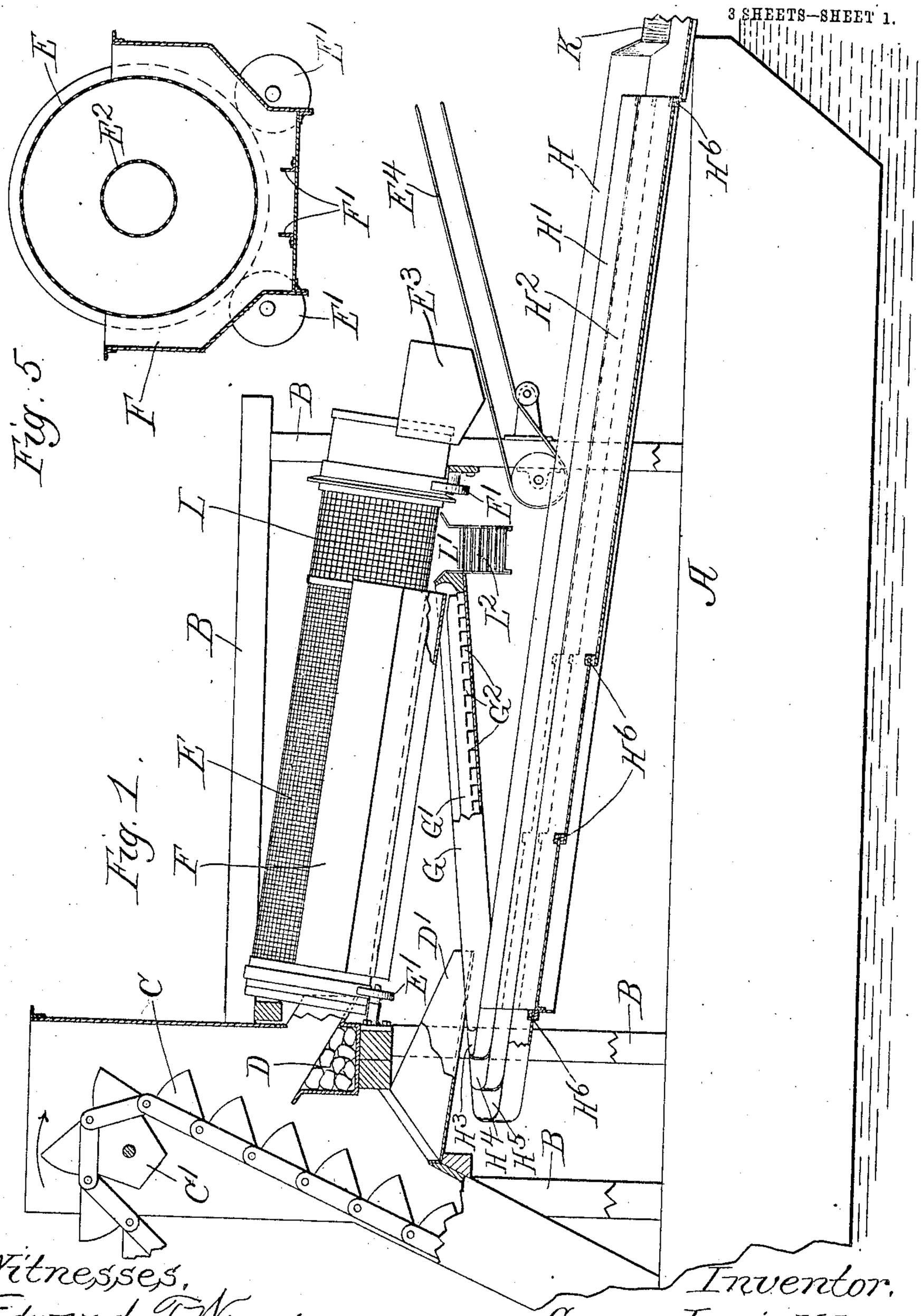
No. 849,614. PATENTED APR. 9, 1907.

G. L. HOLMES.

GOLD WASHING AND SAVING APPARATUS.

APPLICATION FILED JUNE 26, 1905.

3 SHEETS—SHEET 1.



Witnesses,
Edward T. Wray.
Howard L. Kellogh.

Inventor.
George Ferris Holmes,
by Parker Carter
Attorney's.

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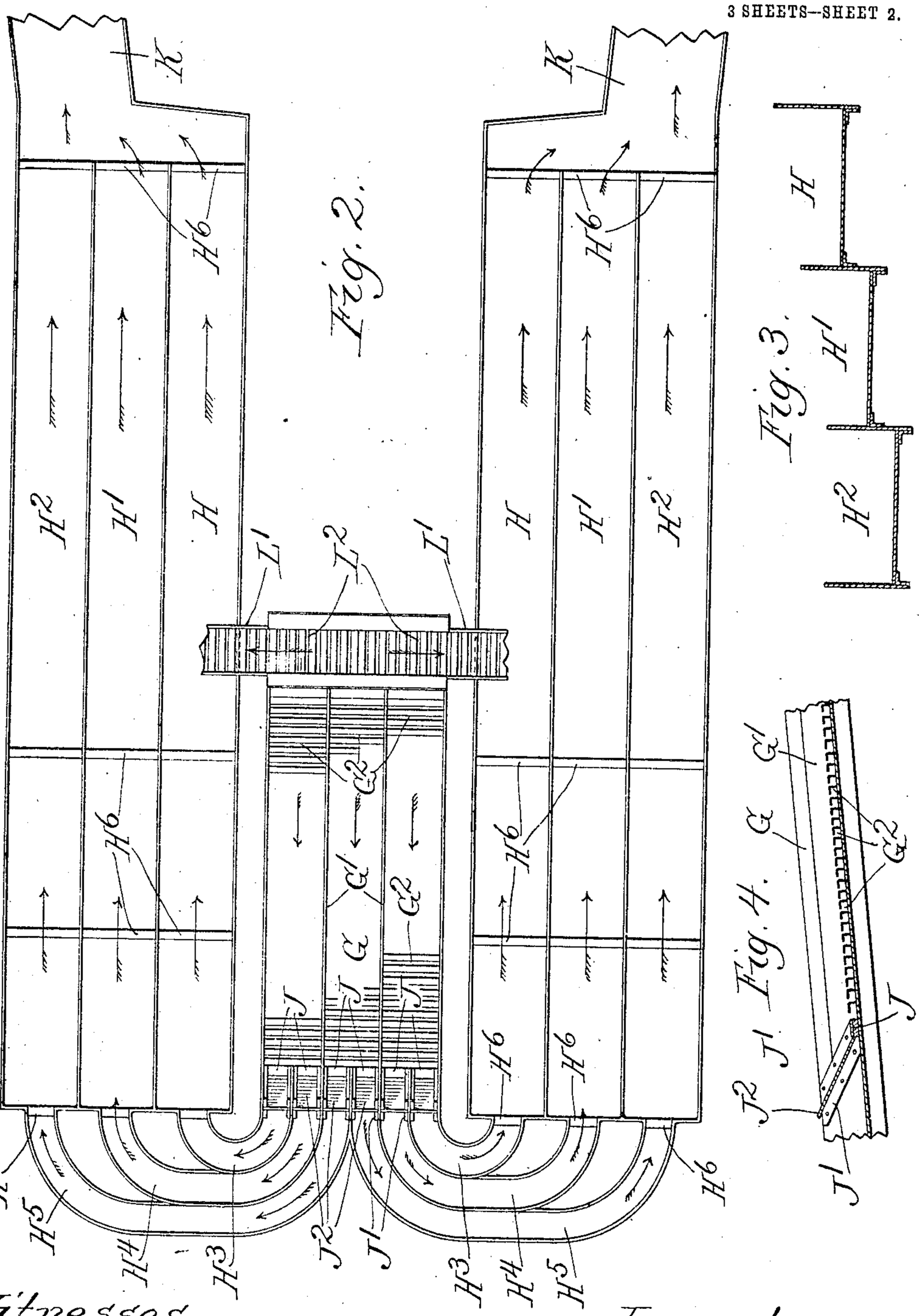

Fig. 2.

Fig. 3.

Fig. 4.

Witnesses.
Edward T. Wray.
Howard L. Brough

Inventor.
George Lewis Holmes.
by Parker Coles
Attorneys.

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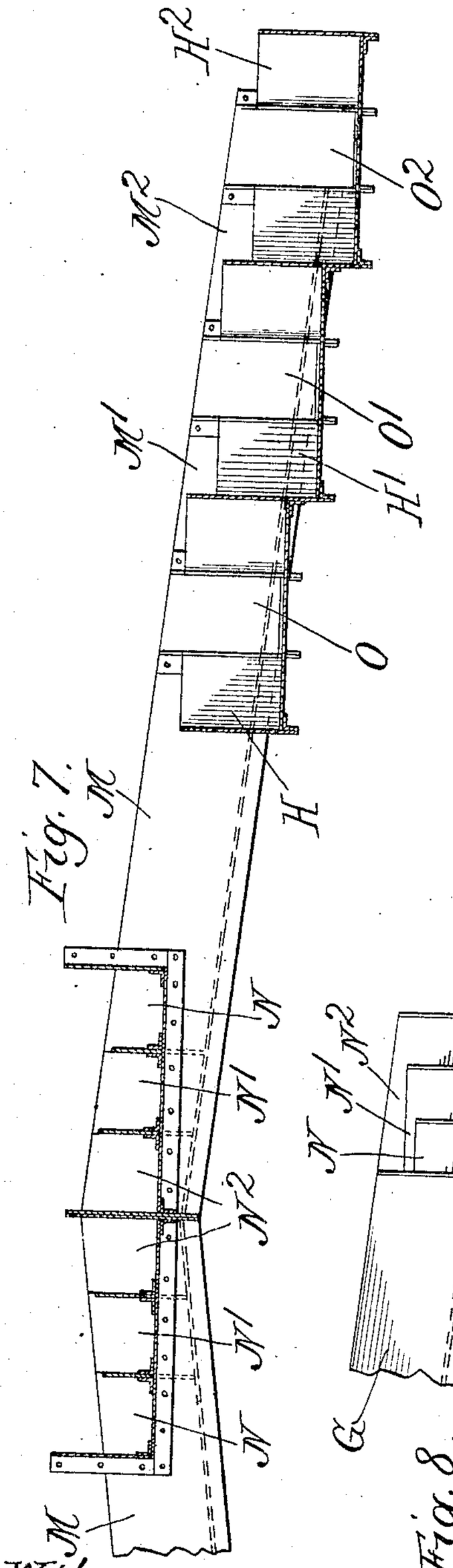

Fig. 7.

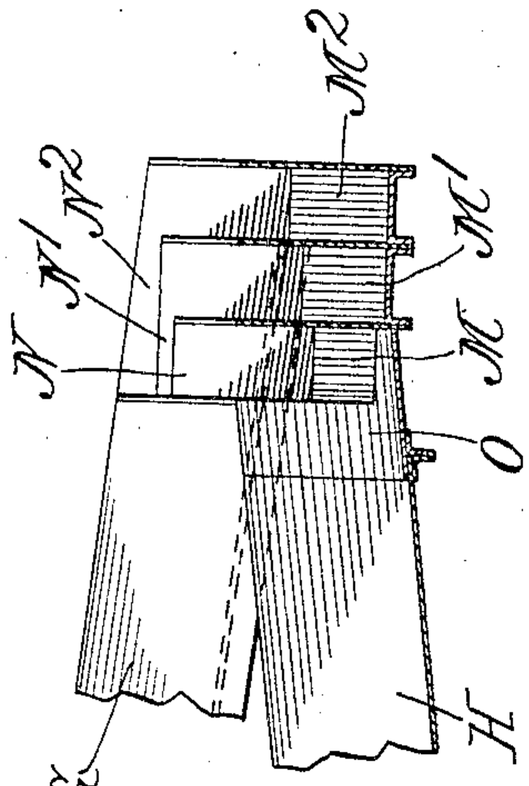

Fig. 8.

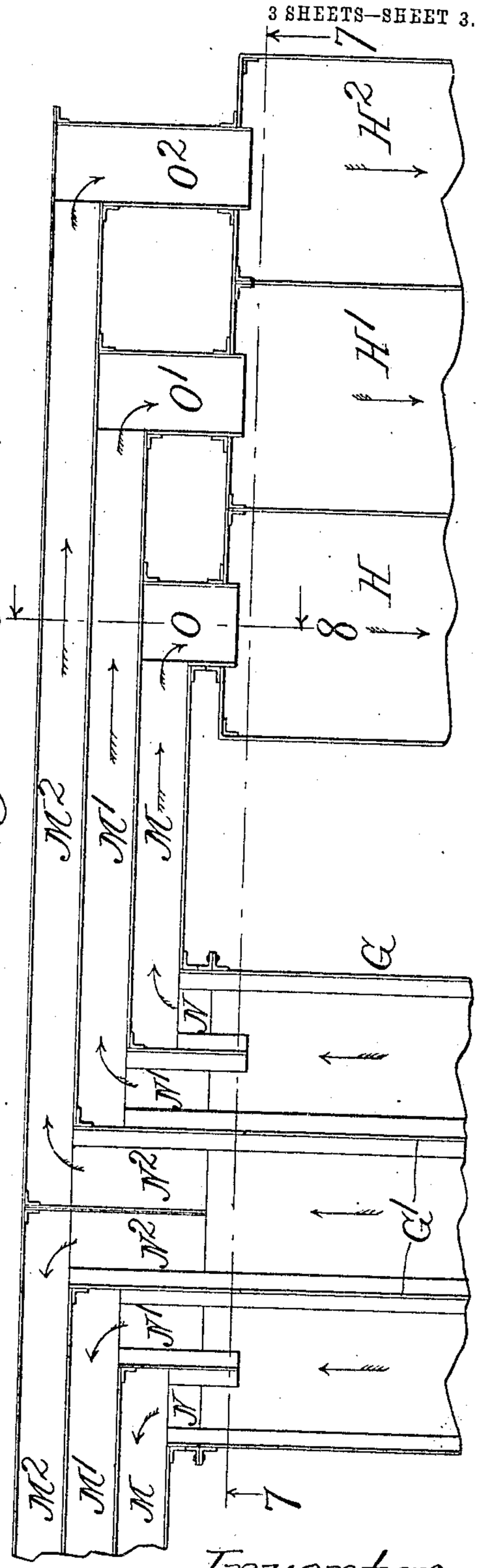

Fig. 6.

Witnesses.
Edward T. Wray.
Howard L. Kraft.

Inventor.
George Lewis Holmes.
by Parker Carter
Attorneys.

UNITED STATES PATENT OFFICE.

GEORGE LEWIS HOLMES, OF OAKLAND, CALIFORNIA.

GOLD WASHING AND SAVING APPARATUS.

No. 849,614. Specification of Letters Patent. Patented April 9, 1907.

Application filed June 26, 1905. Serial No. 266,966.

To all whom it may concern:

Be it known that I, GEORGE LEWIS HOLMES, a citizen of the United States, residing at Oakland, in the county of Alameda and State of California, have invented a certain new and useful Improvement in Gold Washing and Saving Apparatus, of which the following is a specification.

My invention relates to gold washing, concentrating, and saving apparatus, and has for its object to provide new and useful improvements in such constructions.

The invention is diagrammatically illustrated in the accompanying drawings, wherein—

Figure 1 is a side elevation of a portion of the apparatus, showing certain parts in section; Fig. 2, a plan view of certain parts with the screen and gathering-hopper removed; Fig. 3, a section through the side sluices; Fig. 4, a longitudinal section through one of the separators; Fig. 5, a cross-section through the grizzly and gathering-hopper; Fig. 6, a plan view of a modified construction of the reverse troughs or launders with parts broken away; Fig. 7, a cross-sectional view on line 7 7 of Fig. 6, and Fig. 8 a sectional view at right angles to the plane of Fig. 7 on line 8 8 of Fig. 6.

Like letters of reference indicate like parts in all the drawings.

The apparatus is designed to be used particularly in connection with a gold-dredger or other vessel of the sort and to meet the conditions which obtain when gold-saving apparatus is used in such a way. It is illustrated as forming a part of the fitting of such a dredge, but it will be clear that it could be used in other connections.

In the drawings, A represents the body of the scow on which the dredging apparatus is placed, and B B the beams and trusses forming a supporting-framework for the operative parts of the apparatus.

C is an endless bucket-chain dredge operating over the sprocket C′ and discharging into the chute or hopper D, these parts being suitably supported on the framework B B. Below the hopper D a save-all chute D′ may be provided to catch any material that may not be discharged into the hopper and convey it to the system of sluices, to be described later.

The spoils from the buckets are preferably first passed over a screen of any desired kind. In the drawings I have shown this as a cylindrical rotary grizzly, (indicated by the letter E.) This screen is inclined from the horizontal and supported in any desired manner on the framework B, preferably being mounted on the rollers E′ E′. The screen may be driven in any desired manner—for example, by friction, by a chain belt, or by gearing. (Not here shown.) Longitudinally through the screen is the perforated water-pipe E^2. Both ends of the screen are open. The spoils from the buckets are discharged into the upper end of the grizzly and stones and the like pass out through the lower end into the hopper E^3 and are thence carried away by any desired means—as, for example, by the belt-conveyer E^4.

Surrounding the lower part of the screen is the gathering hopper or pan F, sloping aft, the same as the grizzly. This pan is preferably divided into channels by the longitudinal separators F′ F′. These separators may consist of angle-irons bolted to the bottom of the pan and in number they will be proportioned to the breadth of the pan. The pan F at its lower end discharges into a middle sluice G, which I prefer to make somewhat wider than the pan and which is designed to slope in the opposite direction. The upper end of the sluice is provided with a curved head, as shown, to break the force of the flow. This sluice may also be separated into channels by the separators G′ G′. Three of these sluice-channels are shown. There may be any number of these sluice-channels, however. This sluice is preferably provided with some kind of gold-saving devices. As shown in the drawings, the bottom of these channels are provided with a number of cups or cavities for mercury or the like, as indicated by G^2, although any sort of foraminous bottom or like contrivance or device for intercepting and saving the values might be utilized.

I here show six side sluices, three of these (indicated by the letters H H′ H^2) on each side of the dredge. These sluices slope aft in a direction opposite to that of the middle sluice, and they are connected to it by means of the reverse troughs or launders, (indicated, respectively, by the letters H^3, H^4, and H^5.) The width of these side sluices in the aggregate is several times that of the middle sluice G, and they are stepped one below the other, as shown particularly in Fig. 3. By this arrangement a uniform grade is maintained in the launders. The side sluices may also be

provided with gold-saving devices, which are here shown as a number of cross-riffles H^6, placed at intervals in the sluices.

In order that the current may be shut out from one or more of the side sluices without stopping the operation of the apparatus, I provide the launders H^3 H^4 H^5 with gates. These may of course be of any desired construction. As shown in the drawings, the lower end of the sluice G has across it a cleat J. On the sides of the launders are the guide-bars J′ J′, and the gates J^2 rest against and move between these guide-bars and abut against the cleat, as shown in Fig. 4. The material from the side sluices passes into a sluice K, from whence it is dumped into the pond or conveyed on shore in any desired manner.

The lower end of the screen E beyond the pan F is preferably made with coarse perforations, as shown at L, so that the water may drain rapidly and so that any coarse gold which may be in the material treated can get through the screen and not be delivered to the stacker. Below this portion of the screen are the sluices L′ L′, which can drain off into the sluices at each side and which are provided with some sort of gold-saving devices—as, for example, the riffles shown at L^2 in the drawings. These sluices are of course unnecessary where the values are in fine gold only.

In Figs. 6, 7, and 8 I have shown a modified form of the reverse launder construction. The launders are in this instance rectangular, comprising the cross-sluices M′ M^2, which slope from the middle of the vessel sidewise and which are connected with the sluice G by means of the separator-troughs N N′ N^2 of different lengths, as shown. The cross-sluices M M′ M^2 discharge into the sluices H H′ H^2, respectively, through connecting-troughs O O′ O^2. It will be obvious that the construction of these launders and also of other parts of the machine may be varied to meet a variety of conditions.

The use and operation of my invention are as follows: In a gold-saving device of the kind herein referred to the material is delivered by an excavator to a hopper, from whence it flows to a screen, where it is to be washed and partially separated, the finer material and heavy concentrates being washed through the perforations of the screen and delivered in the form of an intimate mixture of fine material and water, which will hereafter be referred to as "pulp." It is desirable that this pulp should be distributed as uniformly as possible over the gold-saving surfaces, so that the further concentration of the values may be carried on continuously and uniformly over the entire width upon which it is distributed for concentration. If the distribution is not uniform and continuous, it will obviously entail inequality of working and concentration, together with loss of time and material. Under ordinary conditions there is a tendency of the dredge to list or pitch either on its longitudinal or its transverse axis, or both. My apparatus is so arranged that I secure a very extensive treating or concentrating surface over which the distribution and flow is very nearly uniform if regard be had to a definite and extended period of time. Consequently uniformity in the concentration of the values is approximated. I secure an extended saving or concentrating surface by having my saving-surfaces arranged longitudinally or fore and aft of the boat, so that there may be any number of sets of such surfaces or sluices. By properly proportioning these sluices or saving-surfaces the rate of flow over the saving-surfaces is relatively uniform for a given period, because when the boat pitches down at the bow a certain number of sluices will be more sharply inclined in one direction, while the remaining sluices will be less sharply inclined in the opposite direction, thus tending to equalize the flow. When the boat pitches in the opposite direction, this relation is reversed, so that a practically uniform flow and deposition takes place over the entire width of surface if the same be considered for a definite and extended period. The transverse or side list of the boat would tend with such longitudinally-arranged sluices to cause the pulp to flow to one side of each sluice, and the concentrates would bank up in the deeper corners and diminish the effective saving-surface or even spill the pulp over the side of the sluice or trough. By dividing these sluices by a set of longitudinal separators this result is greatly obviated, so that in practice the deleterious effect is not serious and does not interfere with the continuous and effective working of the device. Of course these several features could be utilized under different conditions or some of them be utilized to a certain degree in very differently-arranged troughs or sluices. I have endeavored to show and describe what seems to me to be the best application of my invention.

The gold-bearing sand, gravel, and the like is dug up by the dredge-buckets and deposited in the grizzly E, where the fines are washed out and screened, water being supplied through the pipe E^2 in any desired manner. The fines bearing the value are first collected in the pan F and then passed through a series of sluices, such as has been described, these sluices being provided with some form of gold-saving device. There may be any number of sluices in each set or any number of sets of sluices. Among other characteristics it will be noted that my sluices are all adapted to extend fore and aft of the dredge, with the result, of course, that a very extended saving-surface flow is ob-

tained. This arrangement also gives a better distribution of the pulp upon the gold-saving devices than if they were arranged transversely of the vessel. A side list of the dredger does not affect the distribution seriously, the arrangement being further aided in this respect by the separators which divide the pan and sluices into a number of different channels, thereby tending to keep the pulp from being washed from side to side of the trough with the movement of the vessel. A fore-and-aft list, which is likely to occur whenever the angle of the supporting-ladder for the buckets is changed, will of course change the grade of the sluices; but by my arrangement the change in current-flow is compensated for. When the grade in one sluice is increased, the grade in the other is decreased in like proportion.

The pulp to be treated is first gathered together and flows in a mass through certain sluices, which are preferably provided with gold-saving apparatus. After having passed for a considerable distance in one mass over such apparatus, with the result that much of the solid matter is precipitated into the channels formed by the separators, the pulp is separated into a number of streams and conducted away into a number of sluices, which in the aggregate are of much greater width than the sluice through which the pulp has first passed. The pulp therefore passes in a relatively thin film over these latter sluices and such gold as has escaped separation is then caught and retained by the gold-saving devices at the bottom of these sluices. The result of this arrangement is a very close saving of the gold.

In the foregoing description I have set out with some particularity one form and one adaptation to use of my invention; but it will be very clear that the parts might be changed considerably in form, construction, and arrangement without departing from the broad spirit of my invention. For example, I have shown a rotary cylindrical form of screen; but any other separating means would accomplish the same result. The apparatus has been described as used for the treatment of gold-bearing material; but it will be understood that the device could be used in other connections where similar conditions are met with. It will also be clear that all of the elements of the invention need not be in all cases combined and that the object of the invention may be possible of accomplishment if some of the features which have been described were eliminated or other devices substituted in place thereof. My apparatus has among others these characteristics: first, the material to be treated is thoroughly collected before distribution; second, the distribution over the gold-saving device is kept relatively uniform in spite of the continual movement of the apparatus incident to its use upon the floating vessel; third, the material is treated by a succession of processes, resulting in a very close and economical separation of the precious metal; fourth, the flow of liquid over each part of the saving-surface is for a certain period substantially the same as the flow over each other like part of the saving-surface, and, fifth, the stream of liquid gradually diminishes in depth as it passes over the successive saving-surfaces. It will be seen, therefore, that the material when it comes from the screen is received first in a gathering-sluice which discharges over an inclined surface, which may aptly be termed the "primary" concentration sluice. The stream with the gold-bearing material in suspension flows through this sluice and over the concentrating-surface, which it presents as a unit. The separators G′ in the bottom of this sluice prevent the material deposited from washing from side to side when the vessel lists, while at the same time they do not prevent the unitary flow of the liquid and particles suspended therein. The stream is then divided into a number of thinner streams which flow over reversely-inclined surfaces, which may aptly be termed "secondary" concentrating-sluices. A portion of the gold-bearing material will have been collected in the primary sluice. The particles still in suspension at the time of the separation of the stream will be concentrated in the secondary sluices.

I claim—

1. In apparatus for saving precious metals, the combination of a vessel, with an inclined primary sluice, means for conveying the material mixed with water to said sluice so that it will flow therethrough as a unit, a plurality of reversely-inclined secondary sluices of greater aggregate width arranged side by side and one below the other and substantially parallel to the primary sluices, a plurality of reverse troughs one leading from the lower end of the primary sluice to the upper end of each of the several secondary sluices, and concentrating devices in said sluices.

2. In apparatus for saving precious metals, the combination of a vessel, with an inclined primary sluice, means for conveying the material mixed with water to said sluice so that it will flow therethrough as a unit, a plurality of longitudinal partitions in the bottom of said sluice to prevent the washing from side to side of the material deposited when the vessel is listed, a plurality of reversely-inclined secondary sluices of greater aggregate width arranged side by side and one below the other, a plurality of reverse troughs leading from the lower end of the primary sluice to the upper ends of the several secondary sluices, and concentrating devices in said sluices.

3. In apparatus for saving precious metals,

the combination of a vessel, with an inclined primary sluice, means for conveying the material mixed with water to said sluice so that it will flow therethrough as a unit, a plurality of longitudinal partitions in the bottom of said sluice to prevent the washing from side to side of the material deposited when the vessel is listed, two sets of reversely-inclined secondary sluices arranged one set on each side of the primary sluice, the sluices of each set being arranged opposite each other and one below the other, a plurality of reverse troughs leading from the lower end of the primary sluice to the upper ends of the several secondary sluices, and concentrating devices in said sluices.

4. In apparatus for saving precious metals, the combination of a vessel, with an inclined screening device, the screen of said device being of greater mesh at the lower than at the upper end, a gathering-sluice, and under the upper end of said screening device a primary sluice reversely inclined with respect to the gathering-sluice into which said gathering-sluice discharges, a plurality of reversely-inclined secondary sluices of greater aggregate width than the primary sluice, and inclined in the opposite direction means for separating and distributing the stream of material to the secondary sluices, and a pair of inclined separating-tables under the lower end of the screening device transverse to the direction of the aforementioned sluices, and concentrating devices in said sluices.

5. In apparatus for saving precious metals, the combination of a vessel, with an inclined fore-and-aft screen, means for conveying the material to the screen and mixing it with water, a gathering-sluice under said screen, an inclined primary concentrating-sluice into which the gathering-screen discharges and over which the material flows as a unit, longitudinal partitions in the bottom of said sluice, a series of reversely-inclined secondary sluices of greater aggregate width than the primary sluice and arranged side by side and one below the other, all of said sluices running fore and aft, a plurality of reverse troughs leading from the lower end of the primary sluice to the upper ends of the secondary sluices, said troughs having different inclinations to compensate for their different lengths, and concentrating devices in said troughs.

GEORGE LEWIS HOLMES.

Witnesses:

CONSTANT W. LEESE,

MATTHEW ARNOLD.