

No. 688,567.

Patented Dec. 10, 1901.

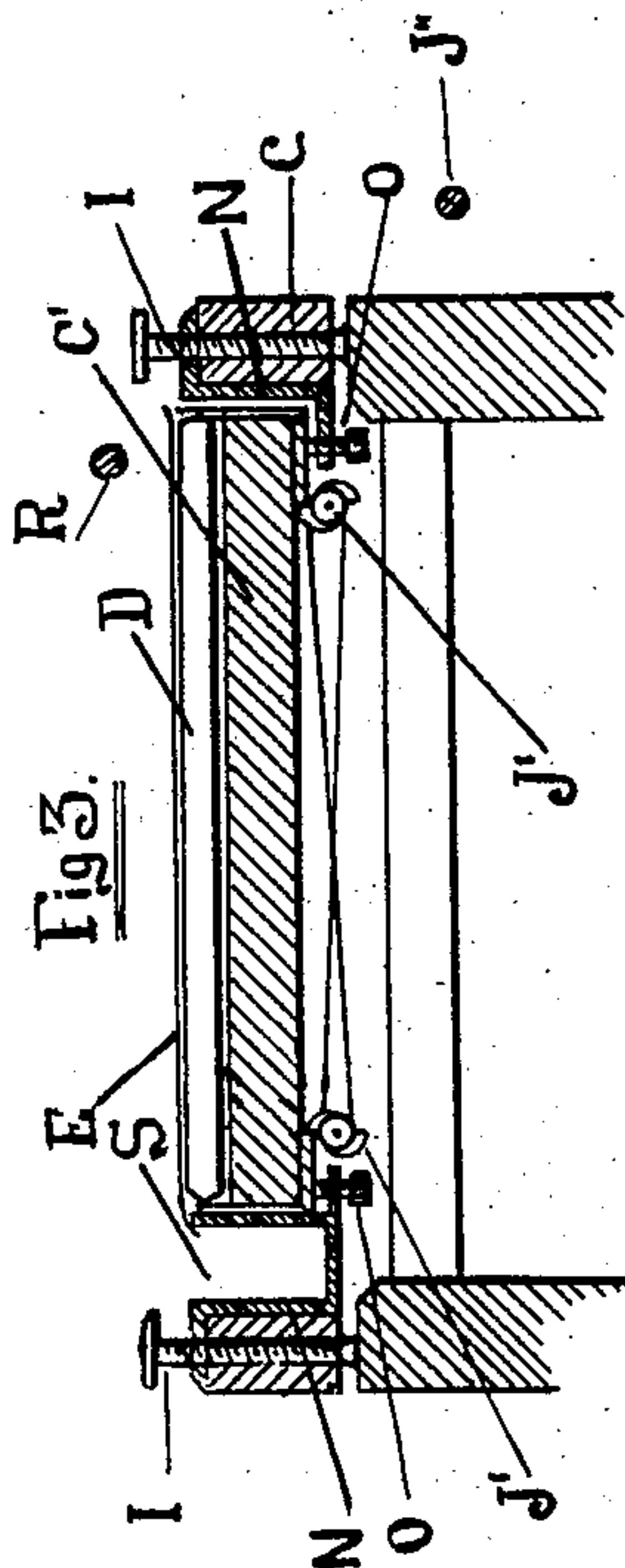
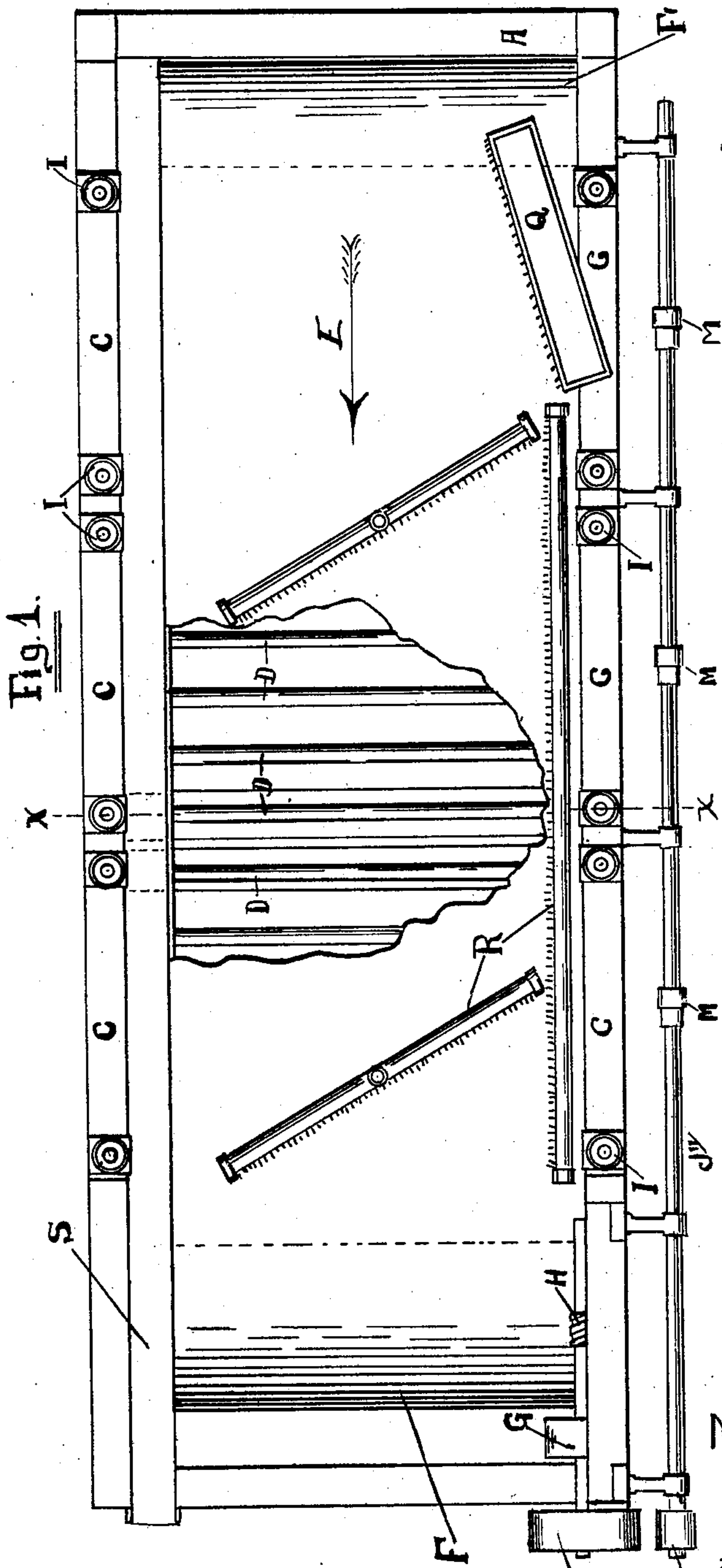
VAN BURTON WILLITS, Dec'd.

M. P. WILLITS, Executrix.  
ORE CONCENTRATOR.

(Application filed Apr. 10, 1901.)

(No Model.)

2 Sheets—Sheet 1.



Witnesses

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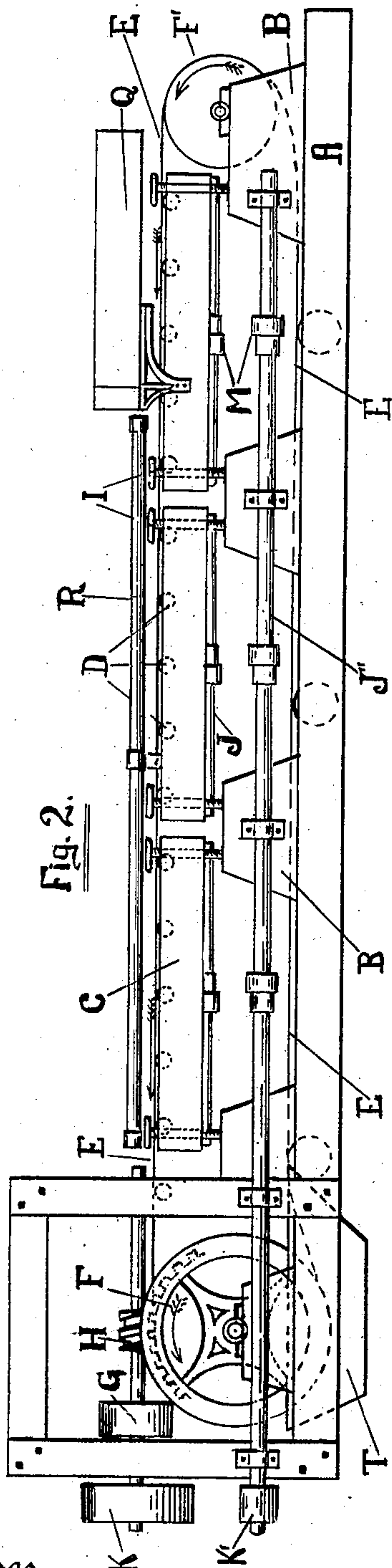


Fig. 2.

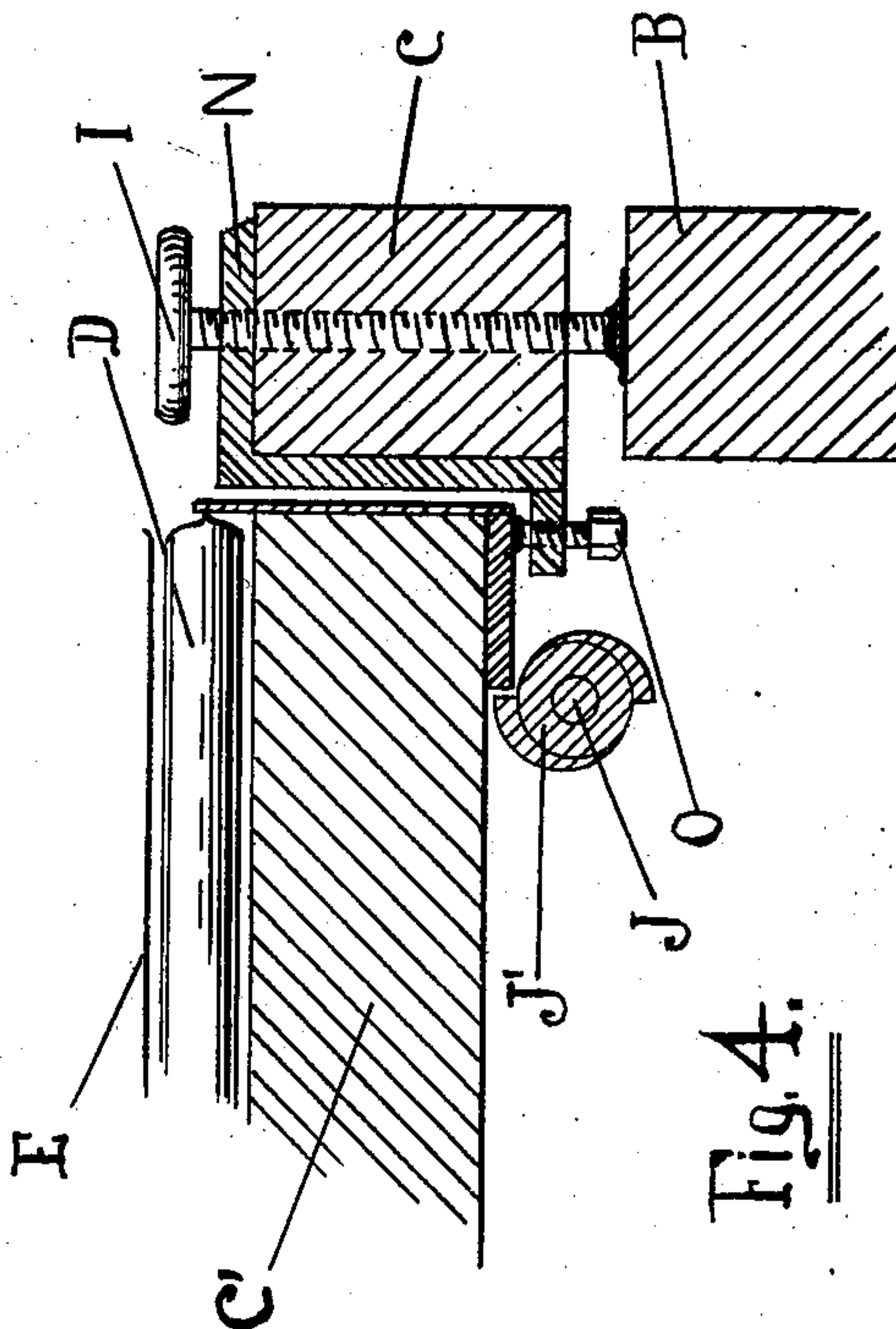


Fig. 4.

Witnesses

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# UNITED STATES PATENT OFFICE.

MARTHA P. WILLITS, OF INDIANAPOLIS, INDIANA, EXECUTRIX OF VAN BURTON WILLITS, DECEASED.

## ORE-CONCENTRATOR.

SPECIFICATION forming part of Letters Patent No. 688,567, dated December 10, 1901.

Original application filed June 19, 1900, Serial No. 20,909. Divided and this application filed April 10, 1901. Serial No. 55,247. (No model.)

*To all whom it may concern:*

Be it known that VAN BURTON WILLITS, deceased, late a citizen of the United States, residing at Nederland, in the county of Boulder and State of Colorado, did invent a new and useful Ore-Concentrating Table, of which the following is a specification.

The object of this invention is to provide a new and improved form of ore-concentrating table which is simple and durable in construction, very effective in operation, and which separates the ore from the tailings much more efficiently than other tables now known and used for that purpose.

The subject-matter of this specification was by requirement of the Patent Office divided out of an application for patent filed on the 19th day of June, 1900, Serial No. 20,909, for an ore-concentrating table, and to which reference is here made.

This invention consists of certain parts and details and combinations of the same, as will be hereinafter fully described, and pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figure 1 is a plan view of the improvement with the parts broken out. Fig. 2 is a side elevation of the same. Fig. 3 is a transverse section of the same on the line X X of Fig. 1. Fig. 4 is a detail sectional view showing the adjusting devices.

This improved concentrating-table is mounted on a suitably-constructed frame A, carrying upwardly-extending arms B, which support the jigger frame or frames C and the jigging frame or frames C'. Upon the top of the jigging-frame C' are journaled a number of rollers D, upon which passes an endless carrier-belt E, which also passes over drums F and F', journaled near the ends of the main frame A. The drum F receives by means of the main drive-pulley G and the worm-gear H a rotary motion which carries the carrier-belt E around the drums F and F', passing over the rollers D.

The frame C' may be inclined laterally to any desired degree by means of the adjust-

ing hand-screws I, operated to raise the frame C a greater or less distance above the main frame A, and it will also be evident that when the frames C and C' are in multiple one or more of said frames may be elevated independently of the others, thus inclining that portion of the jigging-table C', the carrier-belt E conforming to the pitch of that portion of the jigging-table over the rollers of which it is passing at a given time.

Mounted to turn in suitable bearings hung from the jigger-frame C are cam-shafts J, each bearing cams J', operating to raise and allow to drop the inner jigging-frame C'. By means of the drive-pulleys K and K' a rotary motion is imparted to the main shaft J'' and by it transferred through conical pulleys M and M' to the cam-shafts J, revolving them at varying speeds, as may be desired.

Attached to the jigger-frame C are hung castings N, the lips of which catch the jigging-frame C' when it is released by the cams J'. In the lip of this casting N there is an adjusting-screw O, by means of which the distance which the jigging-frame C' can drop when released may be accurately adjusted from no movement at all to the full throw of the cams. In other tables operated by cams it is usual to allow the table to drop the full throw of the cams without means being provided for regulating the vertical drop, and consequently the amount of jigging motion imparted to the table.

The jigging-table is preferably composed of two supplemental frames—i. e., the jigger-frame C, which is adjustable with reference to the main frame A for the purpose of giving a lateral incline to the jigging-table, and the jigging-frame C', to which is imparted the vertical reciprocating motion by the cams J', or other suitable means, and resting at its lowest position upon the lip of the castings N. In operation one side of the table is slightly lower than the other, and by a duplication of the parts N, I, and O on the two sides of the table the reciprocation of the lower side of the table can be so reduced as to be practically *nil*, as preferred in practice, or it may be increased until equal to the reciprocating motion at the upper side of the



table. The frames C and C' and cam-shafts J and accompanying details may be constructed in multiple, in which event each portion may be independently adjusted relative to the others with reference to speed of operation, extent of jiggling motion, and degree of incline laterally.

The operation of this concentrating-table is as follows: After a given portion of the carrier-belt E passes over the drum F' it receives from the head-box Q the stock to be concentrated, and from the pipes R R R, which may be swung at any desired angle to the belt, a supply of water flows in a gentle stream over the stock, carrying the lighter particles of quartz, white sand, and other foreign matter transversely across the table toward the lower side and into the waste-trough S, while the heavier ore particles settle and cling to the carrier-belt E and travel slowly with it in the direction of and over the drum F and are collected in the concentrate-box T, which is filled with water, and may, if desired, be equipped with brushes coming in contact with the belt E for the purpose of better freeing it from the concentrates which it carries. The separation of the ore from the foreign matter is greatly aided by the agitation of the mass occasioned by the rapid reciprocation of the jiggging-frame C', communicated to it in the preferred construction by the revolution of the cams J'. The rapidity of the jiggging motion is varied at will by means of the conical pulleys M and M', and the degree or amount of agitation is regulated to a nicety by the adjusting-screws O increasing or diminishing the amount of drop. It has been found that with most ores the best results have been obtained with a reciprocation within .375 inch as an extreme, although in some cases more drop may be advisable.

By using under the endless belt E multiple jiggging-frames, each independently adjustable as to speed, degree of agitation, and relative lateral incline, the operator is enabled to apply to the mass being concentrated such different kinds of treatment as may be best suited for the different kinds of ore at the various stages of its progress over the concentrating-table. It is found in practice that the best results are obtained by subjecting the first portion of the jiggging-table to a more rapid and violent agitation, as well as a greater degree of incline laterally, and causing the water to flow in greater volume and force over the surface of the mass. That the second portion may profitably receive a less degree of agitation, slower jiggging motion, and less incline, allowing the water to flow more slowly in smaller volume and with less ebullition, whereas in the later stages, the ore having become more highly concentrated and cleaner, it is desirable to still further reduce the incline and speed and amount of agitation and diminish the flow of water, in order that the valuables may not be washed into the waste-trough S.

In this way the effect is obtained in one table of two or more tables of different manner of operation.

A further and important feature of this construction is to be found in the fact that it is so constructed that the agitation may be gradually reduced as the mass undergoing treatment approaches the lower side of the table. In other tables the agitation is practically equal in all portions of the same, or else the comparative degrees of agitation of the different portions remain fixed and not subject to adjustment relatively to each other, whereas in this construction as the mass reaches a point near the lower side of the table and close to the waste-trough S there may be practically no agitation of the table, and consequently a very even and gentle flow of the water over the particles thereon, thus reducing to a minimum the danger of the values washing into the waste-trough. By this particular feature it is adapted to be used not only upon stock direct from the mill, but, if desired, in connection with and as supplemental to other tables which do not so thoroughly concentrate the ore, in which latter event the stock for the table is taken from the tailings end of such coarse concentrator by arranging with a sizing-screen of, say, one hundred mesh the spout where the tailings run off. The fine slime that other concentrating-tables lose will go through this fine screen, while the coarser quartz will jig off at the lower end and go into the waste. This fine slime or stock is carried to the concentrating-table in a trough and deposited in the head-box Q, from which it is fed in a fine stream upon the upper edge of the head end of the table, where it spreads out in a wide stream. A constant supply of water from the pipes R R R washes over this stock, carrying the waste matter into the waste-trough at the lower edge of the table, while the agitation, slight or greater in degree as may be required, helps to bring the lighter worthless particles of sand or silica to the top and in contact with the stream of water to be washed off, while the heavier valuable portions are caused to settle and adhere to the carrier-belt E. This agitation should only be enough to dapple the water in most cases within a maximum drop of .375 inch, as otherwise it will agitate the minerals too much and cause them to wash off with the worthless portions, and it is important that the agitation at the lower side or edge of the table should be much less than at the upper edge; hence the great advantage in having a concentrator in which the vertical reciprocating motion of the jiggging-table can be accurately adjusted as to speed and extent at the will of the operator, both as a whole and in portions to meet the requirements of different kinds of ore and various stages of concentration.

This table has been found particularly efficient, either as applied primarily to the stock



or as supplemental to other tables, in certain mining regions where the stock as it comes from the mill is of a greasy slimy nature and very difficult to concentrate owing to the tendency of the valuables to float off with the gangue. It is in certain localities a well-recognized fact that a very large proportion of the values is lost on this account and many good properties have been abandoned by reason of being unable to secure paying proportions of the metals. This table, owing to its adjustability and the diminishing agitation as the stock approaches the waste-trough and the concentrate-box, has been proved to be peculiarly fitted to save an exceedingly high proportion of the values from stock of this kind.

By making this concentrator with multiple frames under one belt it is possible to secure in one table various degrees of vertical agitation, various speeds of operation, various degrees of lateral incline, and rapidity of flow and volume of water, whereas in most tables the ore is subjected to the same treatment in its last stages and near the foot of the table that it is when it is first deposited in its coarse condition at the head of the table. This feature is considered to be very important for the reasons given.

It is manifest that this combination of multiple jigging-frames, independently adjustable as to speed and extent of reciprocation and degree of lateral incline, all under one endless carrier-belt, may be applied to various old forms of jigging-frames in which these various properties are not adjustable. It is also manifest that the reciprocating motion may be varied anywhere from a vertical to a horizontal motion without departing from the principle employed.

It is not desired to limit the invention to the particular construction, as the same result may be obtained by various modifications of the particular means found most desirable and shown in the drawings for adjusting and regulating the amount of reciprocation, degree of incline of the jigging-table, and the adjustability of the multiple jigging-frames independently of each other, as well as other details of construction. Further, if it is desired to obviate the use of conical pulleys and belt connections underneath the table the main shaft J' may be dispensed with and the several cam-shafts J may receive their motion direct from the drive-pulley G, or, if desired, these cam-shafts and cams may be placed above instead of below the frames and the jigging motion may be conveyed to the frames by rods descending and supporting the frames.

Having thus described the invention, what is claimed as new, and desired to be secured by Letters Patent, is—

1. In a concentrating-table, the combination with an endless belt of a jigging-frame thereunder, and means for imparting a recip-

rocating motion to both sides of said frame, substantially as set forth.

2. In a concentrating-table, the combination with an endless belt of a jigging-frame thereunder, means for imparting a reciprocating motion to both sides of the frame, and mechanism as described for regulating the extent of said reciprocating motion, substantially as set forth.

3. In a concentrating-table, the combination with an endless belt of a jigging-frame thereunder, means for imparting a reciprocating motion to both sides of the frame, and mechanism as described for inclining said frame laterally, substantially as set forth.

4. In a concentrating-table, the combination with an endless belt of a jigging-frame thereunder, means for imparting a reciprocating motion to both sides of the frame, and mechanism as described for adjustably inclining said jigging-frame laterally, substantially as set forth.

5. In a concentrating-table, the combination with an endless belt of a jigging-frame thereunder, and means for simultaneously lifting and dropping both sides of the frame, substantially as set forth.

6. In a concentrating-table, the combination with an endless belt of a jigging-frame thereunder, means for imparting a vertical reciprocating motion to both sides of said frame, and mechanism as described for regulating the extent of said reciprocating motion independent of the adjustment of the main frame, substantially as set forth.

7. In a concentrating-table, the combination with an endless belt of a jigging-frame thereunder, means for imparting a vertical reciprocating motion to both sides of the frame, and mechanism as described for regulating the inclination of said frame laterally independent of the adjustment of the main frame, substantially as set forth.

8. In a concentrating-table, the combination with an endless belt of a jigging-frame thereunder, mechanism as described for imparting to each side of said frame a reciprocating motion variable with relation to the other side, substantially as set forth.

9. In a concentrating-table, the combination with an endless belt of a jigging-frame thereunder, mechanism for imparting to said frame a reciprocating motion, and adjusting-screws for regulating the extent of the reciprocating motion of the two sides of said frame independently, substantially as set forth.

10. In a concentrating-table, the combination with an endless belt of multiple jigging-frames thereunder and mechanism as described for imparting a reciprocating motion to both sides of the jigging-frames, substantially as set forth.

11. In a concentrating-table, the combination with an endless belt of multiple jigging-frames thereunder in longitudinal series, and means for imparting a reciprocating motion



to both sides of said jigging-frames, substantially as set forth.

12. In a concentrating-table, the combination with an endless belt of multiple jigging-frames thereunder, means for imparting a reciprocating motion to both sides of said jigging-frames, and mechanism as described for regulating the extent of the reciprocating motion, substantially as set forth.

13. In a concentrating-table, the combination with an endless belt of multiple jigging-frames thereunder, means for imparting a reciprocating motion to both sides of said frames, and mechanism as described for regulating the inclination of said frames laterally, substantially as set forth.

14. In a concentrating-table, the combination with an endless belt of multiple jigging-frames thereunder, means for imparting to each side of the respective frames a reciprocating motion independent of the other side and of the other frames, and mechanism as described for regulating the rapidity of the reciprocating motion of the respective frames, substantially as set forth.

15. In a concentrating-table, the combination with an endless belt of multiple jigging-frames thereunder, means for imparting to each side of the respective frames a reciprocating motion independent of the other side and of the other frames, and mechanism as described for regulating the extent of the reciprocating motion of the respective frames, substantially as set forth.

16. In a concentrating-table, the combination with an endless belt, of multiple jigging-frames thereunder, means for imparting to

each side of the respective frames a reciprocating motion independent of the other side and of the other frames, and mechanism as described for regulating the inclination of the respective frames, substantially as set forth.

17. In a concentrating-table the combination with an endless belt of multiple jigging-frames thereunder, and means for imparting to each side of the respective frames a reciprocating motion independent of and variable with relation to the other frames, substantially as set forth.

18. In a concentrating-table, the combination with an endless belt of multiple jigging-frames thereunder, means for imparting a reciprocating motion to both sides of the respective frames, and mechanism as described for regulating said reciprocation independently with relation to the other frames, substantially as set forth.

19. In a concentrating-table, the combination with an endless belt of multiple jigging-frames thereunder having an independent reciprocating motion, and the screws O in the castings N for regulating the extent of reciprocating motion of the two sides of the respective jigging-frames independently of each other, substantially as set forth.

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

MARTHA P. WILLITS,  
*Executrix of the last will and testament of*  
*Van Burton Willits, deceased.*

Witnesses:

WM. H. PRAY,  
ETHELYN WRIGHT.