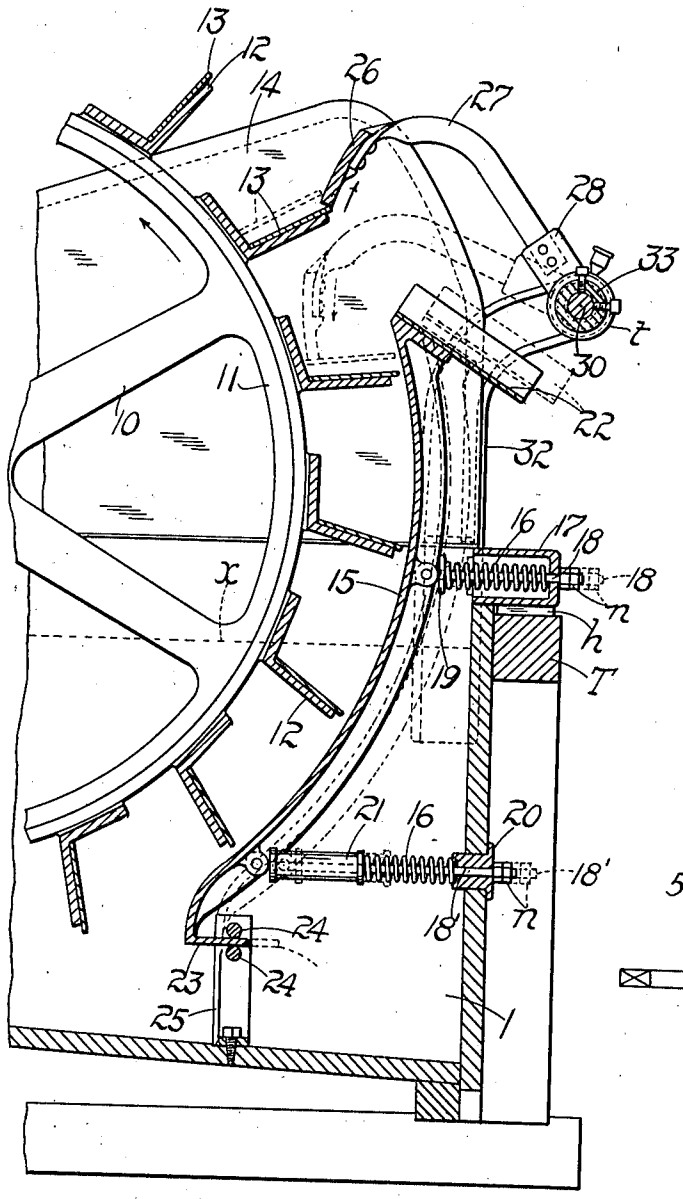


FIG. 5.

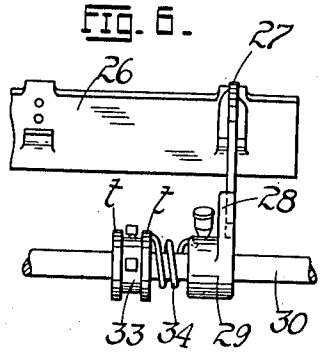


FIG. 6.

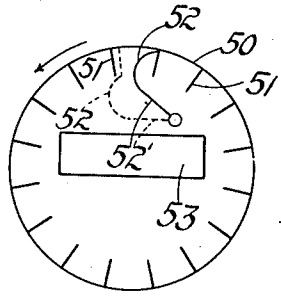


FIG. 7.

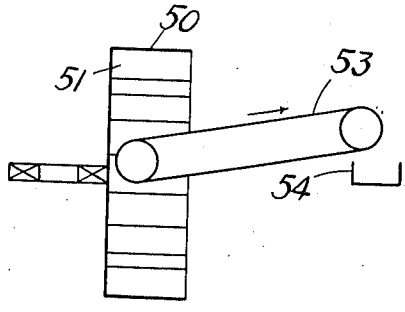


FIG. 8.

WITNESSES:

Harry A. Beinus

Josamiche

INVENTOR.

Frank E. Marcy.

BY Emil Starek

ATTORNEY.

UNITED STATES PATENT OFFICE.

FRANK E. MARCY, OF SALT LAKE CITY, UTAH.

MECHANICAL CLASSIFIER.

1,316,911. Specification of Letters Patent. Patented Sept. 23, 1919.

Application filed February 20, 1919. Serial No. 278,265.

To all whom it may concern:

Be it known that I, FRANK E. MARCY, a citizen of the United States, residing at Salt Lake City, in the county of Salt Lake and State of Utah, have invented certain new and useful Improvements in Mechanical Classifiers, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part hereof.

The present invention is directed to improvements in what are known in ore dressing as mechanical classifiers in contradistinction to the purely hydraulic type in which the agitation is effected by an upward current of clean water through which the coarse or heavy particles of the material under treatment are caused to fall, and by which the fine particles or fines are separated from the coarser particles or sands. The classifier under consideration may be used in circuit with ore grinding mills, serving the specific purpose of returning the coarse sands forming a component part of the finished product of the mill, back to the mill for further grinding. The object sought of course is to effect a separation between the coarse particles or sands and the fines without the use of screens, the latter being impractical for sizing finer than 40 mesh, whereas the classifier may separate out sands as fine as 120 mesh and finer. So far as concerns the immediate improvement herein, one of the objects sought is to provide a classifier which will have a maximum sand capacity, that is to say, one which will effect a separation of a maximum quantity of fines from the coarse sands in a given unit of time; one which effectively regulates the size and character of the fines to be removed; one which operates without causing a surging of the pulp content of the classifier, an objection inherent in some of the prevailing types of machines now in use; one in which the scrapers or shovels by which the sands are removed are kept clean by a special spring-actuated hoe or scraper; one having provision for feeding the pulp to the classifier below the surface of the pool or plane of overflow to prevent any coarse sands from floating away, the fine material being however free to rise through the pulp to the surface and pass off with the overflow; one provided with means for sorting the material before the coarse sands are returned to the sand wheel. The classifier is further characterized by special features of construction the advantages of which will be fully apparent from the following detailed description in connection with the accompanying drawings in which—

Figure 1 represents a top plan of the classifier; Fig. 2 is a side elevation of the apparatus; Fig. 3 is a rear end elevation thereof with parts broken away; Fig. 4 is a front end elevation of the apparatus with parts broken away; Fig. 5 is an enlarged vertical longitudinal section of the front end of the apparatus on the zig-zag line 5—5 of Fig. 4; Fig. 6 is an enlarged detached front elevation of the hoe partly broken away, and one of the oscillating arms to which the same is secured; Fig. 7 is a side diagrammatic view of a modified form of classifier wheel; and Fig. 8 is a diagrammatic middle cross-section of the same.

Referring to the drawings, and for the present to Figs. 1 to 6 inclusive, 1, represents an oblong tank across one end of which is disposed a feed launder 2 provided at a point adjacent the end wall of the tank with an elongated feed opening O extending the width of the tank, the pulp being received by an inclined chute or apron 3 beneath the opening, which directs the material to a point below the level of the pulp in the tank and in proximity to the blades 4 of a vertically rotating drum or agitator 5 mounted on the shaft 6. To prevent eddying of the feed pulp in its flow into the opening O, a parting or deflecting plate *d* in the form of an angle bar is disposed longitudinally of the launder 2, the same terminating at the inner corner of the opening as shown (Fig. 1). This serves to part the current, a portion flowing into the opening O at one end, and another and major portion following the inner side wall of the launder and cataracting into the opening across the full length of the inner longitudinal edge thereof as indicated by the arrows in Fig. 1. The tank 1 is formed on one side with an extension 1′ which terminates at its rear end at a point slightly forward of the rotation axis of the drum agitator 5 (the feed end of the tank being for convenience assumed to be the rear end), the said extension forming a sorting compartment C which is provided with a

side overflow for the discharge of the fines into a launder 7 located adjacent thereto, the bottom of the launder sloping forwardly and downwardly and conducting the pulp to any convenient point for further treatment known to the art. The level of the pulp *x* in the tank and hence the plane of overflow may be regulated by the removal strips 8 inserted between the vertical terminal edges *e*, *e*, defining the length of the opening O′ through which the overflow from the compartment C into the launder 7 is maintained. The bottom of the tank slopes slightly toward the front end of the apparatus so as to in a measure cause a gradual advance of the sands in that direction and toward the sand wheel (to be presently described) mounted opposite the sorting compartment C and between the drum 5 and front end of the tank. The sand wheel in the present improvement takes the place of the usual belt conveyer, the use of a wheel resulting in increased efficiency and sand capacity and permitting of the convenient application of cleaning devices to the shovels carried by the wheel. The sand wheel, in the present embodiment of my invention, comprises a shaft S mounted across the top of the tank 1, said shaft having centrally secured thereto within the tank the hub 9 from each end of which radiate the inwardly bowed spokes 10, leading to the rims 11, the whole forming a wheel, herein denominated as the "sand wheel" or "classifier wheel," the two rims whereof are connected by angle bars 12 the legs of which are disposed at an obtuse angle to one another whereby when one set of legs is secured to the peripheries of the rims 11, the remaining legs will each project outward at a slight angle to a radial plane through the rotation axis of the wheel. The outwardly projecting legs of the angle bars form blades or shovels the bottom of each shovel being provided with a liner 13 whose outer longitudinal edge projects slightly beyond the corresponding edge of the shovel, or leg of the angle bar to which it is attached. The upper portions of the sides of the sand wheel are protected by the wall extensions or wings 14 leading from the sides of the tank 1. These wings may be constructed in any suitable manner, the top edges thereof preferably sloping toward the rear end of the machine. The shovels 12 with their charges of sand sweep upwardly in close proximity to a curved guide or apron 15 which is connected to the front end wall of the tank by means of coiled springs 16, the upper set of springs being preferably mounted in sockets 17 provided with side flanges *h*, *h*, bolted or otherwise secured to the cross timber T, the several springs being traversed by stems 18, 18′, the inner ends of which are pivotally secured to the apron in any suitable mechanical manner. The upper set of springs have their outer ends bearing against the end walls of the sockets 17, their inner ends bearing against the disks 19 on the stems 18. The outer ends of the lower set of springs bear against the inner ends of the bearings 20 loosely traversed by the stems 18′, the inner ends of the springs bearing against the sleeves 21 interposed between the springs and the apron. The lengths and tensions of the springs are regulated by the outer nuts *n* carried by the outer screw threaded terminals of the respective stems. The upper end of the apron 15 has secured thereto the inclined chute or trough 22 discharging into a launder L, the lower end being formed with a forwardly directed lip or flange 23 operating loosely between the rods or rollers 24 mounted across the tank between the brackets or castings 25 bolted to the tank bottom. The free edges of the shovels (or rather the liners thereof) are spaced slightly from the guide or apron 15 so as to eliminate friction, the sands being carried up by the shovels opposite the apron and subsequently discharged into the chute 22 as presently to be more fully described. Should a large or coarse piece of mineral or other material lodge between a shovel and the apron, the springs 16 will yield or give, thereby permitting the apron to yield and preventing injury to the mechanism, the yielding of the apron releasing the coarse piece that was causing the trouble. In this yielding movement the lip or flange 23 plays freely between the guide rods or rollers 24. Upon the release of the coarse piece of material the springs will expand to normal and restore the apron to its original position, the nuts *n* being so set as not to allow the apron to be driven against the shovels.

One of the features to which the present improvement is directed is the means for positively removing the sands from the shovels, it being found in practice that the sands which are often thick and pasty, tend to adhere to the shovels so that a thorough and effective discharge of the material is impossible without resorting to some device for assisting in its removal. In the present embodiment of my invention this device comprises a hoe or scraper 26 secured to the free ends of a pair of curved arms 27 oscillating in the plane of rotation of the sand wheel, the fixed ends of the arms being secured in the sockets 28 leading from the hubs 29 mounted loosely on a fulcrum rod 30 rigidly secured to the upper terminals of the standards 31, 32, disposed on the sides of the tank at the front end thereof. Set-screwed to the rod 30 at the center thereof is a collar or ring 33 terminating in flanges *t*, *t*, to each of which is secured one end of a coiled spring 34 (wrapped loosely about the rod 30) the opposite end of the spring being secured to the hub 29. The

springs are so tensioned that they jointly operate to rotate the hubs 29 in a direction to cause the arms 27 to oscillate inward and downward, that is to say toward the shovels 12, thereby forcing the free longitudinal edge of the hoe against the shovel. It follows from this that as a shovel continues in its upward sweep (the peripheral speed of the shovels being about seventy feet per minute along a circumference whose diameter is substantially seven and one-half feet) it will not only lift the hoe or scraper against the tension of the springs 34, but cause the edge of the hoe to progressively sweep across the width of the shovel, the hoe finally passing off the free edge of the shovel. The moment the hoe is released, the tension of the springs oscillates the arms 27 downward, the radius described by the free edge of the hoe being of such length as to bring said edge against the inner edge of the shovel or to the line of intersection of the legs of the angle bars 12 forming the shovels. It will thus be seen that as the sand wheel rotates, the shovels are successively scraped clean, the material removed by the hoe being in the main swept into the chute 22; and should any portion fail to reach the chute it will simply drop onto the next shovel below, but in the normal operation of the machine the velocity with which the material is scraped off lands it in the chute 22.

The sorting compartment C is provided with a stirrer, the same being of any conventional type, and in the present instance composed of a longitudinally disposed shaft 35 with hubs 35′ to which are attached the radiating blades or paddles 36, the stirring of the pulp tending to keep the fine particles in suspension while the heavy sands are allowed to drop to the bottom of the tank to be picked up by the blades or shovels of the classifier wheel. Any suitable means for imparting rotation to the classifier wheel, the agitator 5, and the stirrer in the sorting compartment may be resorted to, the mechanism in the present embodiment of my invention comprising a belt pulley P mounted loosely on the shaft S, the pulley being coupled to any suitable engine shaft or transmission (not shown). Secured to the hub of the pulley is a pinion 37 which meshes with a gear wheel 38 on the short shaft or spindle 39 projecting from the tank, said spindle having keyed or otherwise secured thereto adjacent the gear wheel 38, a pinion 40 which in turn meshes with a large gear wheel 41 keyed or otherwise secured to the shaft S of the classifier wheel. By the system of reducing gear described, a speed of seventy-five revolutions per minute imparted to the pulley P will impart about three revolutions per minute to the shaft S of the classifier wheel. Likewise secured to the spindle 39 is a gear wheel 42 which in turn meshes with a larger gear wheel 43 on the adjacent end of the shaft 6 of the agitator 5. The opposite end of the shaft 6 on the other hand terminates in a bevel pinion 44 which meshes with a slightly larger bevel pinion 45 on the stirrer shaft 35. Without further explanation it will be obvious from the gear mechanism described that with a rotation imparted to the pulley P in proper direction the several elements referred to will have rotation imparted to them in proper directions, said directions being indicated by suitable arrows in Figs. 2, 3, 4 and 5.

The operation though clearly apparent from the previous description may be briefly stated to be as follows: Rotation being imparted to the various members of the apparatus as above described, and the pulp being fed to the tank from the launder 2, the contents of the tank and of the sorting compartment C are subjected to constant agitation by the agitator and stirrer blades as well as by the blades or shovels 12 of the classifier wheel plowing through the pulp, this agitation keeping the light particles in suspension to insure their desired overflow from the sorting compartment C into the launder 7 by which they are conducted to any suitable point for further treatment. In this agitating or sorting action the heavy sands are separated out and seek the lower levels of the pulp in the tank where they are gathered up by the shovels 12 of the sand or classifier wheel and carried upward opposite the guide or apron 15 to be finally discharged into the chute 22 into which the sands are assisted by the raking or scraping action of the hoe 26 which is caused to successively engage the several shovels by the torsion of the springs 34, said springs yielding sufficiently to allow the shovels to pass off the hoe as already described. In this raking action the material is swept by the hoe into the chute 22. Since the plane of oscillation of the hoe corresponds to the plane of rotation of the classifier wheel, it follows that the movement of the hoe across the shovels is in a path parallel to said plane, that is to say the hoe scrapes the shovel from the inner edge to the outer edge in lines perpendicular to said edges. I do not however wish to be limited to this precise movement as the sweep of the hoe across or over the shovel may be in other directions from that which inheres in the present construction.

In the form of classifier wheel above described the shovels 12 radiate outwardly from the periphery or rim of the classifier wheel, but I do not wish to be limited to this precise arrangement of shovels. Other forms of construction may be resorted to. Thus, in the diagrammatic illustrations in Figs.

7 and 8 I show a wheel 50 in which the shovels 51 project inwardly, the material being scraped off by a hoe 52 at the end of the spring-controlled oscillating arm 52', the material being received by an endless traveling belt 53 which discharges the sands into a launder 54. Other forms of classifier wheel and other forms of hoes or cleaning devices may be employed without involving a departure from the nature or spirit of the invention. Features shown but not alluded to are well understood in the art and require no description in the present connection.

Having described my invention what I claim is:

1. A classifier of the character described comprising a tank having a feed end for the pulp and a discharge end for the sands, a sand wheel interposed and rotating between said feed and discharge ends, a sorting compartment in free and open communication with the tank located on one side of the sand wheel and provided with a side overflow edge.

2. A classifier of the character described comprising a tank having a feed end for the pulp and a discharge end for the sands, an agitator in the tank located adjacent the feed end, a sand wheel interposed between the agitator and point of discharge for the sands, a sorting compartment in free and open communication with the tank located on one side of the sand wheel and provided with a side overflow edge, and a stirrer in said compartment.

3. A classifier of the character described comprising a tank having a feed end for the pulp and a discharge end for the sands, a sand wheel interposed and rotating between said feed and discharge ends, a sorting compartment in free and open communication with the tank located on one side of the sand wheel and provided with a side overflow edge, and a stirrer in said compartment.

4. In a classifier of the character described, a tank having a feed for the pulp at one end and a discharge for the sands at the opposite end, a sorting compartment offset from one side of the tank, a stirrer in said compartment, a vertically rotating wheel dipping into the pulp in the tank opposite the sorting compartment, shovels radiating from said wheel for removing the sands from the tank, a curved guide or apron coöperating with the upwardly sweeping sand-laden shovels, and means for removing the material from the shovels at a point near the top of the guide.

5. A classifier of the character described comprising a tank having a feed end for the pulp and a discharge end for the sands, an agitator in the tank located adjacent the feed end, a sand wheel independent of the agitator interposed between the latter and the point of discharge for the sands, the tank being provided with an overflow for the fines on one side of the sand wheel.

6. In a classifier of the character described, a tank, a classifier wheel rotating in a vertical plane and having a portion thereof permanently dipping into the pulp in the tank, a series of shovels radiating outwardly from the wheel periphery, and a yielding apron positioned in proximity to the free edges of the shovels in their upward sweep through and out of the pulp in the tank, and means for causing a discharge of the material from the shovels across the apron at a point above the pulp line.

7. In a classifier of the character described, a tank, a classifier wheel rotating in a vertical plane and having its lower portion submerged in the pulp in the tank, a series of radially disposed shovels leading from the rim of the wheel, a spring-controlled guide or apron curved to the arc of sweep of the outer edges of the shovels, positioned in proximity to said edges in their upward sweep through and out of the pulp in the tank, a chute carried by the apron, and means for sweeping the contents of the shovels successively emerging from the pulp, into the chute.

8. In a classifier of the character described, a tank having a feed for the pulp at one end and a discharge for the sands at the opposite end, the bottom of the tank sloping from the feed to the discharge end, a sorting compartment off-set from one side of the tank, a stirrer in said compartment, a vertically rotating wheel dipping into the pulp in the tank opposite the sorting compartment, shovels radiating from said wheel for removing the sands from the tank, an agitator in the tank interposed between the wheel and feed end of the tank, a curved guide or apron coöperating with the upwardly sweeping sand-laden shovels, and means for removing the material from the shovels at a point near the top of the guide.

9. In a classifier of the character described, a tank, a rotating sand wheel operating in said tank, an apron or guide curved to conform to the peripheral sweep of the wheel located in proximity to the periphery of the wheel, a fixed support, springs connecting the apron at different points to said support and holding the apron in normal position relatively to the wheel, a flange on the apron directed toward the fixed support, and guide rods spaced to loosely receive the flange between them, the apron being caused to yield with the lodging of a coarse piece of material between the apron and wheel.

10. In a classifier of the character described, a pulp container, a series of blades or shovels operating therein, means for advancing the blades through and out of the pulp, and a rectilinearly movable guide or apron positioned in proximity thereto.

11. In a classifier of the character described, a pulp container, a sand wheel rotating therein about a fixed axis, shovels on said wheel dipping into the pulp and subsequently emerging therefrom with the rotation of the wheel, and a rectilinearly movable guide or apron positioned in proximity to the path of sweep of the outer edges of the shovels.

12. In a classifier of the character described, a pulp container, a sand wheel operating therein, and a rectilinearly movable guide coöperating with the sand wheel.

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

FRANK E. MARCY.

Witnesses:
EMIL STAREK,
ELSE M. SIEGEL.