No. 871,369. PATENTED NOV. 19, 1907.

A. SCHWARZ.

ORE CONCENTRATING TABLE.

APPLICATION FILED DEC. 26, 1906.

2 SHEETS—SHEET 1.

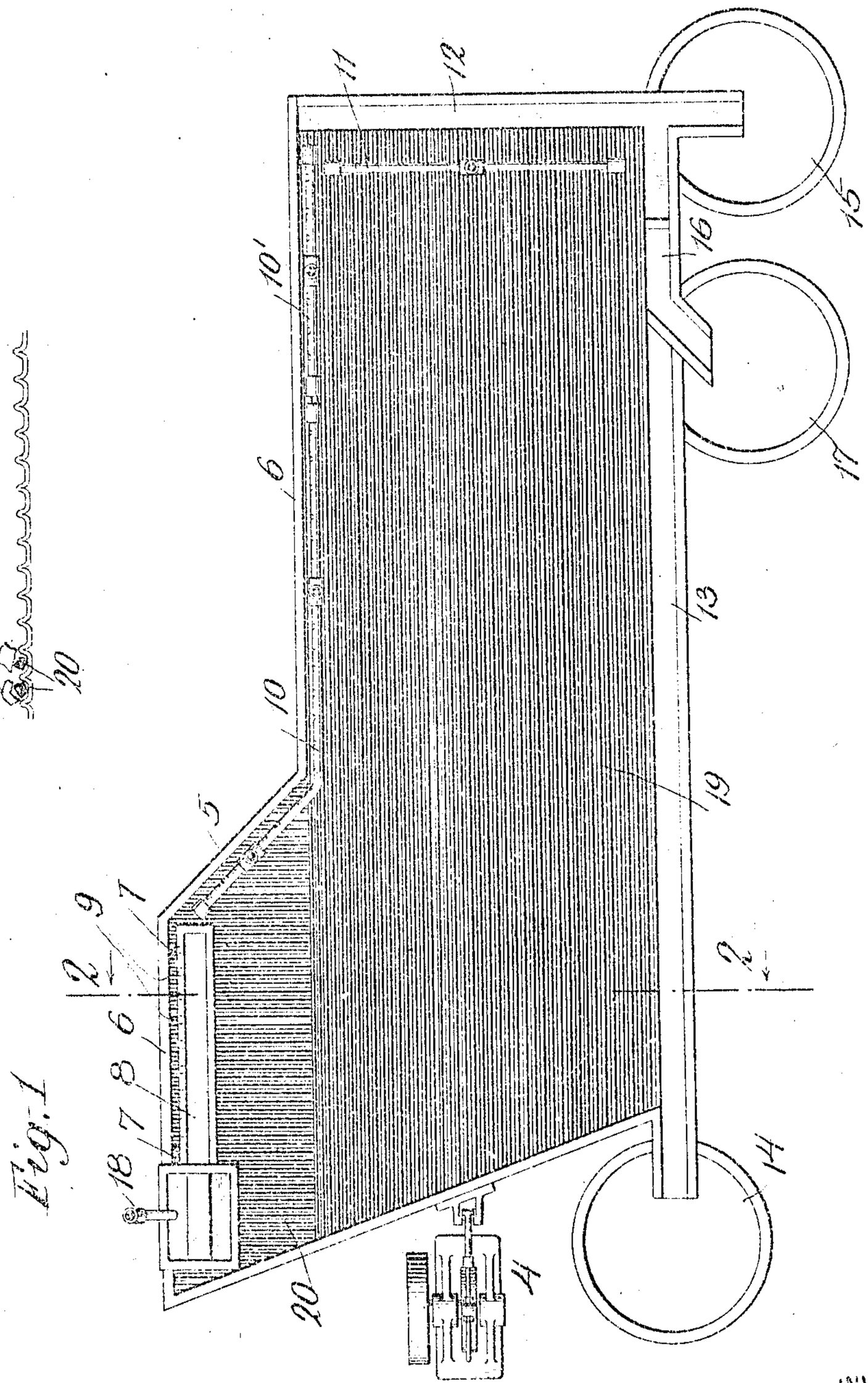

Fig. 1.

Fig. 6.

WITNESSES:
M. E. McNeish
M. S. Avery

INVENTOR
Alfred Schwarz.
BY
Mastick & Jones.
His ATTORNEYS

No. 871,369. PATENTED NOV. 19, 1907.

A. SCHWARZ.

ORE CONCENTRATING TABLE.

APPLICATION FILED DEC. 26, 1906.

2 SHEETS—SHEET 2.

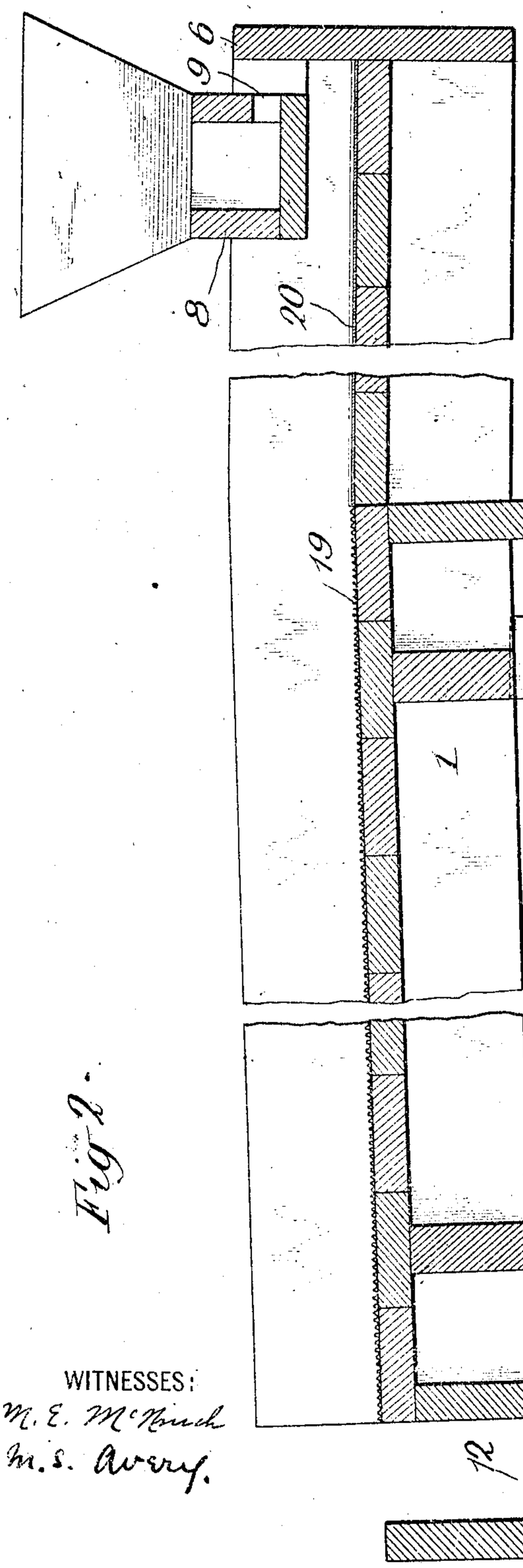

Fig. 2.

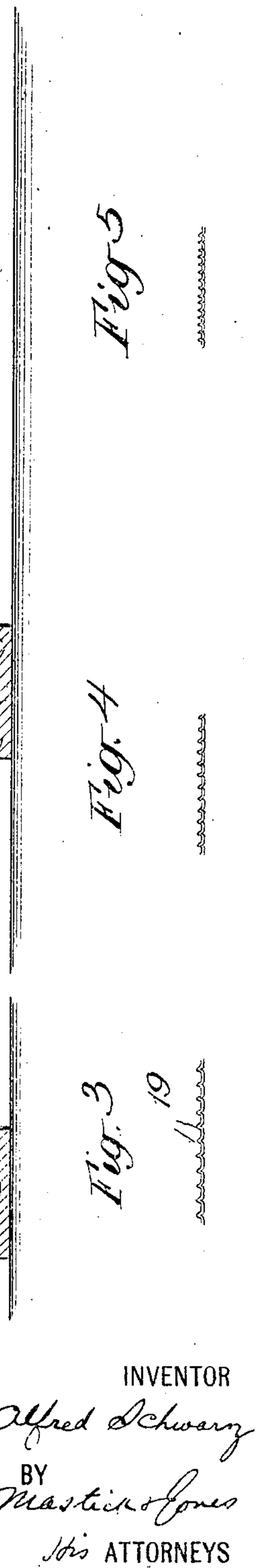

Fig. 5

Fig. 4

Fig. 3

WITNESSES:
M. E. McNinch
M. S. Avery.

INVENTOR
Alfred Schwarz
BY
Mastick & Jones
His ATTORNEYS

UNITED STATES PATENT OFFICE.

ALFRED SCHWARZ, OF NEW YORK, N. Y.

ORE-CONCENTRATING TABLE.

No. 871,369. Specification of Letters Patent. Patented Nov. 19, 1907.

Application filed December 26, 1906. Serial No. 349,471.

To all whom it may concern:

Be it known that I, ALFRED SCHWARZ, a subject of the Emperor of Germany, residing at New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Ore-Concentrating Tables, of which the following is a specification.

The present invention relates to a concentrating table designed more particularly to carry out the method described and claimed in a companion application filed October 27, 1906, Serial Number 340,863.

In the previous practice of concentrating ores the surface of the concentrating tables is divided by longitudinal wooden strips, sometimes of equal, sometimes of unequal length, the length in the latter construction increasing from the upper to the lower side of the table. These strips or "riffles" have been made substantially rectangular in section. The tables are inclined transversely, and in operation the ore in the form of pulp is introduced at the higher side near one end, and under the action of the wash water and the reciprocations of the table the ore is carried transversely downward and longitudinally forward, the purpose being that the gangue shall be discharged at the lower edge of the table, while the values or concentrates are discharged at the foot of the table. The lighter portion of the gangue passes over each riffle in succession while the values and the heavier gangue are caught by the riffles and carried toward the foot of the table. The function of the riffles is to catch and retain the values and confine their movement to one longitudinal of the table; but, owing to the comparatively great width of the riffles and their depth as compared with the particles of ore, masses of the latter become banked against the sides of the riffles, causing back eddies which prevent the proper settling of the values and afford an opportunity for the escape of the finer metallic particles.

The presence of obstructions in the form of riffles to check the travel of the ore pulp has heretofore been extensively used in gravity concentrating tables. I have ascertained from practical experience that for the better working of that type of table there should be a substantially continuous and unobstructed flow of water over a surface that offers no opportunity for the piling up or even stoppage of either gangue or values and to guide the heavy mineral particles in the direction of movement of the table (which is substantially at right angles to the flow of water) in such a manner as not either to disturb substantially the even flow of water or to offer obstruction to the particles of gangue carried thereby. A further advantage of my method of treatment is dependent upon these facts. In pulverizing the ores preparatory to subjecting them to concentrating operations it is found that the values are ground finer than the gangues, which are, on the average, of harder composition. Hence, when the mass is ground to "30 mesh", or "40 mesh", it is, in general, the gangues—*e. g.* silica—that compose the bulk of the particles that are of about the caliber of the screen, while the values are mostly among the finer particles. These large particles, on account of their size, will act as heavier material in gravity processes; and tend to find lodgment at any obstruction, whereby they retard all the finer particles and prevent their separation. I have found that if the surface upon which the operations are taking place be provided with a series of fine indentations sufficient to act as guides for the mineral particles, but of such size and shape that the particles of large average caliber cannot lodge in them, the values will all follow the direction of the indentations, while the gangue will be carried by the water in the direction of its flow.

The invention will be understood by reference to the accompanying drawings in which

Figure 1 is a top plan view of my table; Fig. 2 an enlarged sectional view on the plane of the line 2—2 of Fig. 1; Figs. 3, 4 and 5 represent corrugated surfaces which may be applied to the table according to the mesh of the ore treated; and Fig. 6 is a detail, greatly enlarged, illustrating the corrugated surface of the table and the method of separation effected thereby.

Similar reference numerals indicate similar parts in the several views.

Referring to the drawings the numeral 1 designates the table suitably mounted as on rollers 2 running upon track 3 so that it may be given a longitudinal reciprocating movement which may be imparted to it by any suitable means, such as that illustrated at 4, as will be readily understood. A head motion to impart a differential reciprocating movement, well understood in this art, will

be employed. The body of the table is preferably inclined slightly transversely of its length, as illustrated in Fig. 2, and in describing it I shall refer to the right-hand side of Fig. 2 as the "higher" or "upper" side of the table; and in like manner I shall refer to the left-hand end of the table as shown in Fig. 1 as the "head", and the right-hand end "foot."

The table is constructed in the form shown in Fig. 1 having at the head on the upper side thereof an offset 5, said offset being preferably supported in a horizontal plane while the body of the table is inclined as above stated. The upper side of the table is provided with a vertical wall 6 extending above its surface, and secured thereto by brackets 7 is a trough 8 located near the head of the table, having openings 9 in the bottom thereof for the discharge of the ore pulp on the surface of the offset. The operating surface of the table is corrugated, as will be more fully described, the corrugations being proportioned to the mesh of the particular ore treated. Thus assuming that the ore is "30," "40" or "60 mesh" the surface of the table will have 8, 12 or 16 corrugations per inch respectively, these differences being illustrated in Figs. 3, 4 and 5.

Extending along a part of the upper side of the table is a perforated water supply pipe 10 which is so disposed as to discharge the wash water issuing from the perforations thereof against the vertical wall 6 extending around said side of the table, so as not to splash the water over the corrugated surface which would create an undesirable disturbance of the masses of ore and concentrates thereon. A short distance back of the foot of the table, and extending transversely thereof, is a water discharge pipe 11, the perforations of which direct the flow of water toward the foot of the table so as to wash it clear and carry the values into a trough 12. Secured to the lower side of the table is a trough 13 adapted to receive the gangue or tailings, said trough being inclined downwardly toward the head of the table and discharging into a settling tank 14. The trough 12 at the foot of the table extends transversely across it and connects with a settling tank 15, into which it discharges the values or concentrates. Between the troughs 12 and 13 is a short trough 16 which receives the middlings and discharges them into a settling tank 17. The lengths of the troughs 13 and 16 may be varied to suit conditions met with in the treatment of different ores.

The pipes 10 and 11 may be connected with a pump or other suitable source of water supply, and the trough or hopper 8 is similarly supplied through a pipe 18. As will be readily understood, a complete water circulating system may be used whereby the water running into the settling tanks 14, 15 and 17 may be drawn off and run back into the pipes 10, 11 and 18. Instead of having a single pipe 10 extending along the upper side of the table I may provide separate discharge pipes 10 and 10′ so as to have separate regulation of the water supply at different points of the table.

As has been stated before, the surface of the table is provided with indentations or corrugations, those on the body of the table designated 19 extending preferably in the direction of the reciprocating movement imparted to the table, and those on the offset 5 designated as 20 extending in a direction at right angles to the corrugations on the body of the table. It is to be understood that the corrugations indicated at 19 and 20 are proportionately far larger than are used on such a table as represented in Fig. 1, which is in the neighborhood of six feet in width. These corrugations may be mere lines or scorings cut into or raised upon the surface of the table, which will be sufficient to act as guides for the heavier particles of ore, or values. I have obtained the best results when these indentations or corrugations have an appreciable depth and width that bears a certain relation to the mesh of the ore; that is, the size of the large particles of gangue. Practical experience suggests that for "30 mesh" ore there should be 8 corrugations per inch; for "40 mesh" ore, 12 corrugations per inch; for "60 mesh" ore, 16 corrugations; and for "80 mesh" ore, 20 corrugations. These proportions are not absolute, but it is of the greatest importance that the width and depth of the corrugations shall be so proportioned to the mesh of the ore that the larger particles of the latter do not form obstructions upon the table, the avoidance of eddies in the flow of water being of great importance. So far as my experience has shown, the maximum permissible width of the indentations or corrugations is about four or five times the mesh of the ore, and in no case should the width exceed a quarter of an inch. The best results I have attained by making the indentations from one twenty-fifth to one-fortieth of an inch deep; and as a general rule the width of the indentations or corrugations is about three times the diameter of the larger particles, and the depth less than the width.

It is not necessary that the corrugations on the body of the table shall be in the direction of agitation alone, or even that they shall be exactly in that direction. For example, there may be several series of intersecting corrugations, or a single series running at an angle of less than 90 degrees to the direction of flow of the water.

The ore to be concentrated on the table above described is first pulverized and after being screened is fed to the table through the hopper 8 in the form of pulp, and falls

upon the corrugated surface of the table which is being agitated or moved backward and forward longitudinally. At the same time water is supplied to the table through pipes 10, 10′ and 18 in such quantity and at such rate as to make an even and uninterrupted current down the table from the upper to the lower side. A preliminary separation is effected on the surface of the offset 5, a large portion of the lighter particles of gangue being washed off and flowing without interruption to the tailings trough 13. The mass of ore pulp as it leaves the surface of the offset begins to work in a general diagonal direction across the surface of the table, this direction being varied to some extent by regulating the flow of water from the rear section of pipe 10′, the gangue being washed out and carried over to trough 13, whence it flows into tank 14. The values, on the other hand, by the reciprocations of the table and guided by the corrugations 18 move down toward the foot of the table. If the guides 19 are in the form of corrugations the small particles of values fall into them and progress toward the foot of the table until they are caught by the wash water from the pipe 11 and swept into the trough 12, thence into the tank 15. If the guides 19 are mere scorings or lines upon the surface of the table, the travel of the concentrates is in less definite paths, there being some lateral shift of the lines of values in their progress toward the foot of the table. There is a certain residue not entirely separated, but composed of a large proportion of gangue with a small percentage of values, that continues on the diagonal path until it reaches the middlings trough 16; the values in these middlings, however, are practically all unliberated from particles of silica, thus forming a medium gravity material. One of the advantages of my process is that by a single operation a plurality of metals of different specific gravities will be separated from a single composite ore, and may be taken off at different points of the field.

In the construction shown in the drawing, the values, by reason of their greater specific gravity, tend to settle in the corrugations near the upper side of the table and over a well defined area; and as they are then free from any disturbing influence except that which tends to move them toward the foot of the table, they will be carried off to the concentrate tank without loss such as has been occasioned in former treatments by the formation of dams and eddies due to the lodgment of large particles of gangue. The body that continues to move diagonally across the table tends to spread out in a fan-like mass, the characteristic of which is that the values are held or tend to fall into the corrugations toward its higher side, while the gangue is being constantly carried off by the current of water down toward the trough 13.

The observed behavior of the corrugated surface above described is substantially different from that of a table having riffles in that the corrugations tend toward the maintenance of bodies or zones of water which are substantially quiescent in planes transverse to the corrugations and in which the separated metallic values are protected from, while the gangue is exposed to the currents of wash water, the values being free to move in these protected zones longitudinally of the corrugations. Another factor incident to the present invention and which adds to its utility, is that the corrugations are so proportioned that the values have a proportionately larger area of contact with the walls of the corrugations than the particles of gangue. In this operation there is a substantially uniform flow of water carrying particles of gangue from the upper to the lower side of the table, and a substantially uninterrupted progression of the values down the guides or corrugations 19 to the foot of the table.

For the surface of the table or other field I have used lead, since, being soft, it is easily corrugated by being passed between suitable rolls. I may, however, use materials such as glass, which may be molded in one piece, or aluminium, or even vulcanized rubber. I prefer, however, an electro-deposited covering of copper formed upon a suitable matrix; this covering may be made in one piece, thus dispensing with the necessity of joints or seams which create undesirable local disturbances in the current of water. The electro-deposited covering of copper is particularly advantageous when it is desired to have corrugations such as are shown in the drawings. In Fig. 6 it will be understood the parts are indicated on a greatly enlarged scale for the purpose of showing how the values 20 settle in the hollows, while the current of water carries the large particles of gangue 21 over the tops of the corrugations.

What I claim and desire to secure by Letters Patent is:—

1. A concentrating table having corrugations, said corrugations being sufficiently small in transverse section to create zones of liquid substantially quiescent in planes transverse to the corrugations, said zones being of sufficient extent to receive the metallic values and protect the same from transverse currents of wash liquid, means for differentially reciprocating the table, and means for supplying wash water thereto.

2. An ore concentrating table having its surface unbroken except for a series of corrugations of such dimensions as to be insufficient to break the continuity of the flow of water and small enough to provide zones of water substantially quiescent in directions transverse of the corrugations, means for

causing a flow of water over said table toward the tailings discharge side thereof, and means to differentially reciprocate said table.

3. An ore concentrating table transversely inclined and having its surface unbroken except for a series of corrugations discharging at the foot of the table, said corrugations being so proportioned in transverse section as to create proportionately greater surface contact with the particles of values than those of the gangue of the particular mesh of ore being treated, thereby establishing greater preponderating frictional contact with the values, and means to impart a differential reciprocating movement to said table.

In testimony whereof I have hereunto signed my name in the presence of two subscribing witnesses:

ALFRED SCHWARZ.

Witnesses:
J. BLAIR CAMERON,
S. M. MARCUS.