No. 803,550. PATENTED NOV. 7, 1905.

J. M. CALLOW.

SUBMERGED SCREEN SIZER AND SEPARATOR.

APPLICATION FILED FEB. 10, 1905.

4 SHEETS—SHEET 1.

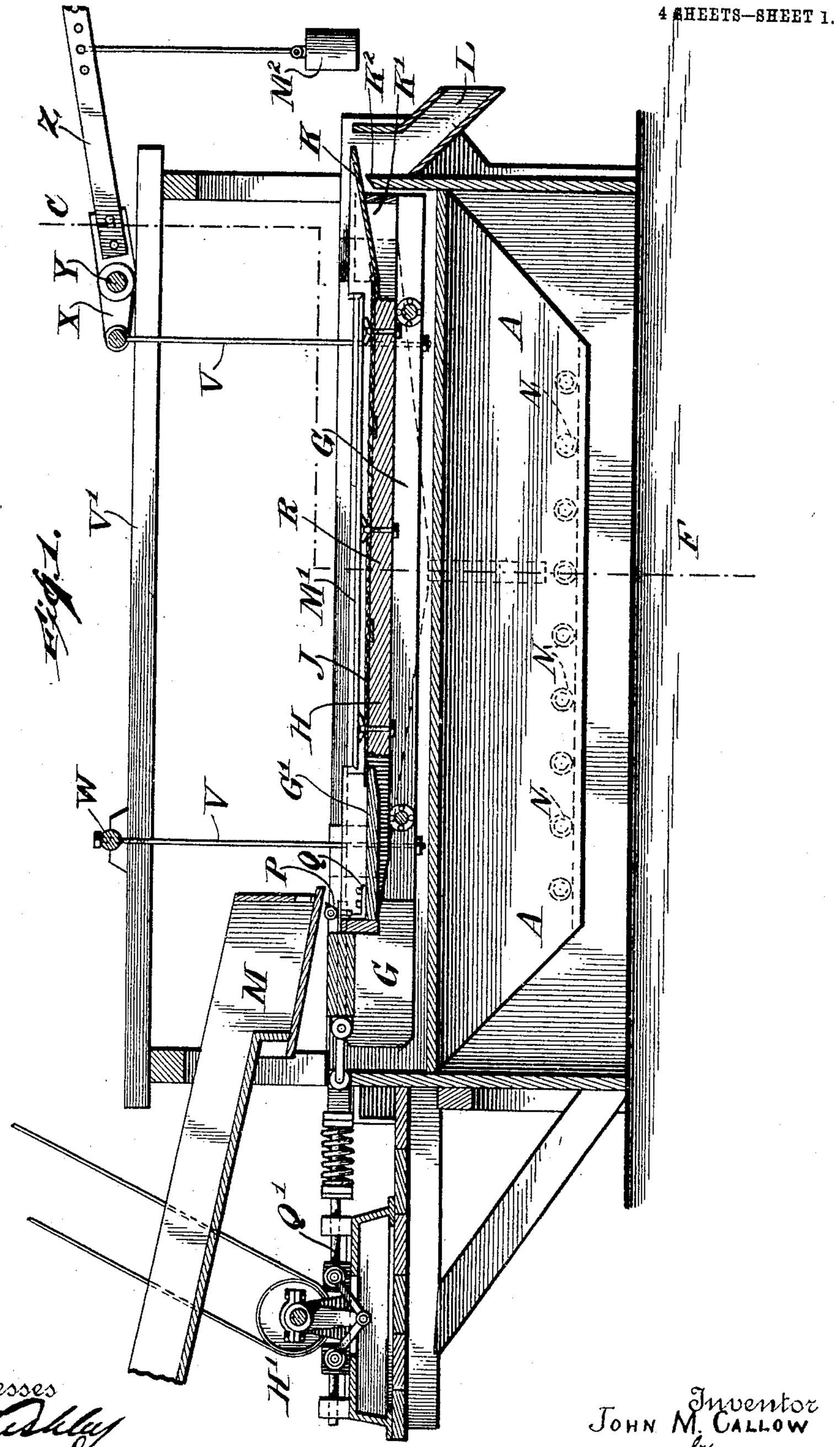

Fig. 1.

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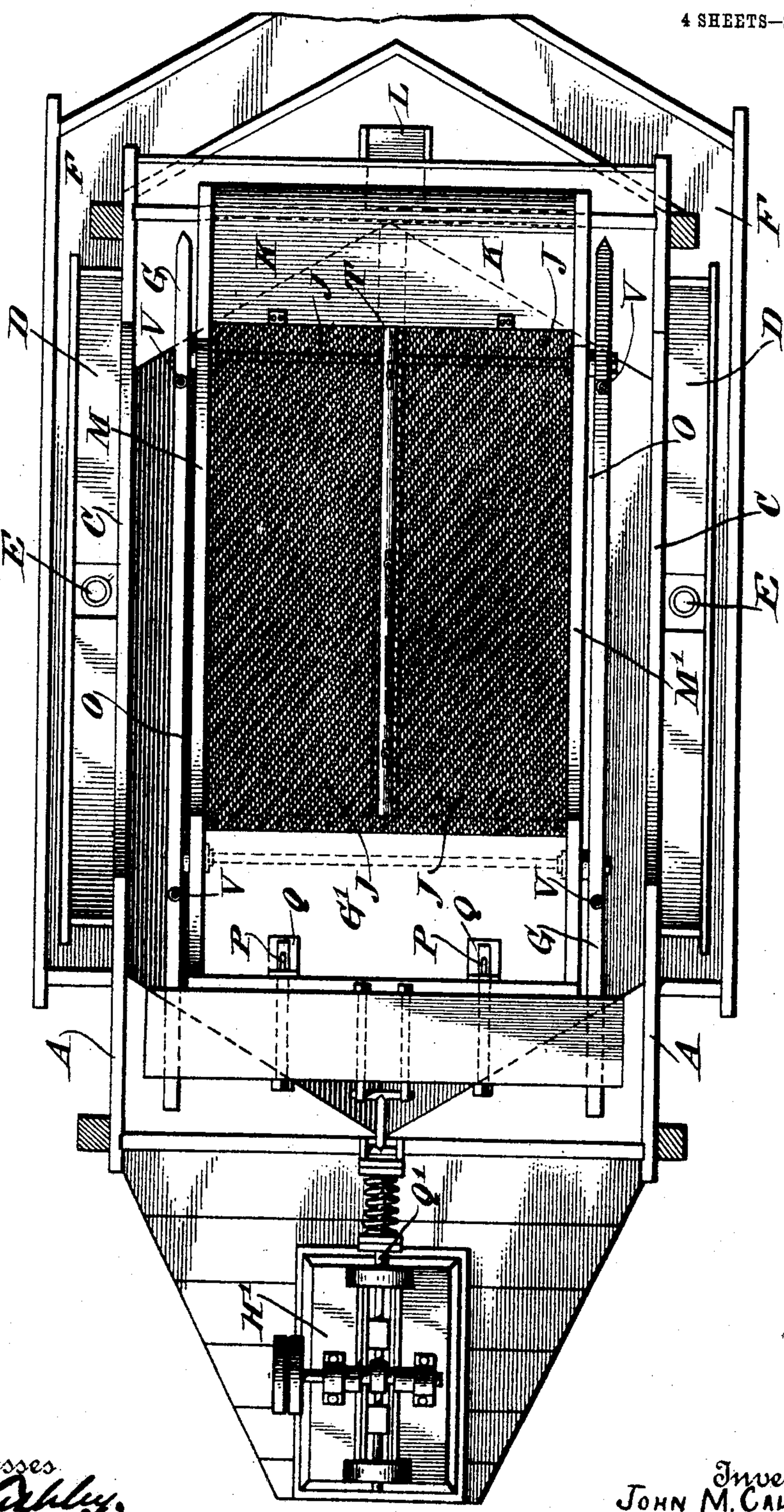

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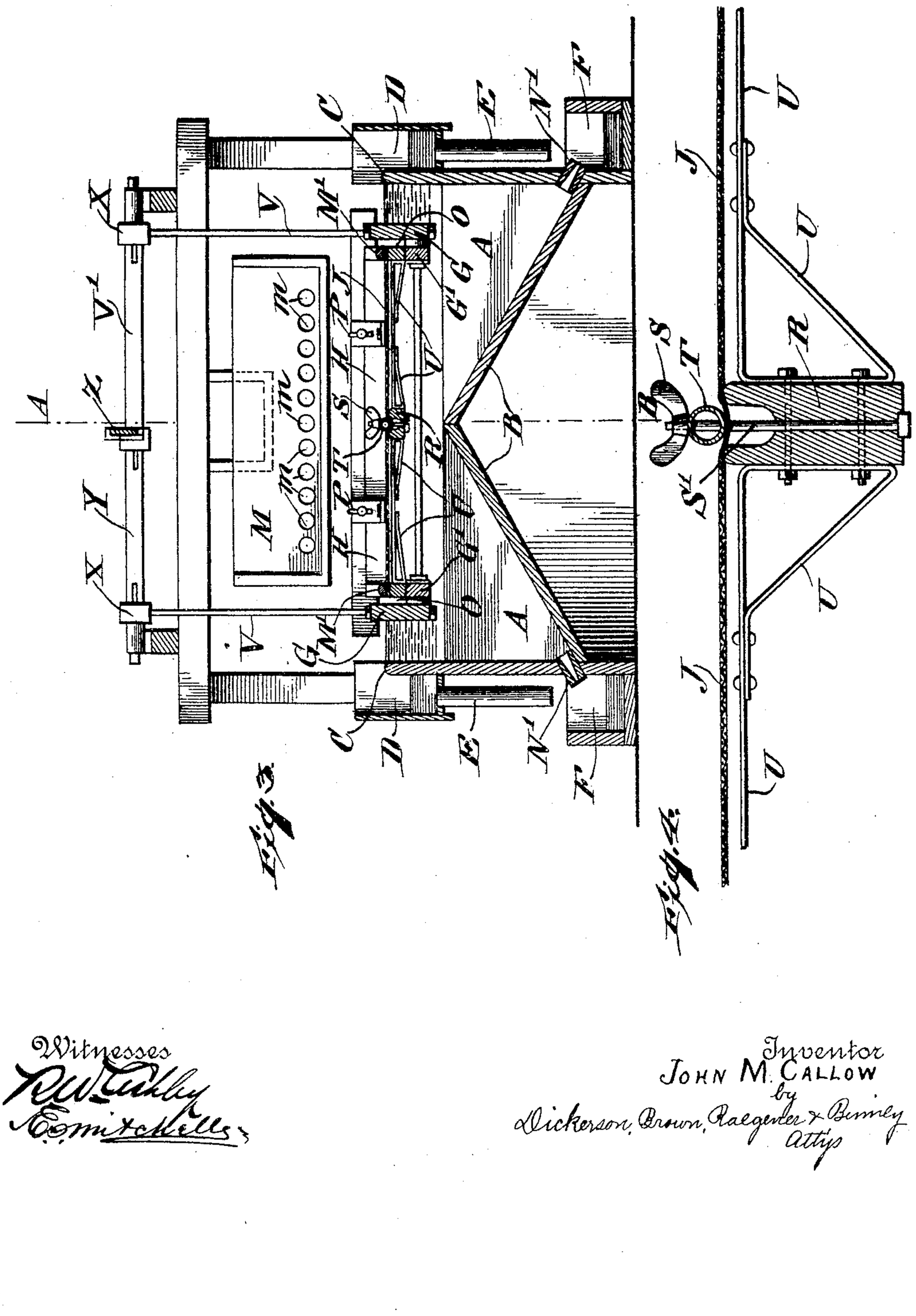
4 SHEETS—SHEET 3.



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4 SHEETS—SHEET 4.

Fig. 5.

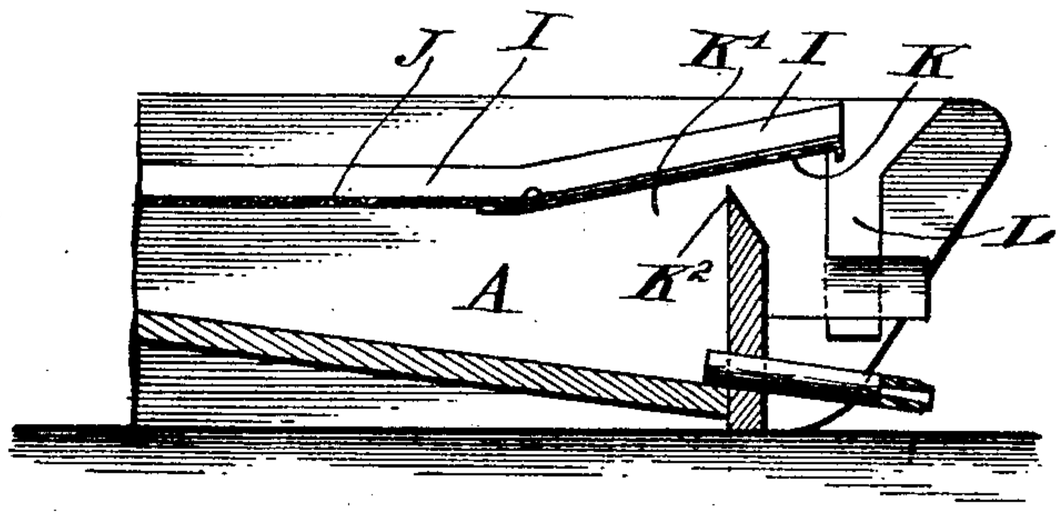


Fig. 6.

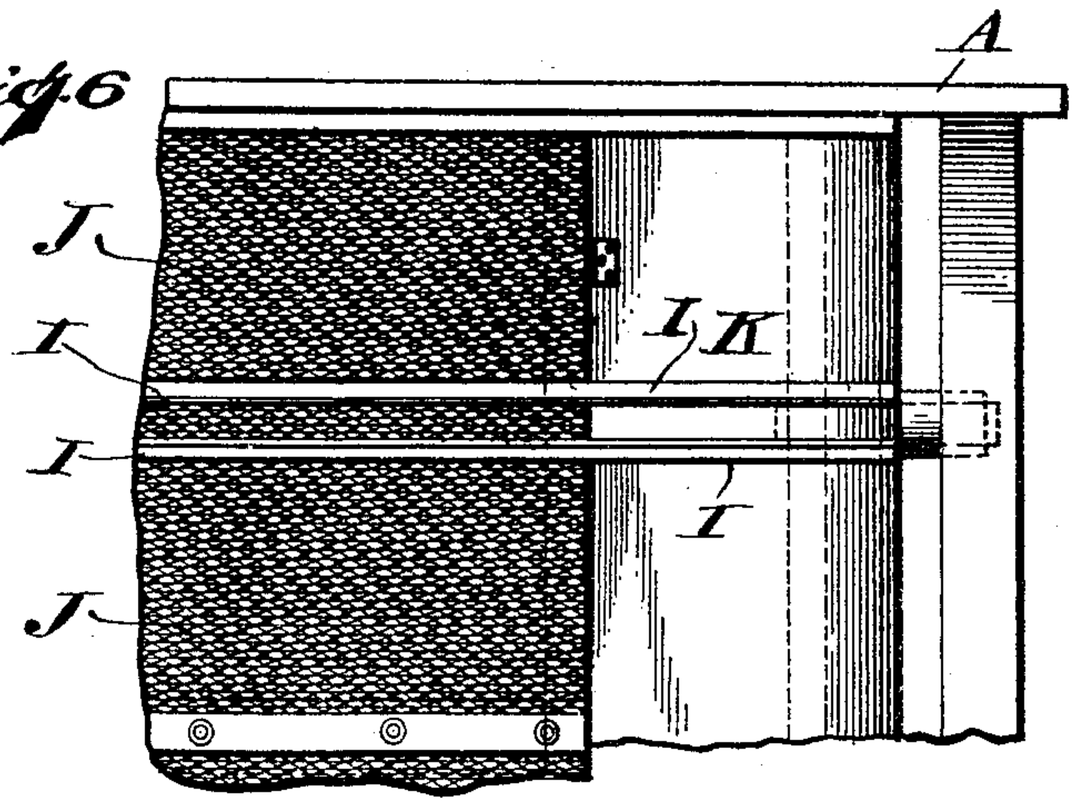
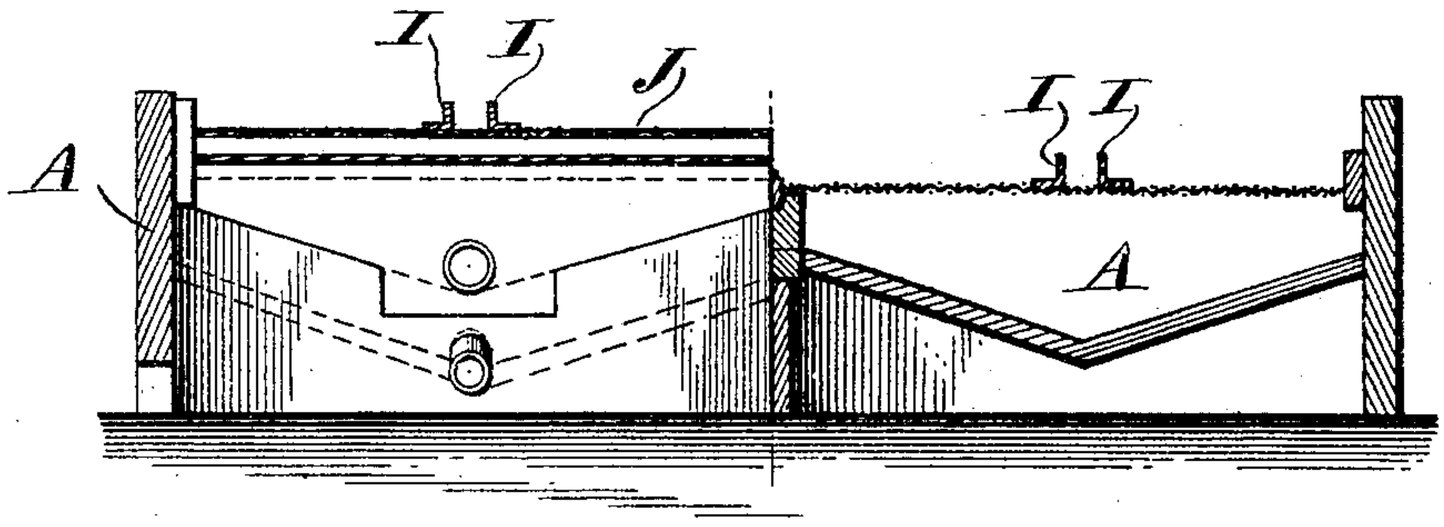


Fig. 7.



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UNITED STATES PATENT OFFICE.

JOHN M. CALLOW, OF SALT LAKE CITY, UTAH.

SUBMERGED-SCREEN SIZER AND SEPARATOR.

No. 803,550. Specification of Letters Patent. Patented Nov. 7, 1905.

Application filed February 10, 1905. Serial No. 245,087.

To all whom it may concern:

Be it known that I, JOHN M. CALLOW, a subject of the King of Great Britain, and a resident of Salt Lake City, Utah, have invented certain new and useful Improvements in Submerged-Screen Sizers and Separators, of which the following is a specification accompanied by drawings.

This invention relates to improvements in screening-machines, and more particularly to that class of screening-machines having a flat perforated sheet or screen-cloth lying in a horizontal or inclined position on which the ore or other material to be screened is placed. In such machines, by means of suitable shaking mechanism, pieces small enough to pass through the holes are shaken through and the oversize portions are retained and by the action of the machine are continuously discharged, thus effecting a separation of the fines from the coarse.

The invention has special reference to the screening of wet material, although the machine may be utilized with any kind of material to which it is applicable.

Many difficulties have heretofore been met with in screening wet material of any kind on horizontal or inclined screens, the principal of these difficulties consisting of the fact that as soon as the pulp strikes the screen the water passes through, leaving the ore in such a plastic condition that perfect work is impossible even when assisted by an excessive vibration of the screen or the addition of large volumes of water to keep the pulp in a dilute state.

This invention has for its objects to avoid the disadvantages attendant upon the use of screening apparatus of the character referred to, obviate the difficulties heretofore met with, improve such apparatus, and render it much more efficient in operation.

To these ends the invention consists of apparatus for carrying out the above objects embodying the features of construction, combinations of elements, and arrangement of parts having the general mode of operation substantially as hereinafter fully described and claimed in this specification and shown in the accompanying drawings, in which—

Figure 1 is a longitudinal vertical sectional view of the machine on the line A B of Fig. 3. Fig. 2 is a plan view of the machine. Fig. 3 is a transverse sectional view of the same on the line C F of Fig. 1. Fig. 4 is an enlarged detail transverse sectional view of the device for tightening the screen-cloth. Fig. 5 is a longitudinal sectional fragmentary view of a modified form of the apparatus. Fig. 6 is a fragmentary plan view of the same. Fig. 7 is a transverse sectional view of the same, taken partly through the body of the screen-sizer and partly through the oversize discharge.

Referring to the drawings, A represents a tank or box containing the body of water in which the screening is done. In this instance it is preferable to move the screen J relatively to the box A, although other constructions and arrangement of apparatus may be found suitable for carrying out the objects in view without departing from the spirit of the invention. Contained in the tank A is a floating frame G, suitably connected, as by means of the rods V, with the superstructure V′ and also connected by a connecting-rod Q′ to the apparatus H′ for imparting a differential motion to the frame. The apparatus H′ may be of any suitable and well-known character for imparting a progressive feeding motion to the screen, and any suitable mechanism may be substituted for that shown in the diagram, the apparatus shown being preferably a "Wilfley" motion. The screen-frame H, as shown, is carried by the floating frame G, and the screening-cloth J is stretched upon the screen-frame. The screen, as shown, terminates in the inclined oversize discharge-lip K.

The screen-frame is suitably secured to the floating frame G, as shown in this instance, said screening-frame resting upon the ledges G′, which form a part of the floating frame G, and the bolts and keys P and angle Q firmly secure the screen-frame in place. By drawing out the keys the screen-frame may be quickly loosened and readily removed for repairs or a duplicate frame inserted in its place.

The box A is provided with a sloping bottom B, at the junction of which with the sides of the tank are arranged a series of orifices N, which may be provided with adjustable gates or reducing-plugs N′ in accordance with the quantity of water used. Along the sides of the machine are provided overflow-weirs C. Gutters D lead from the weirs C to the downtake-pipes E and thence to the launders F.

The screen-frame H is preferably provided with a blind-feed sole-plate G at its receiving end, on which the ore and pulp fall from the

feed-box M and over which it spreads before reaching the delicate screen-cloth. The frame H is also provided with projecting sides or edges M′, each of which is cut down or recessed for a distance equal to the length of the screen-cloth. The edges are then preferably rounded off to form weir-overflows over which the water may flow down through the longitudinally-extending openings or slots O in the floating frame G, and from thence into the tank A. The overflow-weirs C are substantially on the same level as the screen-cloth J, so that the surface of the screen-cloth is approximately coincident with the surface of the water in the tank.

According to this invention the screen-surface in the tank is always kept submerged in a quiescent water-bath, so that the separation of the fines from the course shall take place, as it were, in a water-bath. To prevent the ore from rushing over the end before it has had time to screen properly, the inclined and pivoted lip K is provided, which may have suitable means in connection therewith for altering its angle of inclination. The top edge of the lip K is preferably somewhat above the water-level, but instead the whole length of the screen may be slightly inclined, in which case the discharge end of the screen will be above the level of the water in the tank. The screen may, as shown, be supported in the tank for horizontal movement and may be arranged horizontally or else inclined, as described; but in this instance and to illustrate the invention it is arranged substantially horizontally.

In screening ores it is very desirable that the oversize ore shall pass from the screen substantially free from muddy water and slime, and this is another reason for making the discharge end of the screen higher than the water-level in the tank, it being understood that the inclined lip K when employed is to be considered a part of the screen for this purpose. The oversize ore after leaving the screen does not again come into contact with the muddy water of the tank containing the screen from which it is discharged, and consequently it is practically free from slime and in much better condition for subsequent treatment, such as crushing, &c.

In the operation of the machine such as described in accordance with this invention it is important that provision should be made for the free discharge of any air which may accumulate under the surface of the screen, and this end is accomplished by building the screen-frame without transverse obstructions or projections along the under side of the screen, so that air-bubbles that may form and might accumulate on the under side of the screen can travel forward until they come to the inclined lip K and there be freely discharged into the open space K′ under the lip and between the lip and the surface of the water. The arrangement of the screen in a slightly upwardly inclined position still further assists in the free discharge of any entrained or accumulated air under the screen cloth. It will be seen that a weir K^2 is provided at the end of the tank underneath the lip K of such height that the screen is properly submerged, and the lip is adjusted so that there is an open space between the top of the weir K^2 and the bottom of the lip K.

The floating frame G, carrying the screen, is so hung from the superstructure V′ that the screen may be adjusted vertically. As shown, the rods V at the receiving end of the frame are connected to an idle shaft W. At the front end they are connected to the levers X, which are keyed onto the rocker-shaft Y, to which in turn is connected the lever Z, having a counterbalance M^2 suspended therefrom.

In the operation of the machine, under certain conditions of feed and water it is sometimes found desirable to support the front end of the screen-cloth above the surface of the water, leaving the back or feed end submerged. It will be seen that the inclination of the screen may be changed and regulated while the machine is in motion by varying the weight of the counterbalance M^2 or by varying the leverage. As shown, the leverage may be varied by moving the weight along the lever Z. The floating frame G is preferably made of wood or other buoyant material, so that it is partly, if not wholly, supported and floated by the surrounding water, and one use of the counterbalance M^2 is to assist in supporting and buoying up the frame and to counterbalance the weight of the ore particles upon the surface of the screen.

In the operation of the machine power is applied to the differential motion H′ by a suitable belting and the screen shaken. The feed or pulp is fed from the feed-box M and is distributed over the full width of the screen through the holes *m* and falls onto the blind-feed sole-plate below, from whence it passes to the screen-cloth, the water and the fines passing through the screen and in a short space of time filling the tank A, while the oversize portions are propelled forward up and over the inclined lip K and into the oversize spout L. Part of the water is discharged through the orifices N into the catch-launders F and part over the overflow-weirs C at the sides of the tank, the orifices N being so regulated that there shall always be an overflow at C. By this means the water-level in the tank is maintained at a substantially uniform level.

The relationship between the surface of the front end of the screen and the surface of the water in the tank should remain substantially constant, and the method of suspending the frame as described and the buoyancy of the frame enable this to be done. In the event

of a sudden increase in the quantity of water coming into the machine the orifices N can discharge only a definite quantity and the surplus passes over the weirs C, consequently increasing the depth of the water over these weirs, and were it not for the buoyancy of the frame and the mode of suspension the front end of the screen would be submerged to too great an extent. As soon, however, as the depth of water in the tank increases the frame G is raised correspondingly, and the degree of submergence is thereby maintained substantially constant. One mode of suspending the screen in the tank has been described and has been found to operate efficiently and well; but other arrangements may be constructed for carrying out the same objects, and the invention is not to be understood as limited to the construction shown in the drawings. The arrangement of levers and counterbalance shown for suspending the screen has the advantage that provision is afforded for cleaning the screen by plunging it up and down in the water-bath, causing the water to be impelled through the meshes of the screen, and thereby forcing out slimes and other foreign material that may have become entangled therein.

According to the construction of this apparatus if the water is prevented from passing through the screen with all the fines because of the choking of the screen by a surcharge of material it will be seen that the water will rise above the top of the rounded edges of the screen sides M′ and fall into the opening O and thence into the tank A. This overflow supplies the loss under the screen-cloth, raises the surface of the water there, and again brings about the free settling condition which is requisite for the proper operation of the machine, and in due time the machine resumes it proper functions.

Improved means are provided for tightening the screen-cloth. (Illustrated in detail in Fig. 4.) At substantially the center line of the screen-frame is arranged a center bar R, which is grooved along its whole length to receive the tightening device, consisting in this instance of the rod or piping T, arranged over the groove and adapted to be forced thereinto by suitable means, as the thumb-nuts S on the bolts S′. As the piping T is forced into the groove it carries with it the cloth, thus tightening the screen. To take the strains of this tightening and prevent the distortion of the screen-frame, struts or braces U are provided, of thin iron, preferably, set edgewise with the line of motion, so as to cut through the water and make as little disturbance as possible therein.

In Figs. 5, 6, and 7 a modified form of apparatus is shown having different means from those already described for leading off the surplus of water in the feed following a rush of comparatively dry material onto the screen. In the construction shown in Figs. 5, 6, and 7 both the tank A and screen are movable, by way of illustration, although this need not necessarily be the case, and one may be movable relatively to the other. In order to carry off the surplus water, as described, pairs of angle-irons or guides 1, of suitable material, are arranged longitudinally substantially in the middle of the screen. The tops of these angle-irons or guides 1 are slightly above the normal surface of the water on the screen, and they serve to confine the material to the screen and leave a bare space between them, through which surplus water is discharged in sufficient quantity to rise and flow over the edges of the angle-irons. Preferably these angle-irons are continued beyond the screen-cloth up to the edge of the discharge-lip K, so that any material accidentally getting into the channel between said angle-irons is properly discharged, and material on either side of the irons is prevented from finding its way around the ends into said channel. According to this construction if the water which normally passes through the screen-cloth with the fines is prevented from doing so by the choking of the screen it will rise above the top of the guides 1 and flow through the screen between them, which is kept clear from material. This overflow supplies the loss under the screen-cloth, raises the surface of the water-level, and brings about the free settling condition requisite for proper operation.

I have discovered that by submerging the screen area any large particles placed thereon are thereby put into what may be termed a "free settling" condition, for by reason of being immersed they are in a condition to arrange themselves without friction due to each other, and therefore find a means of exit through the screen-openings in the easiest possible manner. An action which causes the particles to assume a free settling condition more readily admits of their falling through the screen-openings.

According to this invention another action takes place, which may be explained as follows: It has been found that if a submerged screen is simply moved up and down in the water or any such receptacle containing ore particles is so moved—in other words, if a jigging or pumping motion be given to it—the coarse particles will go to the bottom and the fine will come to the top, or if a hollow cylinder, as a round screen, containing ore particles is revolved it will be found that the coarsest pieces are next the meshes of the screen and the finest farthest from it, a condition in both cases which is diametrically opposed to efficiency; but I have discovered that if a screen is shaken horizontally the reverse is the case. The finest pieces will be found at the lowest strata and the others graduated into layers above until the flattest and coarsest are on the top layer of all. Therefore screen-

ing apparatus constructed and operated in accordance with this invention is immeasurably increased in efficiency and capacity per square foot of screen area. It will be observed that in my apparatus I remove the rejections by propelling them forward or forward and upward when the screen is inclined to an inclined lip, and this is accomplished by means of the particular progressive feeding motion imparted to the screen.

Obviously some features of this invention may be used without others, and the invention may be embodied in widely-varying forms.

Therefore without limiting the invention to the constructions shown and described nor enumerating equivalents, I claim, and desire to secure by Letters Patent, the following:

1. In a submerged-screen sizing apparatus, the combination with the tank and screen supported therein, of means for imparting a differential reciprocating shaking motion to the screen in a horizontal direction, a relief area provided at the middle portion of the screen, means for increasing the escape of surplus water above the screen-cloth, means for discharging material tending to block said relief area, and means for keeping material to be screened off of said relief area except under abnormal conditions of feed.

2. In a submerged-screen sizing apparatus, the combination with a tank adapted to contain water, of a carrying-frame hung wholly within the tank and buoyantly supported on the surface of the water therein, a screen-frame and screen connected to the carrying-frame within the tank and submerged slightly below the surface of the water, means for imparting a differential reciprocating shaking motion to the carrying-frame in the tank in a horizontal direction, means for maintaining a constant degree of submergence of the screen, means for supplying any lack of water below the screen from the surface water above the screen, and means for permitting the free discharge of air beneath the screen.

3. In a submerged-screen sizing apparatus, the combination with a tank adapted to contain water, of a carrying-frame hung wholly within the tank and buoyantly supported on the surface of the water therein, a screen-frame and screen connected to the carrying-frame within the tank and submerged slightly below the surface of the water, means for imparting a differential reciprocating shaking motion to the carrying-frame in the tank in a horizontal direction, means for delivering material to be screened to one end of the screen, means for maintaining the water at a substantially uniform level in the tank and below the delivering end of the screen, and means for permitting the free discharge of air from beneath the screen.

4. In a submerged-screen sizing apparatus, the combination with a tank adapted to contain water, of a carrying-frame hung wholly within the tank and buoyantly supported on the surface of the water therein, a screen-frame and screen connected to the carrying-frame within the tank and submerged slightly below the surface of the water, means for imparting a differential reciprocating shaking motion to the carrying-frame in the tank in a horizontal direction, an inclined lip at the discharge end of the screen above the level of the water in the tank and over which the oversize ore passes from the screen, a weir arranged beneath said lip with a space between the top of the weir and the lip, permitting free discharge of air and surface water under the screen-cloth, means for maintaining a constant degree of submergence of the screen, and means for supplying any lack of water below the screen from the surface water above the screen.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

JOHN M. CALLOW.

Witnesses:
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