No. 788,246. PATENTED APR. 25, 1905.

J. M. CALLOW.

SUBMERGED SCREEN SIZER OR SEPARATOR.

APPLICATION FILED MAR. 13, 1902. RENEWED JAN. 31, 1905.

3 SHEETS—SHEET 1.

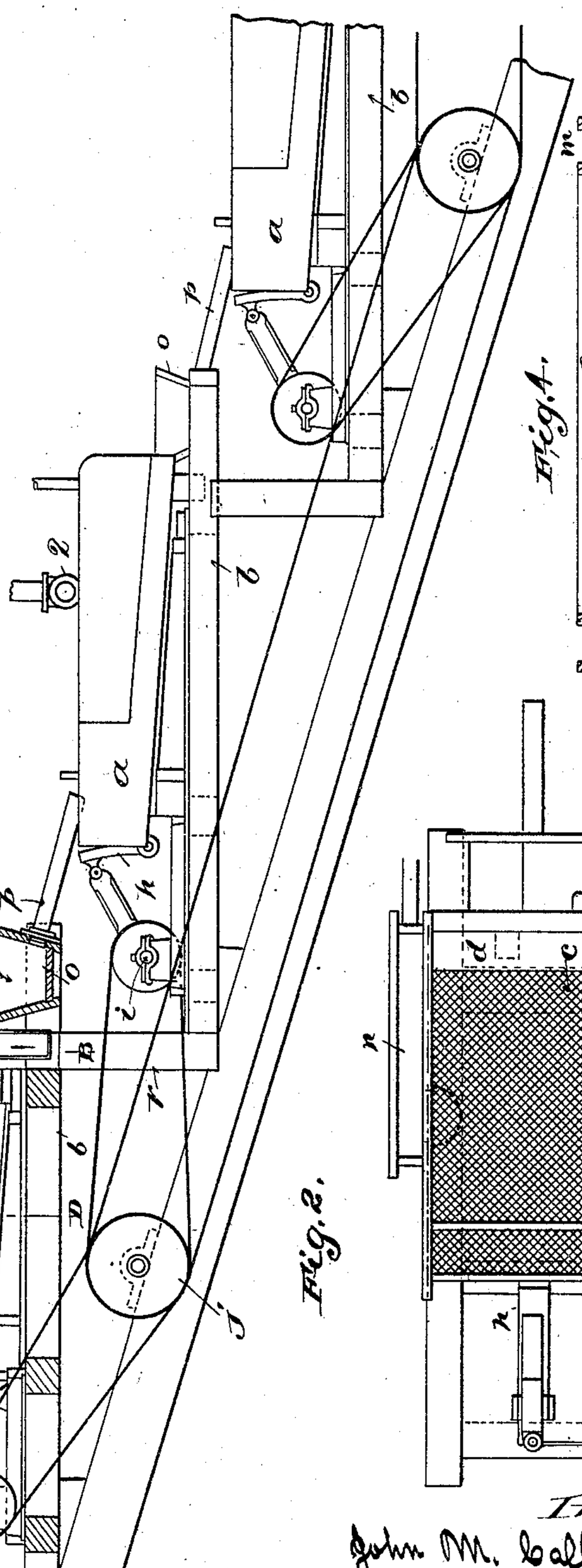

Fig. 1.

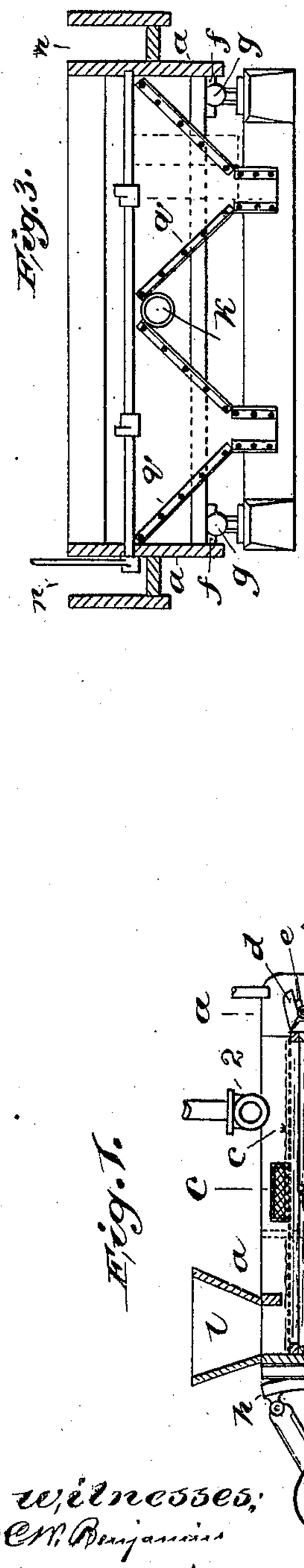

Fig. 3.

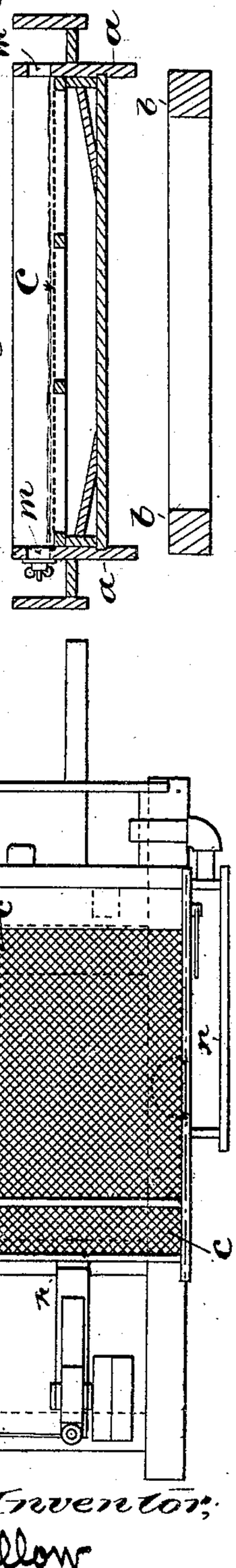

Fig. 4.

Fig. 2.

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3 SHEETS—SHEET 2.

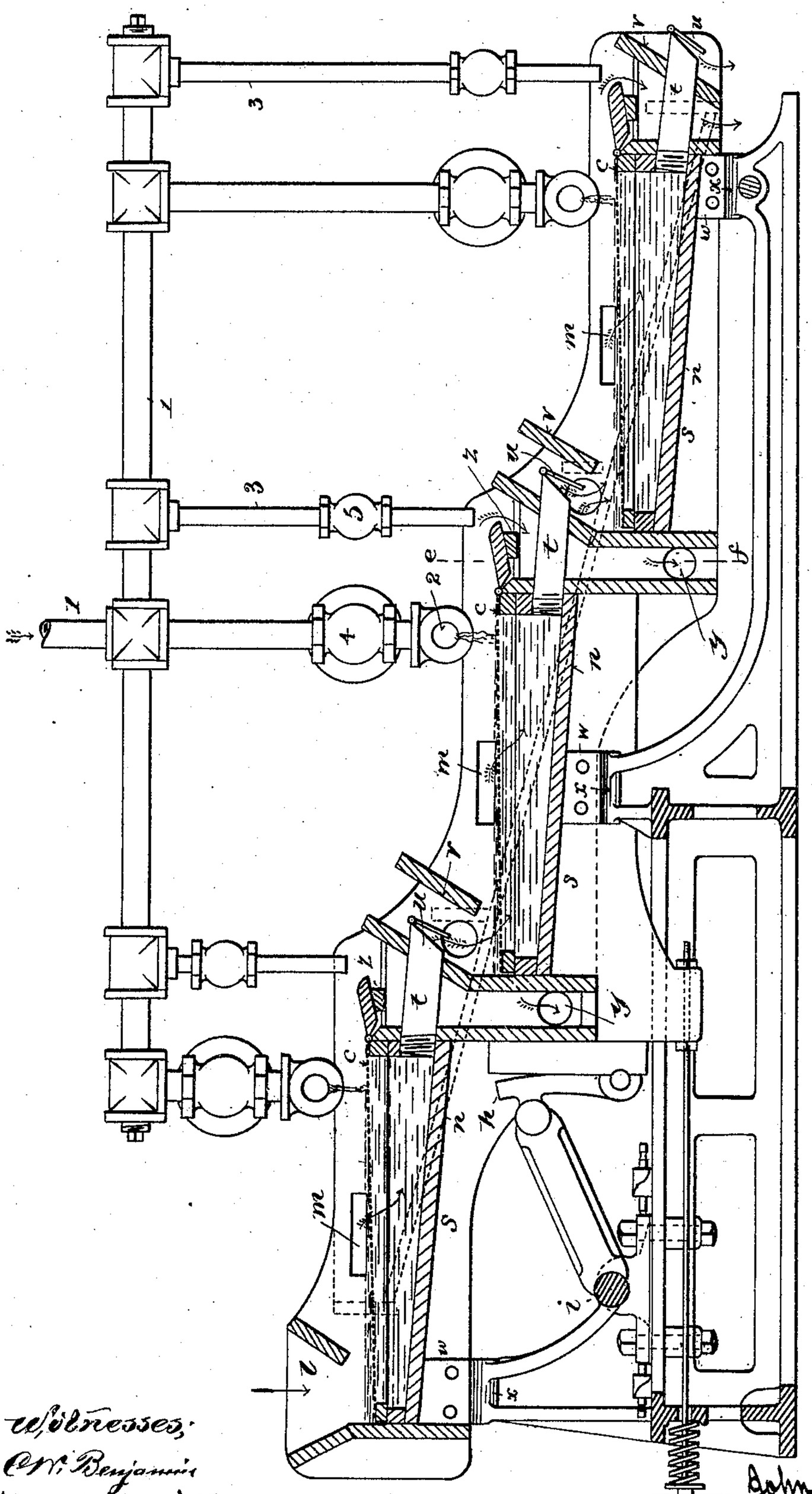

Fig. 5.

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3 SHEETS—SHEET 3.

Fig. 6.

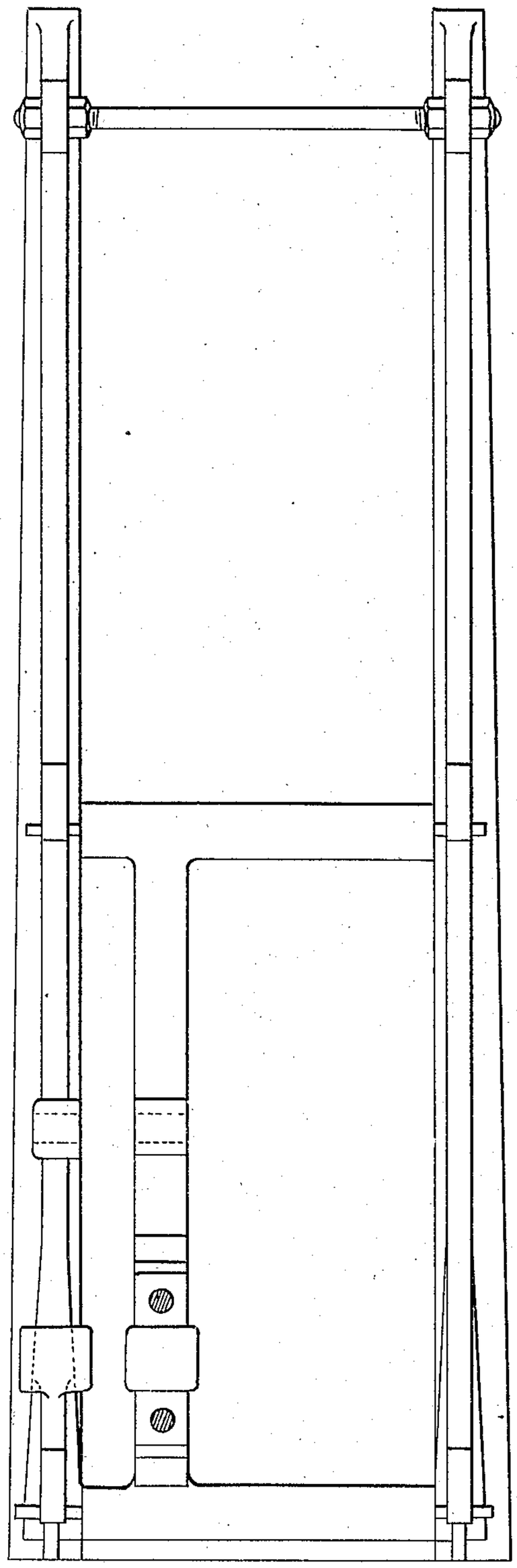
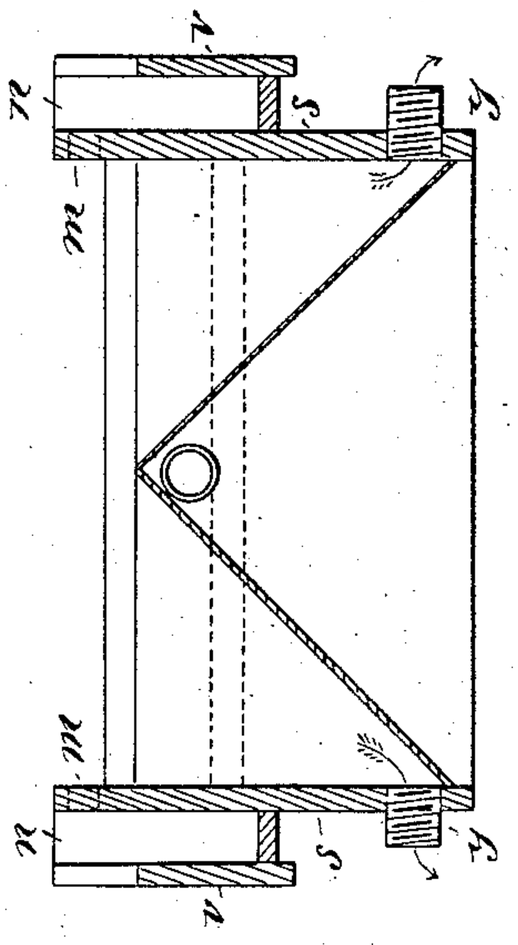


Fig. 7.



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No. 788,246. Patented April 25, 1905.

UNITED STATES PATENT OFFICE.

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

SUBMERGED SCREEN SIZER OR SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 788,246, dated April 25, 1905.

Application filed March 13, 1902. Renewed January 31, 1905. Serial No. 243,465.

To all whom it may concern:

Be it known that I, JOHN M. CALLOW, residence and post-office address Dooly Block, Salt Lake City, Utah, have invented certain new and useful Improvements in Submerged Screen Sizers or Separators, of which the following is a specification accompanied by drawings.

My invention relates to improvements in screening-machines, and more particularly to that class of screening-machines provided with 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 the 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.

My invention has special reference to the screening of wet material, although I am not to be understood as limiting my invention in this particular, for it may be utilized with any kind of material to which it is applicable.

The difficulties which have heretofore been met with in screening wet material of any kind on horizontal or inclined screens consist in 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.

My invention has for its objects to avoid the disadvantages attendant upon the use of screening apparatus of the character referred to and to improve such apparatus and render it much more efficient in operation.

To these ends my invention consists primarily in apparatus and devices having the general mode of operation hereinafter fully described and illustrated in the accompanying specification and drawings, in which—

Figure 1 is a side view, partly in section, of apparatus embodying one form of my invention. Fig. 2 is a partial plan view of said apparatus. Fig. 3 is a transverse sectional view on the line *a* B of Fig. 1. Fig. 4 is a transverse sectional view on the line *c* D of Fig. 1. Fig. 5 is a side elevation, partly in section, of a modified form of my apparatus. Fig. 6 is a plan view of the frame, and Fig. 7 is a transverse sectional view on the line *e f* of Fig. 5.

Referring to the drawings, in Figs. 1, 2, 3, and 4, as stated, apparatus according to one form of my invention is illustrated, in which a series of tanks *a* is provided, in this instance three being shown, although any suitable number may be used. The tanks *a* are conveniently arranged one above the other on suitable framing *b*, and each is provided with a screen *c* of suitable character, while means are provided for the discharge of the fines from one tank to the screen of the one next below, and so on. The oversize portions of the material screened is preferably collected from each tank separately by any suitable means.

According to my invention the screen-surface in each tank is always kept submerged in a quiescent water-bath, so that the separation of the fines from the coarse 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, I provide each tank with an inclined and pivoted lip *d*, having any suitable means in connection therewith for altering its angle of inclination, as a cam *e*. The top edge of the lip *d* is preferably somewhat above the water-level; but instead I may incline the whole length of the screen slightly.

In screening ores it is very desirable that the oversize ore shall pass from the screen substantially free from muddy water and slime, and it is to accomplish this result that I make the discharge end of the screen higher than the water-level in the tank, it being understood that the inclined lip *d* 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 or with that of any other tank, and consequently it is

practically free from slime and in much better condition for subsequent treatment, such as crushing, &c.

The screen *c* may be supported in the tanks for horizontal movement and may be arranged horizontally or else they may be inclined—as, for instance, upwardly—from the receiving end to the discharge end, as shown in Fig. 5; but as shown in Fig. 1 in this instance to illustrate my invention they are arranged substantially horizontally.

The screens are adapted to be shaken by a reciprocating motion suitable for my purpose; but I prefer a longitudinal differential reciprocating motion in a horizontal direction, which progressively propels the material forward regardless of the inclination of the screen, and I have illustrated a well-known form of apparatus in connection with my invention for imparting such a progressive feeding motion to the tanks.

As a convenient construction the tanks may be provided with bearings *f*, adapted to slides or tracks *g* on the framing *b*, although I am not to be understood as limiting myself to a construction in which the tanks and screens both have the desired motion imparted to them. Suitable pivoted and reciprocating curved pushers *h*, connected to be reciprocated from crank-shafts *i*, are provided with each tank, the crank-shafts being actuated, as shown, from a main driving-wheel *j*, through suitable connections, as pulleys and belting. The tanks are moved forward by the pushers *h* and returned, the power for returning the tanks being shown as springs. This form of progressive feeding motion being well known in the art, it will not be further described, it being understood that any suitable mechanism for imparting such motion may be substituted without departing from the scope of my invention.

Means are provided for maintaining a substantially constant level of the water-bath in which the screening is done, and while this may be accomplished in various ways in my apparatus I regulate the discharge from orifice *k*, connecting with the tank to correspond with the inflow through the feed-hopper *l* to the tank. A perfect regulation of the water-level is further maintained by means of openings *m* in the sides of the tanks, above which the level of water cannot rise. The overflow through the openings *m* passes off by means of the overflow-launders *n*.

Suitable hoppers *o* and connecting-piping *p* are arranged between the tanks in order that the outlet of one may connect with the inlet of the next, while the oversize is discharged through hoppers *q* and piping *r* to be operated upon through other machinery.

In Figs. 5, 6, and 7 a modified form of apparatus is illustrated, in which a plurality of tanks *s* are shown, all connected to be moved together by means of the same type of apparatus hereinbefore described for imparting a progressive feeding motion to the tanks. The tanks are arranged at different heights, and, as before, the fines from the uppermost tank are discharged into the one next below, and so on, by means of discharge-pipes *t*, having adjustable gates *u* and discharging into hoppers *v*. Each tank is provided with bearings *w*, adapted to slides *x* on the framing of the machine. As before, the level of the water-bath is regulated by means of overflow-openings *m*, leading to overflow-launders *n*, while the oversize is led off through discharge-orifices *y*, communicating with the discharge from the inclined and adjustable lip *d*, in this instance the means for adjusting the lip being shown as a wedge *z*.

In both forms of my invention suitable means may be provided for supplying water to the water-bath in cases when the water coming in with the pulp to be screened is insufficient or in cases where the ore is of such extremely slimy nature that additional clear water is necessary for the complete washing and cleansing of the oversized portions, and a supply-pipe 1 is provided for leading water to the spray-pipes 2 for the tanks, while branch pipes 3 supply the flush-water. Suitable valves 4 and 5 are provided to regulate the flow of water in said pipes.

It will be observed that the spray-pipes 2 are arranged above the screen near the discharge end thereof, and fresh water will thus be sprayed upon the oversize ore and cleanse it from the slime. The pipes 3 may sometimes be employed for the purpose of still further washing the oversize ore as it passes into the hopper *q*.

In the operation of my machine the material to be screened is fed through the hopper *l* of the uppermost tank to the screen *c* therein, and the apparatus for imparting a progressive feeding motion to the tanks is set in operation. The screen, as stated, is constantly submerged, and the material reposing thereon is propelled forward at each return stroke. In either case the result is the same—that is, the material on the screen is propelled forward. While I have shown the screens arranged both horizontal and at an incline, it is evident that although inclined upwardly from the receiving end to the discharge end the material will still be propelled forwardly up the inclined screen. The oversize portions are then discharged over the inclined lip, while the particles fine enough pass through the screen.

I have discovered that by submerging the screen area any lot of particles placed thereon are thereby put into what I will term 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. The action which causes the particles to assume a free-settling condition more readily admits of their falling through the screen-openings.

According to my 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 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 screening apparatus constructed and operated according to my invention is immeasurably increased in efficiency and capacity per square feet 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 my invention may be used without other features and may be embodied in widely-varying forms. For this reason, without enumerating equivalents, I claim the following:

1. In a submerged screen sizing apparatus, the combination of a tank and a screen supported therein, means for imparting a differential, reciprocating, shaking motion to the screen in a horizontal direction, means for delivering the material to be screened to one end of the screen, means for delivering water onto the ore above the screen, means for maintaining the water at a substantially uniform level in the tank and below the delivery end of the screen, and a receptacle into which the oversize ore is discharged from the delivery end of the screen, substantially as set forth.

2. In a submerged screen sizing apparatus, the combination of a tank and a screen supported therein, means for imparting a differential, reciprocating, shaking motion to the screen in a horizontal direction, means for delivering the material to be screened to one end of the screen, means for delivering water onto the ore above the screen, means for maintaining the water at a substantially uniform level in the tank, and 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, substantially as set forth.

3. In a submerged screen sizing apparatus, the combination of a tank and a screen supported therein, means for imparting a differential, reciprocating, shaking motion to the screen in a horizontal direction, means for delivering the material to be screened to one end of the screen, means for delivering water onto the ore above the screen, means for maintaining the water at a substantially uniform level in the tank, 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, and means for delivering water on the oversize ore as it is discharged from the screen, substantially as set forth.

Signed this 6th day of March, 1902, at Salt Lake City, Utah.

JOHN M. CALLOW.

Witnesses:

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G. C. LETCHER.