Sept. 25, 1923 1,468,844

R. S. TROTT

CLASSIFIER

Filed Feb. 7, 1922 3 Sheets-Sheet 1

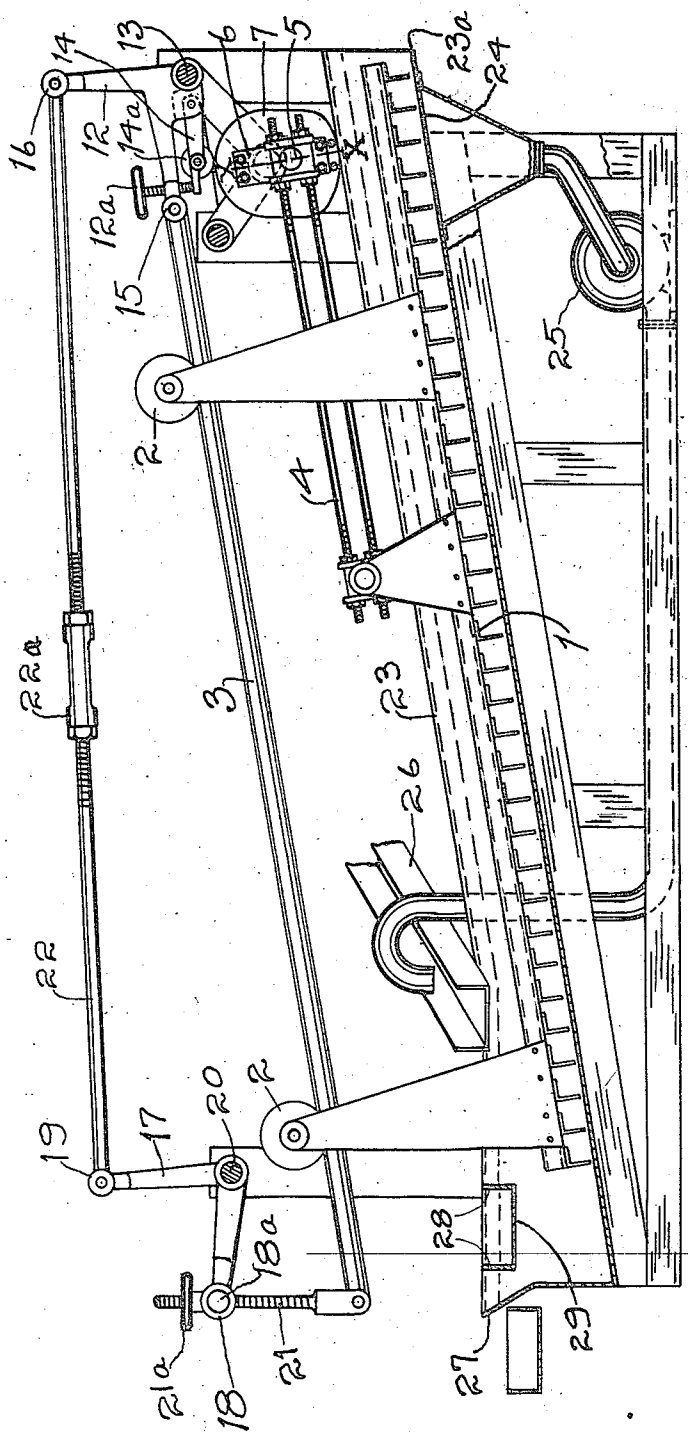



Fig. 1

Rolland S. Trott

INVENTOR.

Sept. 25, 1923. 1,468,844

R. S. TROTT

CLASSIFIER

Filed Feb. 7, 1922 3 Sheets-Sheet 2

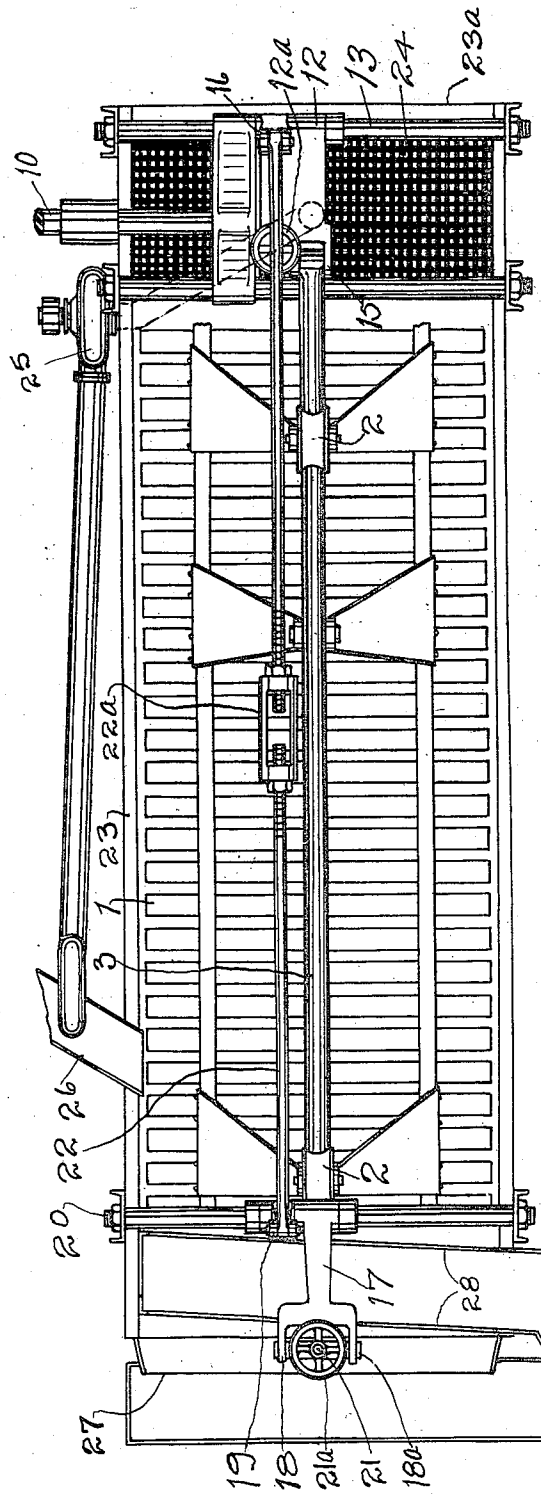



Fig. 2.

Rolland S. Trott
INVENTOR

Sept. 25, 1923. 1,468,844

R. S. TROTT

CLASSIFIER

Filed Feb. 7, 1922 3 Sheets-Sheet 3

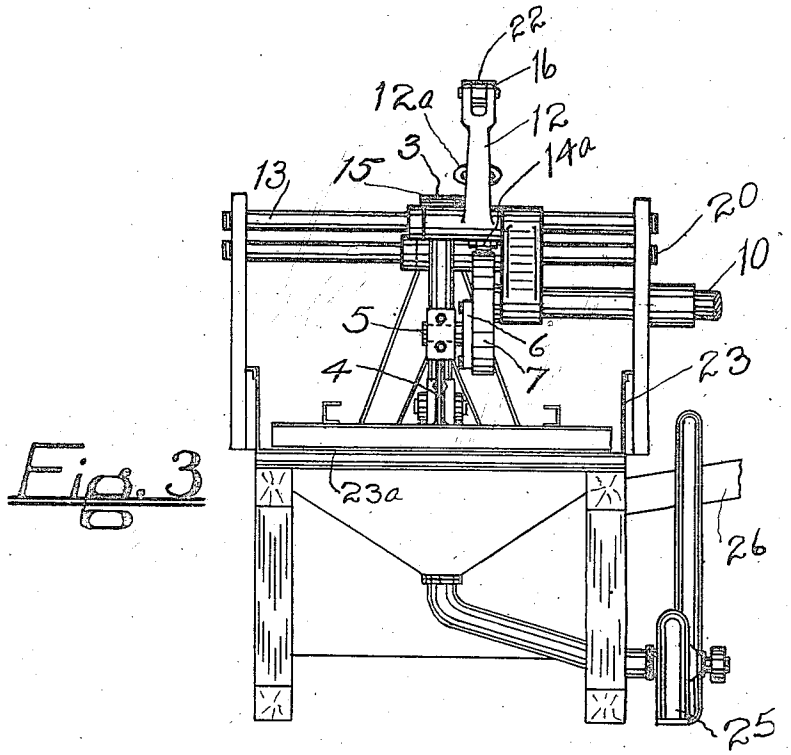



Fig. 3

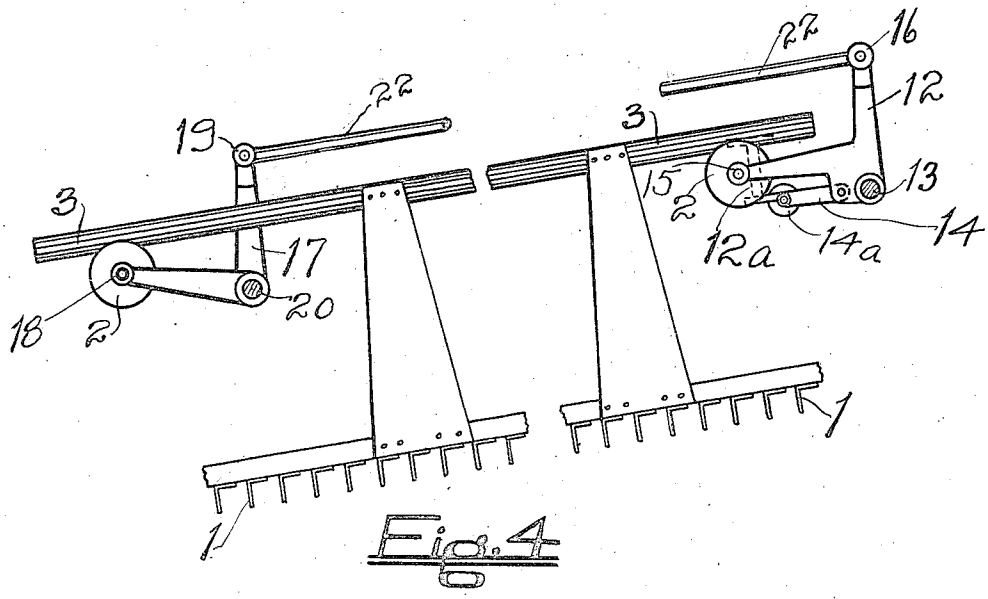



Fig. 4

Rolland S. Trott
INVENTOR

Patented Sept. 25, 1923. 1,468,844

# UNITED STATES PATENT OFFICE.

ROLLAND S. TROTT, OF DENVER, COLORADO.

## CLASSIFIER.

Application filed February 7, 1922. Serial No. 534,770.

*To all whom it may concern:*

Be it known that I, ROLLAND S. TROTT, a citizen of the United States, residing at Denver, county of Denver, and State of Colorado, have invented certain new and useful Improvements in Classifiers, of which the following is a specification.

My invention has to do with classifiers of the reciprocating rake type, and especially with the mechanical construction for actuating same.

An object of my invention is to provide means, in a classifier to obtain a relatively dry sand product.

A further object is to provide means in such a classifier to give great adaptability over a wide range of conditions as will appear below.

In the ordinary reciprocating rake classifier, the rakes, which operate in a sloping box or vat, rake the settled material upward along the slope to the sand discharge end of the machine, which is above water level.

The lighter material and liquid overflow at the opposite end of the classifier, the feed being put in at an intermediate point.

Between the strokes of the rakes the material has a chance to settle, and it is this settled material which the rakes move upward toward the sand discharge end of the classifier.

As the rakes intermittently move the settled material upward along the slope and below the water level, a washing action takes place, tending to clean the sand.

The time required for proper settling under these circumstances naturally varies with the material being treated, the percentage of sand and slimes therein, and the fineness to which it has been ground.

If, with a certain material, the rakes are reciprocated so fast that there is not enough time between strokes for proper settling, the whole mass is merely agitated. For suspended material runs back as fast as the rakes move it up the slope, and hence no classification takes place.

In such a case the only thing to do is to reduce the number of strokes per minute of the rakes till enough time is given the material in question for proper settling between strokes.

As the amount of material the rakes can handle depends directly upon the number of strokes per minute, this naturally reduces the capacity of the classifier.

In my classifier this loss of raking capacity is made up for by lengthening the stroke of the rakes, as the number of strokes per minute is decreased, as will be explained below.

Hence, in my classifier, by lengthening the stroke as required, the raking capacity may be maintained the same, and the settling requirements of any material may be met.

This means not only good classification, but good capacity as well, regardless of the material being treated.

I obtain these advantages by a construction in which the rakes are suspended from wheels that roll upon a sloping, vertically movable track which is held at its lower position while the rakes are moving upward along the slope of the track, and which is held at its upper position while the rakes return toward the lower end of the track. The movable track is made long enough to handle the longest possible stroke of the rakes; so all that is required to change the stroke of the rakes, is to change the off-center position of the crank pin which is connected to the rakes by a connecting rod. The extreme limit of travel of the rakes in either direction may be maintained unchanged if desired by proper adjustment of the connecting rod length as the stroke length is altered.

In the drawings, Figure 1 is a side elevation of my classifier, partly in section; Figure 2 is a plan view of the same, and Figure 3 is a front elevation. Figure 4 is a fragmentary view of the modified parts of a modified form of the track and roller connection between the rakes and the bell-cranks.

The rakes 1 are suspended from the wheels 2, which roll back and forth upon the track 3, when driven by the connecting rod 4 and the crank pin 5.

The crank pin 5 is made as an integral part of the plate 6, which is bolted to the face of the cam 7. Extra bolt holes are provided to allow the crank pin 5 to be shifted along the line X—X as desired to vary the length of stroke of the rakes 1.

Any other proper method of changing the throw of the crank pin 5 may be used provided it retains the crank pin 5 some place

upon the line X—X so that its angular relation to the cam 7 will remain unchanged.

The cam 7 is mounted upon and keyed to the shaft 10, which is properly journaled and is revolved by gearing or any other proper method of power drive.

The bellcrank 12, mounted on the fulcrum 13, carries on one of its arms the pivotally mounted lever 14, which carries the roller 14ª designed to roll upon the cam 7. The same arm of the bellcrank 12 carries the clevis 15 and the adjusting screw 12ª, which bears against the lever 14. The other arm of the bellcrank 12 is provided with the clevis 16.

The bellcrank 17 is provided with the clevis 18, the clevis 19 and the fulcrum 20, upon which it is mounted.

The adjustable link 21 is provided with a clevis at its lower end and passes through the pin 18ª in the clevis 18, the effective length of the link being adjustable by movement of the threaded nut 21ª.

The track 3, preferably of circular cross section, is at its one end pivotally mounted in the clevis of the adjustable link 21, and at its opposite end it is pivotally mounted in the clevis 15 of the bellcrank 12.

The clevis 19 of the bellcrank 17, is pivotally connected to the clevis 16 of the bellcrank 12 by the rod 22, which is provided with the turnbuckle 22ª, or with other means to adjust the rod length.

The tongue and clevis of the above mentioned pivotal connections may be reversed, or other proper form of pivots may be employed if desired.

The wheels 2 put the weight of the rakes on the track 3, and thus through the bellcrank 12, the adjusting screw 12ª and the lever 14 cause the roller 14ª to bear against the cam 7, not only through the weight supported by the bellcrank 12, but also through the action of the adjustable link 21, the bellcrank 17 and the rod 22 in supporting the opposite end of the track 3 and that end of the rakes.

It will now be seen that the cam 7 is designed to raise both ends of the track 3 when the rake 1 is at the upper end of its travel, and to keep it raised till the rake 1 has returned to the lower end of its travel, when the cam 7 then lowers the track 3 and keeps it in that position till the rake 1 has again reached the upper limit of its travel on the track 3, and so on.

It will be noted that the cam 7 has a very simple duty to perform, and hence has no contours likely to menace long life and smooth running.

The height of both ends of the track 3 may be altered as desired by the proper adjustment of the screw 12ª. And the angle of the track 3 with the slope of the vat 23 may be altered as desired by proper adjustment of the nut 21ª of the adjustable link 21, or by the adjustment of the length of the rod 22 by the turnbuckle 22ª.

These adjustments may be required under operating conditions, and they serve to give the machine even more adaptability to meet any and all requirements of the materials to be treated.

At the sand discharge end of the classifier, between the water level and the sand discharge lip 23ª, there is provided in the floor of the vat 23, the porous screen 24.

It is well known that a filter in this position will clog up and become practically useless in a very few minutes, for which reason there are none in use at the present time.

In my invention I use a screen that is porous; that is, the holes through it are perhaps several times the size of the largest particles fed to the classifier.

The result is that as the sand is raked up the slope and upon this porous screen, leaking of sand through the said screen takes place till the next stroke of the rakes carries it up over the discharge lip 23ª, and brings a new quantity of sand upon the screen.

I prefer that this porous screen 24 be made of a steel plate provided with slots or holes, though certain types of wire screens may be used if desired, or any other porous medium.

It has been observed that in reciprocating rake classifiers most of the water in the sand at the discharge lip lies in the first half inch directly above the floor of the vat. That is, in its movement by the rakes up along the slope from the water level the water in the sand quickly drains down to the bottom of the sand bed, as it naturally would in any sand bed.

It is this fact that has caused so many trials of a filter in the floor of a classifier, all of which trials have resulted in failure because the filter could not be kept clean, but quickly became so clogged as to be practically useless for drying the sand.

So, in my porous screen I do not attempt to extract the moisture from the sand, but merely separate the bottom of the sand bed which is wet, from the top of the sand bed which is relatively dry.

In my porous screen, the action of the rakes in raking the sand upward, forces a certain percentage of the sand through the openings of the screen and thus keeps them clean and free from clogging; and with the sand goes the water it contains and some of the water which drains down from the sand higher up.

So, not only a layer of sand at the bottom of the sand bed passes through my porous screen, but also the water which it contains. There is a proper relationship between the size of the screen openings, the size to which the material is ground and

the number of strokes per minute of the rakes. If this relationship is obtained, the sand seems to run through the openings of the screen a certain amount and then forms a bridge over each hole, which greatly checks the amount of sand that passes through the screen. This forms a sort of moving sand filter through which moisture may pass down to my porous screen in the short time remaining before the next rake stroke.

The sand and water which thus pass through my porous screen is returned by the sand pump 25 or other such means to the feed launder 26, and thus back to the classifier, or may be returned direct to the classifier without entering the feed launder 26.

So the leakage through my porous screen, both water and sand, is in closed circuit with the classifier, and only the dryer portion of the sand raked up the slope is allowed to pass over the sand discharge lip 23ª, after the wet portion of the sand has been separated from it.

When slow settling material is being treated, the crank pin 5 may be moved along the line X—X till the stroke of the rakes is long enough to make the required sand delivery at the low number of strokes per minute required to give the material time to settle between strokes.

In general, the slower the settling, the finer is the material, and the slower the contained water will drain to the bottom of the sand bed.

But, in my classifier, this material may be moved by a long stroke of the rakes which will not only give a long time between strokes to permit settling, but will also give a long time between strokes to permit proper draining of the water to the bottom of the sand bed.

Thus, my classifier may meet both the settling and the drying requirements of such material by proper adjustment of the stroke of the rakes, and the number of strokes per minute.

My porous screen may be inclosed and put under a vacuum if desired, but I prefer the construction shown, as the desired drying capacity, or separation of the wet sand from that relatively dry may generally be obtained by variation of the size of the screen openings and the number of strokes of the rakes. In any case, the essential points are that the screen must be porous enough so that the action of the rakes and of the sand passing through it, will keep it open, and it must be in closed circuit with the classifier, so that the material passing through the screen is returned to this or another classifier either directly or uultimately.

In treating material which it is not necessary to dry, my porous screen may be covered, or may be removed and the proper flooring put in in its place in the vat 23.

The overflow from the classifier takes place over the edge 27 of the vat 23, and over the edges 28 of the launder 29, which is let into the sides of the vat 23 till one or both edges are at or near the level of the edge 27, the passage of the launder 29 through the walls of the vat 23 being made water tight. This arrangement gives a great length of overflow edge and prevents channels and localized currents when a great quantity of material is being handled by the classifier.

The above described classifier is of the single type, but naturally it may be made in the duplex type as well, by the combination of two single classifiers and preferably alternate movements of their rakes, as anyone versed in classifiers will understand.

I am aware that the track 3 may be mounted integral with the rakes 1, and the rollers 2 may be mounted in the clevis 18 of the bellcrank 17 and in the clevis 15 of the bellcrank 12, so that the bellcranks will support the track 3 through the rollers 2, as illustrated in Figure 4.

But, this does not depart from the essence of my invention so I do not wish to confine the construction to the exact design described, but what I claim as new, and desire to protect by Letters Patent, is as follows;—

1. In a classifier, a sloping vat, bellcranks mounted upon said vat, a track supported by said bellcranks, rakes supported by said track, a shaft mounted on said vat and provided with a crank pin with adjustable throw, means connecting said crank pin and said rakes to reciprocate said rakes, a lever pivoted upon one arm of one of said bellcranks and provided with a roller, adjustment means between said lever and the bellcrank upon which it is mounted, and means forming a track for said roller and operated by said shaft to actuate the said bellcranks and raise and lower said rakes at predetermined points in their travel.

2. In a classifier, a sloping vat, a pair of bellcranks mounted upon said vat, a track suported by said bellcranks, rakes supported by said track, a shaft mounted on said vat and provided with a crank pin with adjustable throw, means connecting said crank and said rakes to reciprocate said rakes, a lever pivoted upon one arm of one of said bellcranks and provided with a roller, adjustment means between said lever and said bellcrank, adjustment means in the connection between the bellcrank and the other end of said track, and means operated by said shaft and acting through said lever, said adjustments and said bellcranks to raise and lower said track at predetermined points in the travel of the said rakes.

3. In a sloping tank classifier, rakes, supporting means, track and roller means extending longitudinally above the center line

of said rakes and connecting them with said supporting means, means to raise and lower said supporting means, and means to reciprocate said rakes and thereby impart relative movement to the track and roller elements of said centrally located track and roller means.

4. In a sloping tank classifier, rakes, supporting means, track and roller means centrally located above the longitudinal center line of said rakes and connecting them with said supporting means, means to reciprocate said rakes and to vary the length of said reciprocation, and means to raise and lower said supporting means at predetermined points in the travel of said rakes.

5. In a classifier, a vat, bellcranks mounted above the vat, rakes, roller and track connections in a single line above the longitudinal center line of said rakes and forming a self-aligning connection between said rakes and said bellcranks, means to reciprocate said rakes and to adjust the travel of said reciprocation, and means to oscillate said bellcranks and thereby raise and lower said rakes at predetermined points in their reciprocation.

6. In a classifier, a sloping vat, a track mounted centrally above said vat, rakes, bellcranks mounted above said vat, rollers adapted to cooperate with said track and form a central, self-aligning connection between said rakes and said bellcranks, means to reciprocate said rakes, and means to oscillate said bellcranks and raise and lower said self-aligning connection at predetermined points in the travel of said rakes.

7. In a classifier, a sloping bottomed tank provided with an overflow, a sand discharge above the level of the overflow, and feed means intermediate the overflow and the sand discharge, bellcranks pivotally mounted above said tank, a power driven cam, rakes, track and roller means located above the longitudinal center line of said rakes and forming a self-aligning connection between the rakes and the said bellcranks, means operated by said cam and operating said bellcranks to raise and lower said rakes, a crankpin attached to the side of said cam and radially adjustable thereon, and means connecting said crankpin and said rakes to reciprocate said rakes.

8. In a classifier, a sloping bottomed tank provided with an overflow, a sand discharge above the level of the overflow, and feed means intermediate the overflow and the sand discharge, bellcranks pivotally mounted above said tank, a power driven cam, rakes, track and roller means located above the longitudinal center line of said rakes and forming a self-aligning connection between the rakes and the said bellcranks, means operated by said cam and operating said bellcranks to raise and lower said track and roller connections and said rakes, and a crankpin attached to said cam and connected to said rakes to reciprocate them.

9. In a sloping tank classifier, bellcranks pivotally mounted above the tank, a power driven cam, rakes, centrally located self-aligning roller and track connections between the longitudinal center line of said rakes and said bellcranks, means operated by said cam and operating said bellcranks to raise and lower said connections and said rakes, and means mounted on said cam and connected to said rakes to reciprocate them.

10. In a sloping tank classifier, bellcranks pivotally mounted above the tank, a power driven cam, rakes, self-aligning roller and track connections between the longitudinal center line of said rakes and said bellcranks, means operated by said cam and operating said bellcranks to raise and lower said connections and said rakes, and means mounted on said cam and connected to said rakes to reciprocate them.

11. In a sloping tank classifier, bellcranks pivotally mounted above the tank, a power driven cam, rakes, self-aligning roller and track connections between the longitudinal center line of said rakes and said bellcranks, means operated by said cam and operating said bellcranks to oscillate them, and means on said cam and connected to said rakes to reciprocate them.

12. In a classifier, a single movable track, means for moving the track, and a movable rake supported by the track.

13. In a classifier, a sloping, single, movable track, means for bodily lifting the track at intervals, and a movable rake supported by the track.

14. In a classifier, a sloping, single, movable track, means for varying the slope of the track and a movable rake supported by the track.

15. In a classifier, a single movable track, means for moving the track and a movable rake supported by the track, in combination with a trough adjacent the bottom of which the rake travels in one of its movements.

16. In a classifier, a sloping, single, movable track, means for bodily lifting the track at intervals, and a movable rake supported by the track, in combination with a sloping trough, adjacent the bottom of which the rake traverses in one of its movements.

17. In a classifier, a single movable track, means for moving the track, a movable rake supported by the track and means to vary the length of the movement of the rake.

18. In a classifier, a sloping, single, movable track, means for bodily lifting the track at intervals, and a movable rake supported by the track and provided with means to vary the length of its movement.

19. In a classifier, a sloping single movable track, means for varying the slope of

the track, and a movable rake supported by the track and provided with means to vary the length of its movement.

20. In a sloping tank classifier, a tank, rakes, supporting means mounted upon said tank, track and roller means extending longitudinally above said rakes and connecting them with said supporting means, means to raise and lower said supporting means, and means to reciprocate said rakes and thereby impart relative movement to the track and roller elements of said track and roller means.

21. In a sloping tank classifier, rakes, supporting means, track and roller means located above the said rakes and connecting them with said supporting means, means to reciprocate said rakes and to vary the length of said reciprocation, and means to raise and lower said supporting means at predetermined points in the travel of said rakes.

22. In a classifier, a vat, bellcranks mounted above the vat, rakes, roller and track connections above said rakes and forming a self-aligning connection between said rakes and said bellcranks, means to reciprocate said rakes and to adjust the travel of said reciprocation, and means to oscillate said bellcranks and thereby raise and lower said rakes at predetermined points in their reciprocation.

23. In a sloping tank classifier, bellcranks pivotally mounted above the tank, a power driven cam, rakes, self-aligning roller and track connections between the said rakes and the said bellcranks, means operated by said cam and operating said bell cranks to raise and lower said connections and said rakes, and means mounted on said cam and connected to said rakes to reciprocate them.

24. In a sloping tank classifier, bellcranks pivotally mounted above the tank, a power driven cam, rakes, self-aligning roller and track connections between said rakes and said bellcranks, means operated by said cam and operating said bellcranks to oscillate them, and means on said cam and connected to said rakes to vary the length of said reciprocation.

25. The process of classifying material containing granular elements to obtain a relatively dry discharge, which consists of introducing the material into a sloping tank provided with an overflow for liquid and the finer parts of said material moving the material which settles, upward along the slope of said tank and above the level of the said overflow, and then over a pervious member, the perforations of which are larger than the largest granules of said material, whereby a lower wet layer of said material will pass through said pervious member, and the relatively dry material above the said lower layer will be delivered beyond said pervious member.

26. The process of classifying material containing granular elements to obtain a relatively clean, dry discharge, which consists of introducing the material into a sloping tank provided with an overflow for liquid and the finer parts of said material, moving the material which settles, upward along the slope of the tank and above the level of said overflow, and then over a pervious member, the perforations of which are larger than the largest granules of said material, whereby a lower wet layer of said material will pass through said pervious member and be conveyed back to said tank, and the relatively dry material above said lower layer will be delivered beyond said pervious member.

27. The process of classifying material containing granular elements to obtain a relatively dry discharge, which consists of introducing the material into a tank provided with a liquid bath, moving the material which settles, out of the bath and then over a pervious member, the perforations of which are larger than the largest granules of said material, whereby a lower wet layer of said material will pass through said pervious member, and the relatively dry material above the said lower layer will be delivered beyond said pervious member.

28. The process of classifying material containing granular elements to obtain a relatively dry discharge, which consists of introducing the material into a tank provided with a liquid bath, moving the material which settles, out of the bath and then over a pervious member, the perforations of which are larger than the largest granules of said material, whereby a lower wet layer of said material will pass through said pervious member and be conveyed back to the bath, and the relatively dry material above the said lower layer will be delivered beyond said pervious member.

ROLLAND S. TROTT.