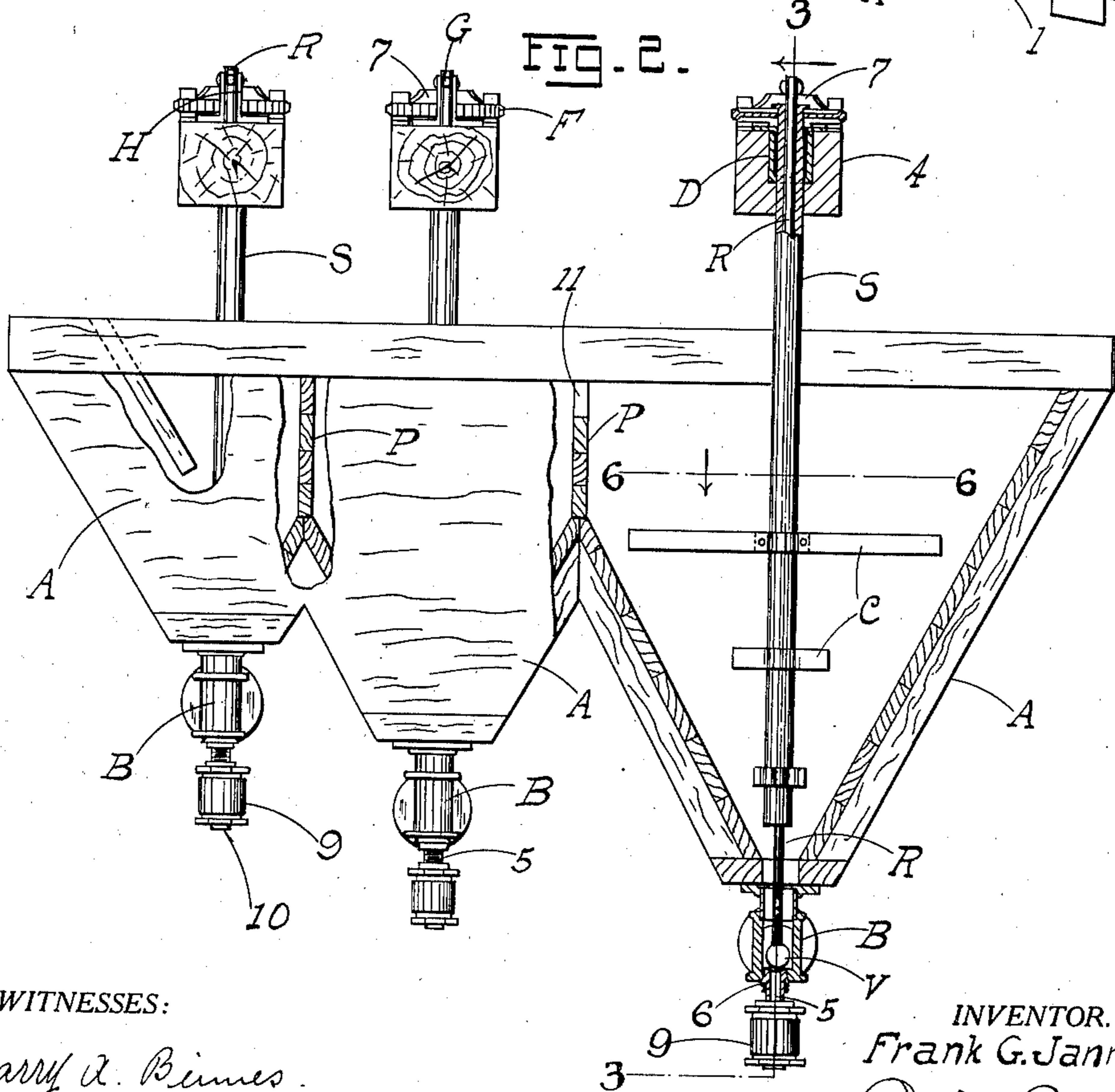
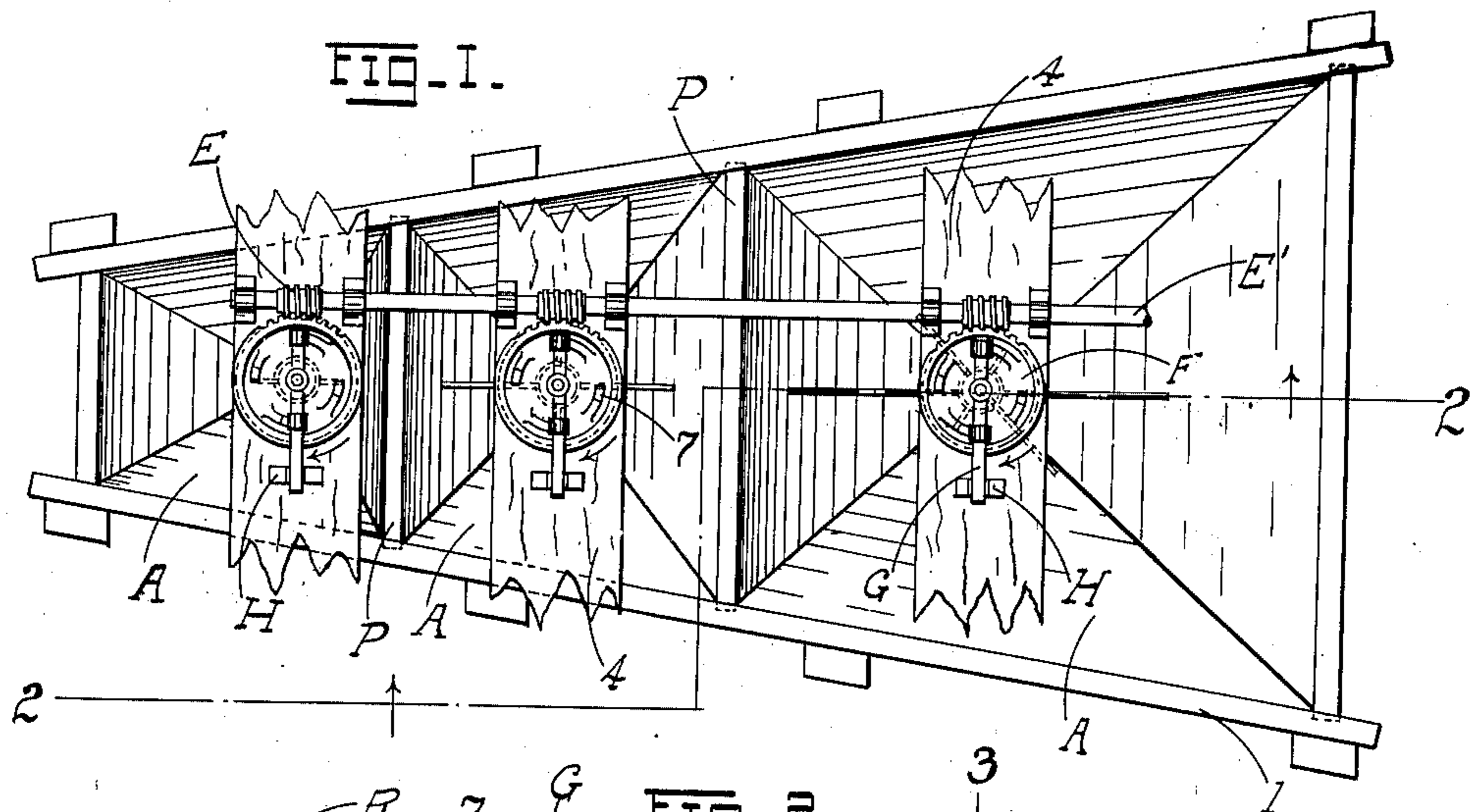


928,455.

2 SHEETS—SHEET 1.



WITNESSES:

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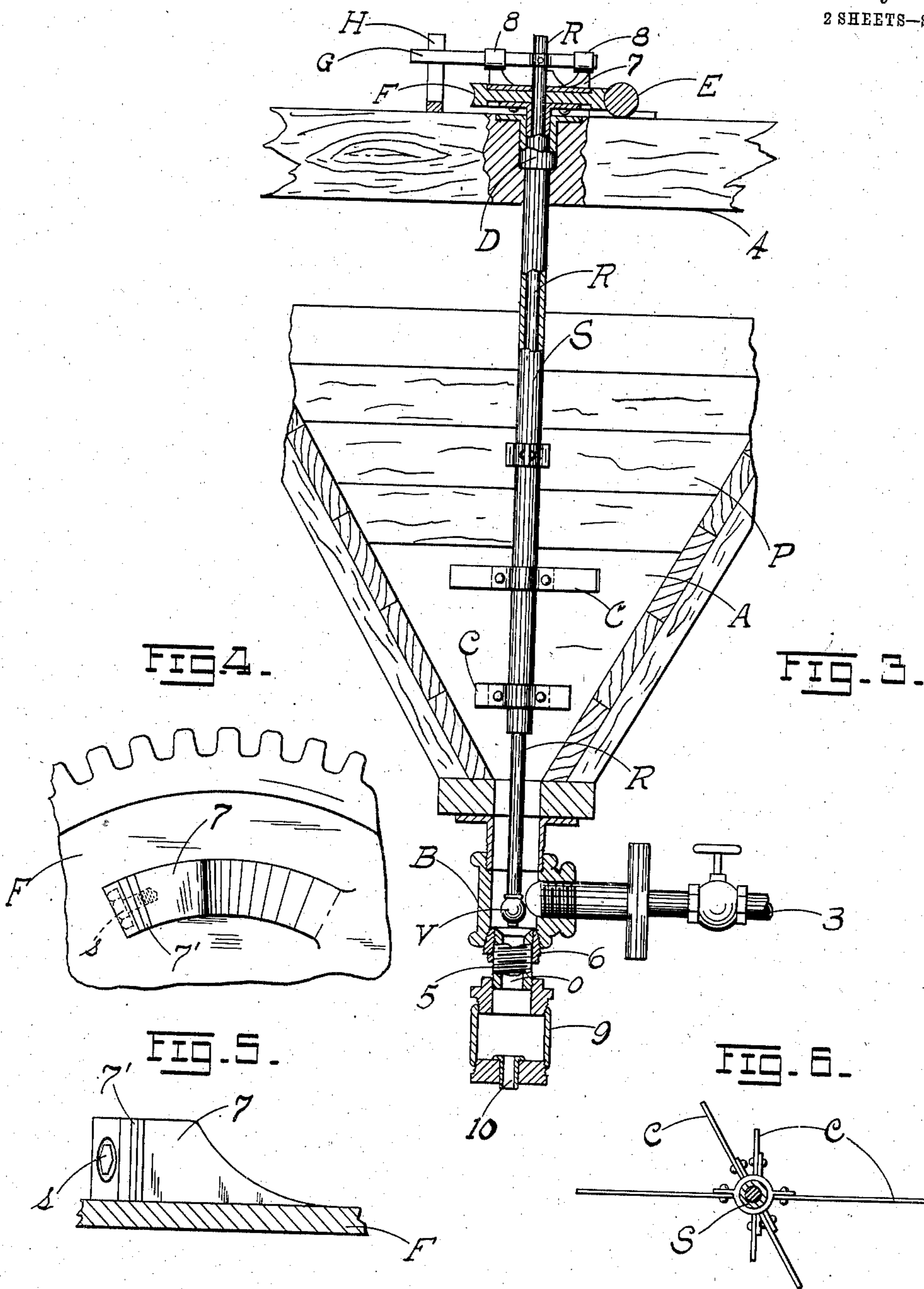
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APPLICATION FILED DEC. 22, 1908.

Patented July 20, 1909.
2 SHEETS—SHEET 2.



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UNITED STATES PATENT OFFICE.

FRANK G. JANNEY, OF SALT LAKE CITY, UTAH.

ORE-CLASSIFIER.

No. 928,455.

Specification of Letters Patent.

Patented July 20, 1909.

Application filed December 22, 1908. Serial No. 468,755.

To all whom it may concern:

Be it known that I, FRANK G. JANNEY, 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 Ore-Classifiers, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part hereof.

My invention has relation to improvements in ore-classifiers; and it consists in the novel construction and arrangement of parts more fully set forth in the specification and pointed out in the claims.

In the drawings, Figure 1 is a plan of a series of ore-classifiers, showing my invention applied thereto; Fig. 2 is a vertical longitudinal elevation and section on line 2—2 of Fig. 1; Fig. 3 is an enlarged vertical cross section on line 3—3 of Fig. 2; Fig. 4 is a top plan of a portion of the worm-gear carrying the adjustable cams or tappets; Fig. 5 is a side elevation of Fig. 4, the body of the wheel being in section; and Fig. 6 is a horizontal section on line 6—6 of Fig. 2.

The present invention is an improvement in what is known as hydraulic ore-classifiers wherein the finely ground ore or pulp accompanied by such water as was used in connection with the grinding operation is caused to flow into a series of hoppers or containers, which receive a stream of water in such a way as to cause the ore entering them to separate into portions decreasing progressively in weight with the successive hoppers, until the last hopper of the series is reached whence the slimes pass off to the proper concentrating apparatus. The purpose of this preliminary classification of the ore is to separate the coarse from the fine particles thereby facilitating the subsequent process of concentration, each grade of ore thus classified requiring as a rule a different treatment during concentration.

A classifier may be made up of one or more compartments or containers which need not be limited to any particular form, those prevailing being conical or of the "spitzkasten" or pyramidal type, though they may be cylindrical, prismatic, or in fact, any shape so long as they subserve their purpose, it being understood that the ore masses within them be given the necessary opportunity to settle through a rising column of water according

to the falling velocities of the various masses in such water column.

The object of the present improvement is to construct a classifier in which the pulp while falling in the rising water column shall be kept thoroughly stirred, thereby avoiding the formation of narrow channels in a mass of ore tending to bank against the sides of the classifier compartment or hopper.

A further object is to increase the capacity of the classifier to a maximum by making it possible to take advantage of a gradually widening column of rising water through which the ore particles flow according to their mass and gravity, the heavier and larger particles being thus found nearer the bottom of the column.

A further object of the invention is to provide means for causing an intermittent discharge of the classified material whereby not only a more complete stratification and a more perfect classification results, but the quantity of water required for classification is very much reduced.

A further object is to provide means for maintaining at all times a slight upward current to prevent the escape of any slime with the discharge of the classified pulp from the bottom of the classifier.

A further object is to provide means for keeping the spitzkasten compartments submerged to a sufficient depth below the intake and overflow that there will be no appreciable current above the partitions separating the compartments.

A further object is to provide means for regulating the quantity of water discharged with the classified pulp thereby preventing blocking of the classifier, and in fine, to introduce further and other details of construction the advantages of which will be apparent from a detailed description of the invention which is as follows:—

Referring to the drawings, in which Figs. 1 and 2 show a conventional form of a series of ore-classifier hoppers or spitzkasten well known in the art, and which will herein be referred to only in a general way, the classifier consists of a long tapering box or trough 1, which is divided into a series of successive compartments, hoppers or containers A progressively increasing in depth and capacity toward the wide end of the box, this being the end at which the slime-water is discharged and toward which the pulp undergoing treat-

ment is directed by the general flow of the water from one compartment to the next compartment of the series. The object of the appliance is to separate the coarser from the finer particles in concentrating work, so that material of approximately equal sizes may be taken off and concentrated on different machines. In operation, the finely ground ore or pulp flows from the small toward the large end of the classifier or box, accompanied by such water as was used in connection with grinding it, and which is sufficient to advance such portion of it as is desired, through the various compartments. At the lower point or apex of each inverted pyramid (or cone) this being the form of compartment or hopper herein shown, is a tee or equivalent connection B, having a comparatively large opening in the side and at the top, and a small opening *o* at the bottom. The water pipe 3 connects at the side opening and clear water is turned in through this discharge to the bottom of the hopper or container A, whereupon the ore particles in the container coming in contact with this rising water column, the heavier particles settle through this rising column and pass out with some of the clear water through the bottom small opening *o* in the tee. The lighter particles are constantly raised by the rising column and pass over the first baffle or partition P into the next container or compartment, the same action taking place in the successive compartment until the finest sands are taken out of the largest compartment of the classifier, the extremely fine material or slimes flowing from the last compartment at the end of the apparatus, and passing to the proper concentrating apparatus (not shown). Of course each compartment or hopper A is a complete classifier in itself, so that a description of my present improvement in connection with a single compartment will answer for all, and I will accordingly confine the description to such single compartment.

The improvement may be described as follows:—Mounted centrally within the compartment or container A is a hollow vertical rotatable shaft S to which are affixed series of paddles or stirrer arms C progressively increasing in length with the inclination of the walls of the compartment. The shaft does not quite reach to the bottom of the compartment. It is supported at its upper end in a timber 4 suspended in any suitable manner above the compartment, a suitable bearing D being provided therefor in the timber. The shaft is propelled by a worm pinion E (on drive-shaft E') engaging a worm-gear F secured to the upper end of the shaft, and may be rotated from any source of power (not shown) at any desired speed. The purpose of this appliance is to keep the pulp in the compartment thoroughly stirred; so that

the rising water column will not have a tendency to form channels, and more particularly so that the pulp itself will not bank against the sides of the classifier compartment and leave only a narrow channel in the center for the classifying or stratifying column, a condition which obtains in classifiers where no provision is made for stirring the contents of the compartment. In the ordinary classifier where the ore has banked on the sides, if the column of water be withdrawn, the ore will slide down the sides into the bottom, and when the upward pressure given the water column is considerable this tendency to bank in the ordinary classifier is a very great detriment. The revolving paddles or arms C here introduced keep this material in motion and thus produce a gradually widening column of rising water through which the ore particles flow, according to their mass and gravity, the heavier and larger particles being thus found nearer the bottom of the column.

A further feature of the present improvement consists in the introduction of means for effecting an intermittent or periodic discharge of the ore-contents of the classifier. This consists of a rod or stem R loosely operating in the hollow shaft S, the lower end of the stem being provided with a valve V which controls the discharge port *o* formed in the tee B, or more properly in the adjustable valve-seat 5 screwed in the gland or ring 6 carried by the tee. To the upper projecting end of the valve-stem R is secured an arm G, one end of which projects beyond the periphery of the gear-wheel F and is guided between the fork members or bracket arms H which are of sufficient height to allow the arm G the necessary vertical movement in the reciprocations to which it is subjected in operating the valve V. Disposed along the top face of the gear-wheel F are a series of cams or tappets 7 which in the rotation of the gear-wheel impinge in pairs against the arm G (the latter being provided with suitable formations or rings 8 which the tappets directly impinge) and thereby lift the stem R and its valve V. After the cams have passed off the arm G, the rod R with its valve V drops by gravity to its lowest position, in which it may completely close the discharge port *o* or leave a slight passage-way between the valve and its seat according to the adjustment of the plug 5. The discharge of the classified material thus becomes intermittent instead of continuous as in the old form of classifiers. When the valve V closes the port *o* all the classifying water as it rises through the water inlet thus becomes available for purposes of classification and thus serves to stratify the agitated body of ore in the compartment. Experiment and experience have shown that the stratification is much more complete, and the classification more perfect under an

intermittent discharge of the pulp than is possible where the pulp is discharging continuously. By the use of the intermittent discharge, the quantity of water necessary for classification is materially decreased.

The quantity of sand or classified material discharged depends of course on the interval during which the valve V remains open, and this is timed by the period of engagement between the tappet end of the cam 7 and the arm G raised by said cam. This end is made adjustable so as to give a long opening and short closing, or vice versa. The adjustment of the cam to accomplish the variable relations between the periods of opening and closing of the valve V referred to, is accomplished by means of a series of adjusting blocks 7' which are secured to the tappet end of the cam by means of a cap screw s. The number of blocks used of course will depend on the relative lengths of time desired for the open and closed positions of the valve V. The greater the number of blocks, the longer the valve remains open, since the tappet thus remains longer in engagement with the arm G. After the time adjustment is once finally effected, the stroke may be lengthened or shortened as desired by a proper adjustment of the valve-seat or plug 5.

Experience has further shown that while the valve V is in open position, there is always a tendency for some of the slime to be drawn out with the discharge of the classified material escaping through the outlet o; and to avoid such a result I make suitable provision for maintaining a slight upward current in the compartment during such discharge. This has the effect of holding the small particles of slime in suspension so that the danger of being pulled or drawn out with the heavy material is entirely eliminated. This result I accomplish as follows: To the lower end of the valve 5 is screwed a small chamber 9, which may be termed a retarding chamber the bottom of which supports a small bushing 10. The passage in the bushing as compared with that of the opening o is somewhat less or constricted so that the flow therethrough is comparatively retarded, and this retarding reacts sufficiently to divert upwardly a portion of the hydraulic current from the pipe 3. This upward current of course may be regulated by substituting bushings having different sized openings, until the desired result is secured.

One of the objects of the present invention is to dispense with all currents that are ordinarily found in classifiers; and in this connection it may be stated that the compartments or spitzkasten are kept submerged to a sufficient depth below the intake and overflow, so there will be no appreciable current above the partitions P separating the same. This depth of submergence can be regulated by lowering or raising the height of the parti-

tion, each partition being built up of a series of boards or sections inserted in grooves 11 on the sides of the compartments. By removing or adding on a board the depth of submergence of the particular compartment can be varied for the purpose desired. In any case, enough boards are always employed to make certain that no appreciable current exists above the top board or top of the partition thus built up.

The drawings obviously show only one form of construction under which my invention may be carried out, for it is apparent that I am not restricted to any special design of classifier, or any specific means of agitating or stirring the contents thereof, or any specific means for effecting the intermittent discharges of the pulp. By virtue of such intermittent discharge all the water introduced at the bottom becomes available for classification a portion of the time, such portion being the time when the valve V is seated. In ordinary practice where a continuous discharge is taking place, only a portion of the water so introduced is available for classification, the remainder continuously discharging with the classified material. With my improvement the discharge may be so regulated that the classified pulp may be discharged with a very small amount of water, whereas in the old style, if it is attempted to discharge a thick pulp, or, in other words, one with a small percentage of water flowing with it, the classifier will become blocked unless it has the constant attention of the operator. As stated, the discharge orifice o may be regulated by adjusting the position of the plug 5 relatively to the valve V, so that the vertical travel or reciprocation of the valve-stem R need not be varied.

Having described my invention, what I claim is:—

1. An ore-classifier comprising a suitable container, means for directing thereinto through the bottom thereof rising columns of water, there being a discharge port for the container, a rotatable mechanical agitator comprising a hollow shaft, and stirrer arms located within the container for stirring the contents during the classifying operation, a stem passing loosely through the hollow shaft, a vertically reciprocating valve at the bottom of the stem beyond the shaft for controlling the discharge port aforesaid, and devices on the stem and agitator intermittently coöperating to effect an intermittent unseating of the valve and a corresponding discharge of the contents of the classifier.

2. An ore-classifier comprising a suitable container, means for directing thereinto rising columns of water, there being a bottom discharge port for the container, a hollow rotatable shaft within the container mounted over the discharge port, a series of stirring

arms carried by the shaft and operating within the container, driving means at the upper end of the shaft, a series of tappets on such driving means, a stem loosely passing through the hollow shaft, a valve at the lower end thereof beyond the shaft for controlling the discharge port, an arm at the upper end of the stem adapted to be struck by the tappets whereby the stem and valve are intermittently lifted for effecting periodic discharges of the contents of the container during the classifying process.

3. An ore-classifier comprising a suitable container, means for directing thereinto an upward current of water, a valve for intermittently discharging the contents of the container, and means positioned beyond the valve in the path of the discharging contents for retarding the flow thereof and thereby maintaining a slight upward current in the container during the periods of discharge.

4. An ore-classifier comprising a suitable container, means for directing thereinto an upward current of water, means for intermittently discharging the contents of the container, and a retarding chamber interposed in the path of the discharging contents below the discharging means whereby a slight upward current is maintained in the container during the periods of discharge.

5. An ore-classifier comprising a suitable container, means for directing therein an upward current of water, means for intermit-

tently discharging the contents of the container, a retarding chamber in the path of the discharging contents below the discharging means, and a bushing at the bottom of the chamber, having a comparatively constricted passage for the escape of the material, said constriction resulting in the formation of a slight upward current in the container during the periods of discharge.

6. An ore-classifier comprising a suitable container having a valve-controlled discharge opening, means for directing into the container an upward current of water, a suitable agitator, a series of adjustable tappets coupled to the agitator, and intermediate connections between the tappets and valve for opening and closing the latter, and adjusting the relative times between such opening and closing.

7. A classifier having a reciprocating discharge valve, a stem coupled to the valve, an arm on the stem, a traveling cam having a tappet end for periodically engaging the arm and shifting the valve in one direction, and blocks for varying the available length of the tappet end of the cam for the purpose set forth.

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

FRANK G. JANNEY.

Witnesses:

J. E. FLIEGE,
A. C. ENSIGN.