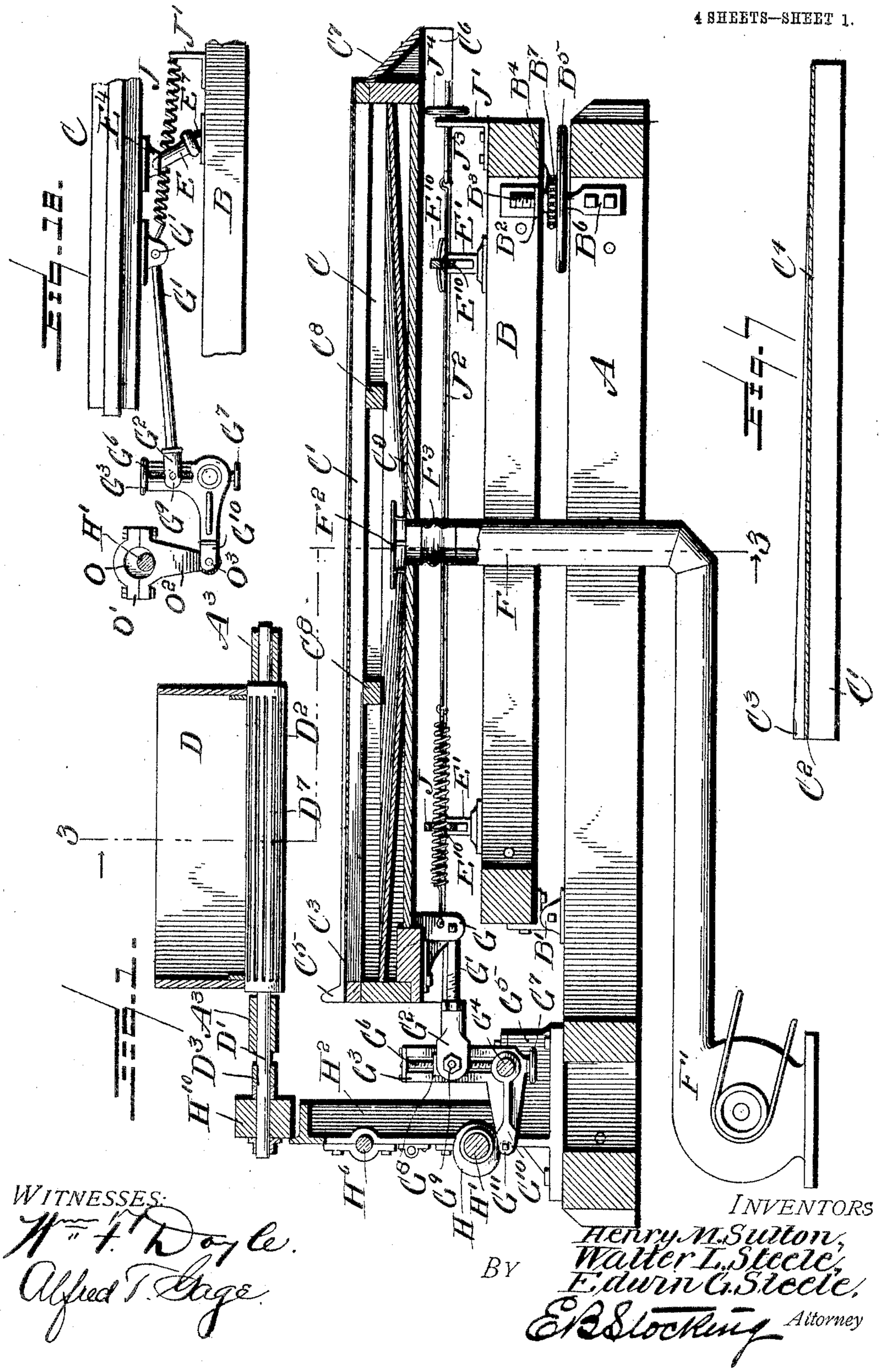
No. 797,239. PATENTED AUG. 15, 1905.

H. M. SUTTON & W. L. & E. G. STEELE.

DRY CONCENTRATING TABLE.

APPLICATION FILED DEC. 4, 1902.

4 SHEETS—SHEET 1.



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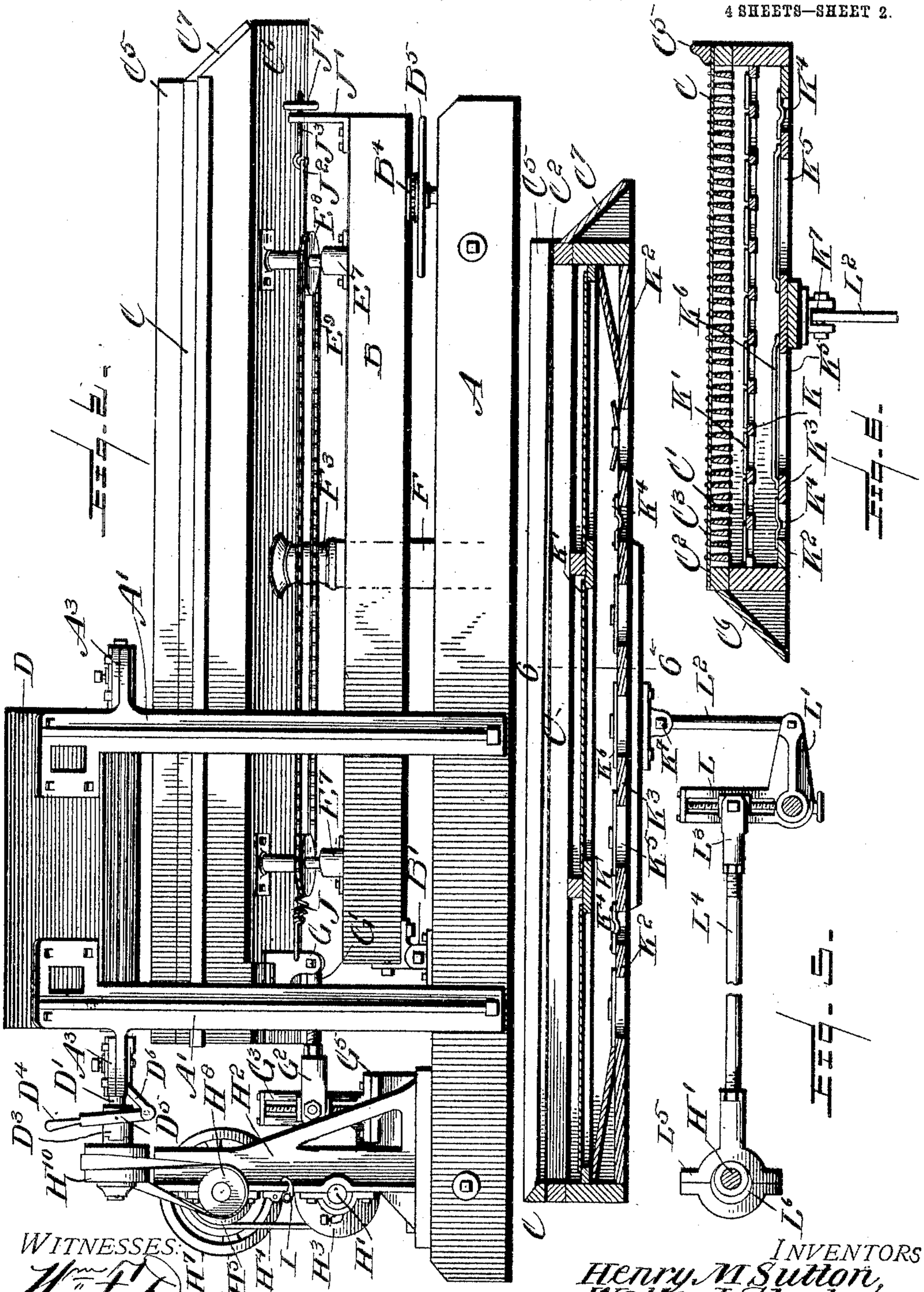

FIG. 5.

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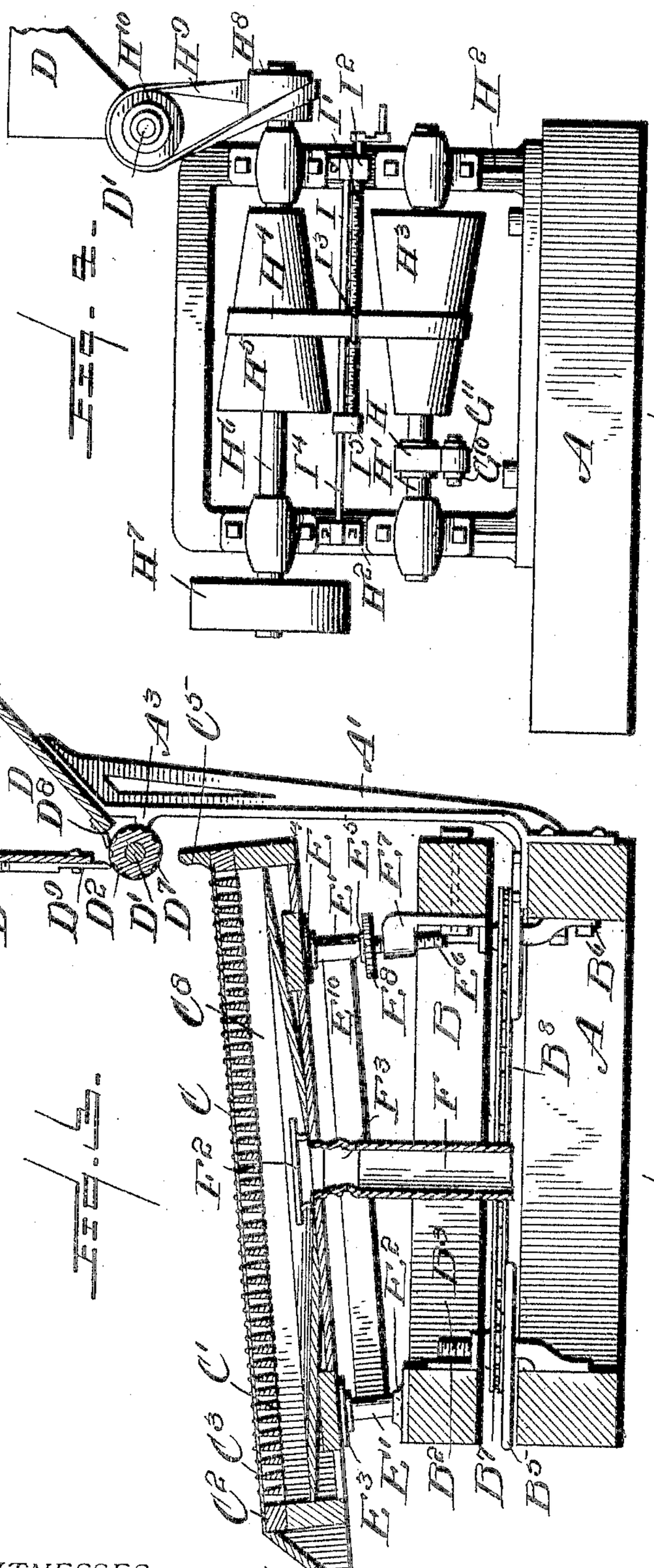

FIG. 4.

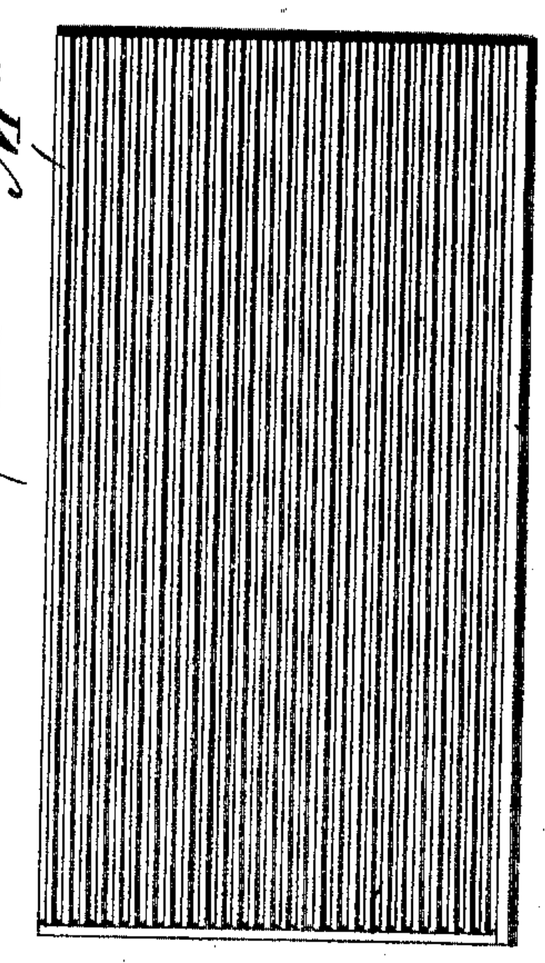

FIG. 5.

FIG. 6.

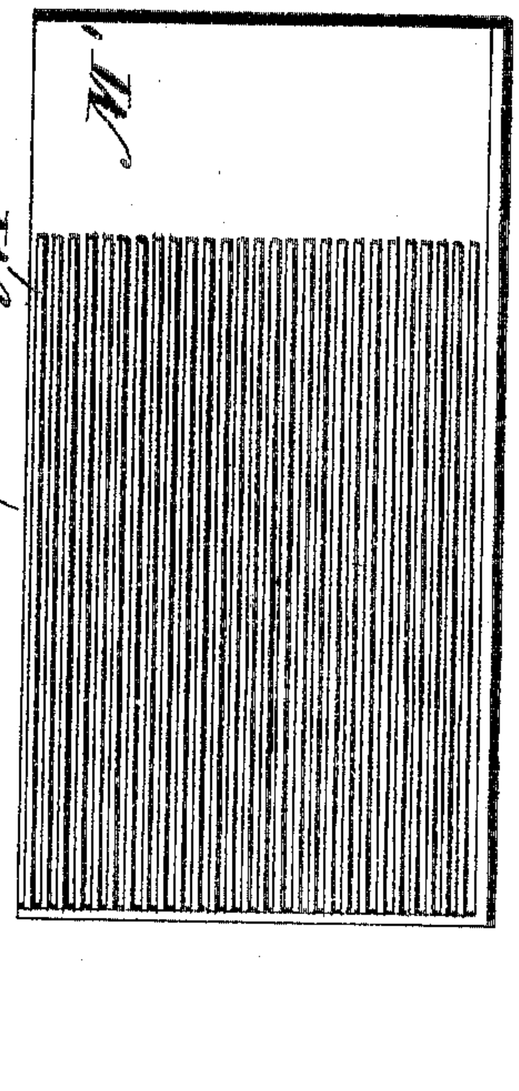

FIG. 7.

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4 SHEETS—SHEET 4.

Fig. 10.

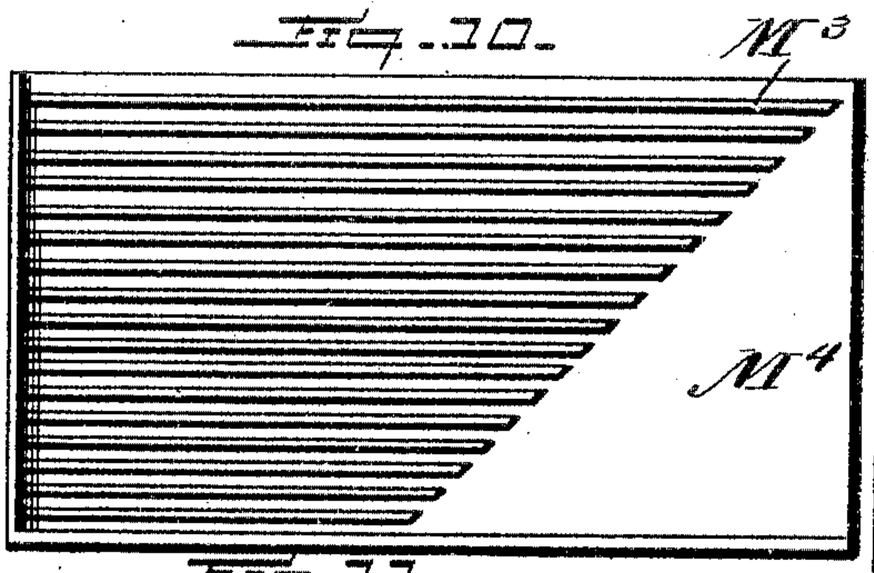


Fig. 11.

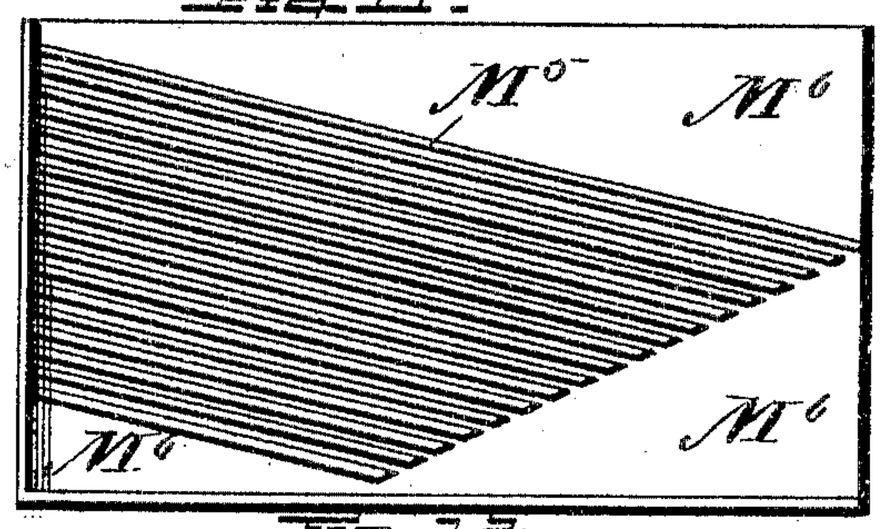


Fig. 12.

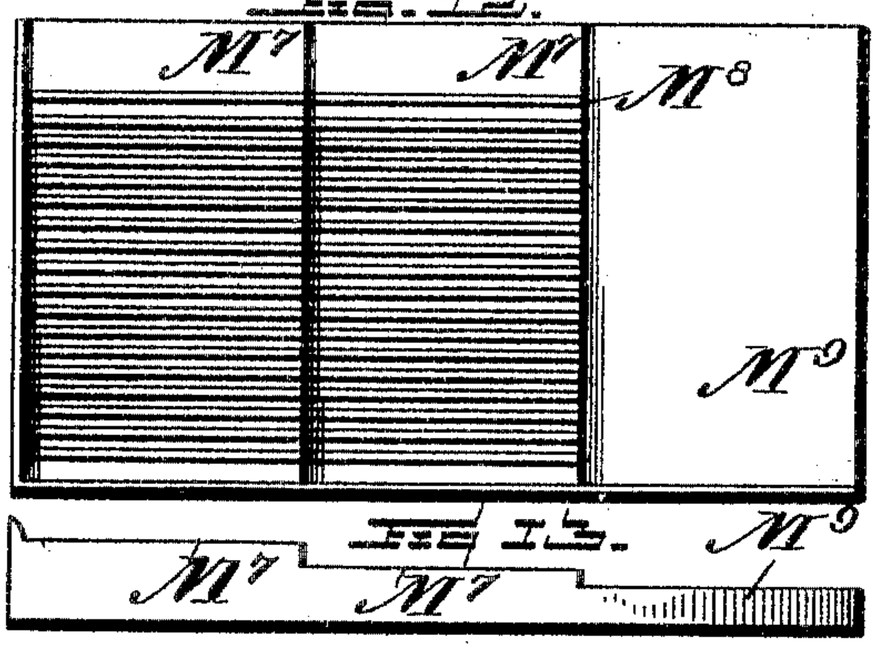


Fig. 13.

Fig. 16.

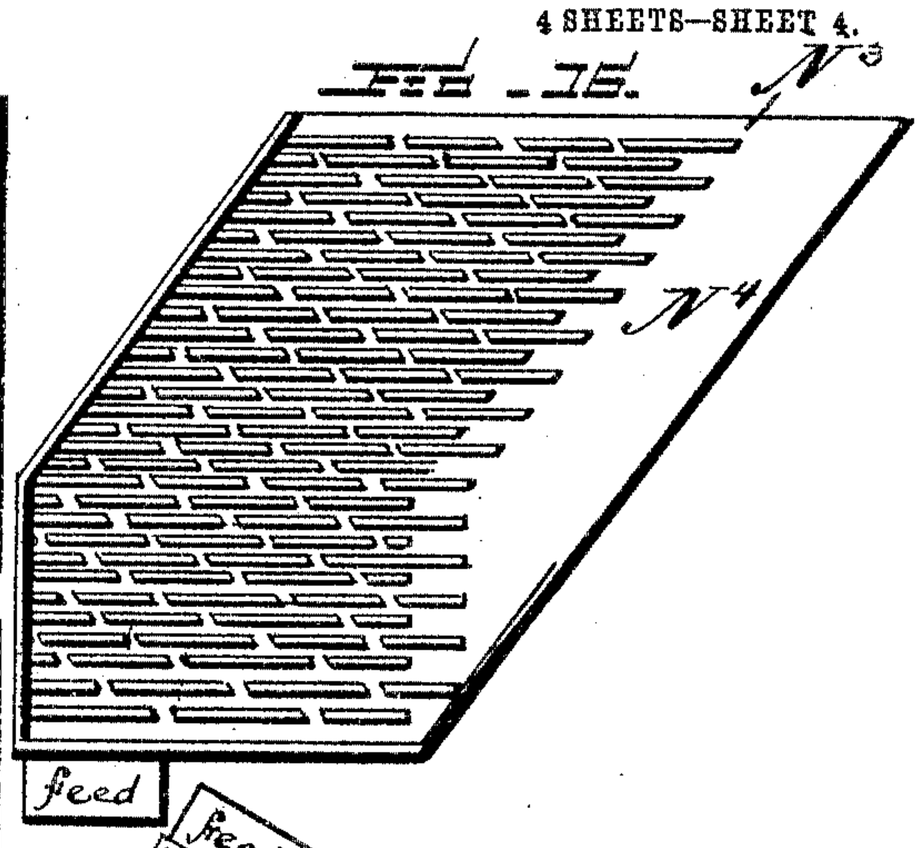


Fig. 17.

Fig. 14.

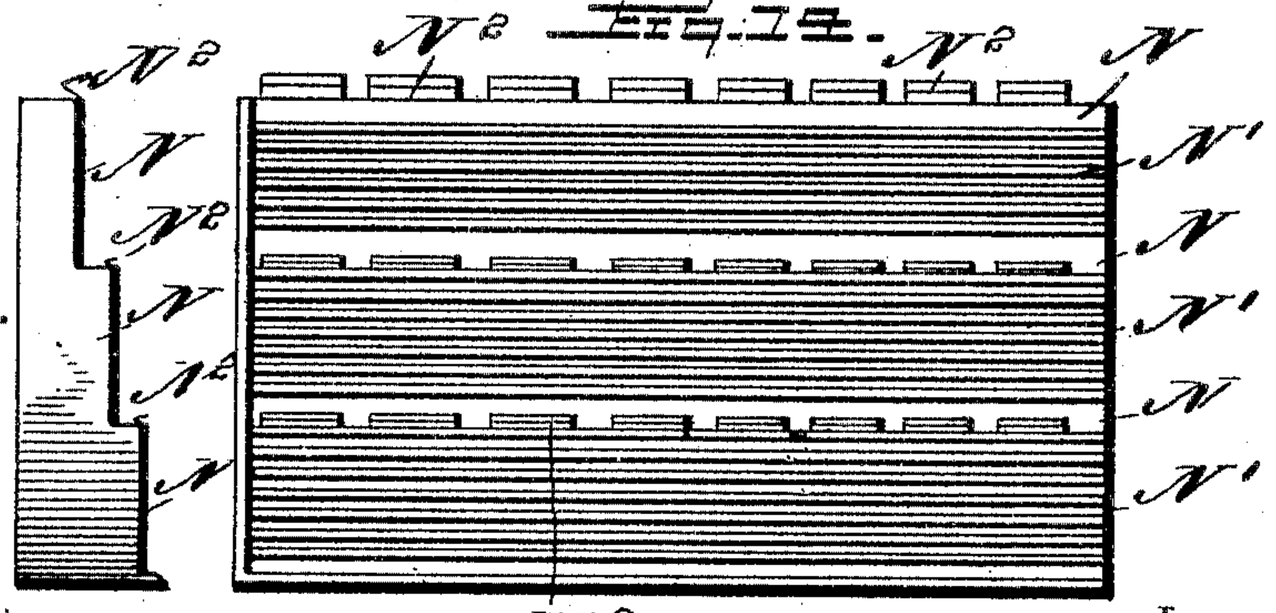
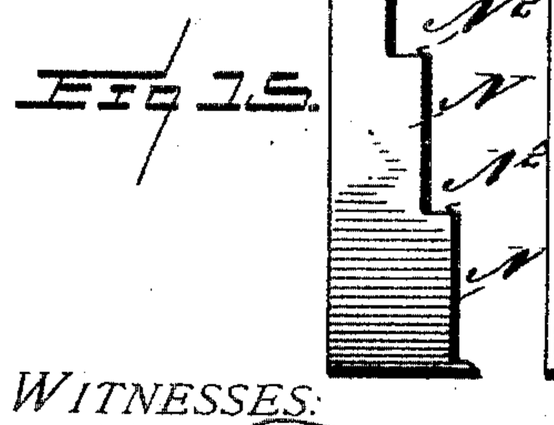


Fig. 15.



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UNITED STATES PATENT OFFICE.

HENRY M. SUTTON, WALTER L. STEELE, AND EDWIN G. STEELE, OF DALLAS, TEXAS.

DRY CONCENTRATING-TABLE.

No. 797,239. Specification of Letters Patent. Patented Aug. 15, 1905.

Application filed December 4, 1902. Serial No. 133,925.

To all whom it may concern:

Be it known that we, HENRY M. SUTTON, WALTER L. STEELE, and EDWIN G. STEELE, citizens of the United States, residing at Dallas, in the county of Dallas, State of Texas, have invented certain new and useful Improvements in Dry Concentrating-Tables, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to a dry concentrating-table, and particularly to a construction by which a riffled table is adapted for use in dry concentration by the use of air as a floating medium for the material.

The invention has for an object to provide a dry concentrating-table adapted to operate by an air-pressure in a similar manner to an ordinary wet concentrating-table, said air for floating the dry material being passed upward between the riffles located upon said surface.

A further object of the invention is to provide a pervious transversely-inclined table-top having longitudinal riffles thereon and means for passing a current of air through said top while the table is reciprocated longitudinally.

Another object of the invention is to provide an improved construction of parts for supporting the table to permit a longitudinal reciprocation thereof and also adjusting means to vary the transverse inclination of the table and the longitudinal inclination thereof.

Other and further objects and advantages of the invention will be hereinafter set forth and the novel features thereof defined by the appended claims.

In the drawings, Figure 1 is a vertical longitudinal section through the table; Fig. 2, a side elevation thereof from the back of the table; Fig. 3, a vertical cross-section through the table and hopper on line 3 3 of Fig. 1; Fig. 4, an end view of the driving mechanism; Fig. 5, a detail vertical longitudinal section showing modified means for applying the air-pressure. Fig. 6 is a vertical cross-section on line 6 6 of Fig. 5 through this construction of table for producing an intermittent air-blast; Fig. 7, a detail section showing one of the tapering riffles. Fig. 8 shows a table provided with longitudinal riffles of equal length extending a portion of the way toward the foot of the table, thus leaving a rectangular unriffled space. Fig. 9 is a plan showing the riffles extending the entire length of the table. Fig. 10 is a similar view showing parallel longitudinal riffles with advancing terminals, leaving a triangular unriffled space. Fig. 11 is a similar view showing parallel diagonally-disposed riffles with advancing terminals and an unriffled space above and below the riffles. Fig. 12 is a plan showing the table-top provided with parallel riffles extending in different planes down a portion of the table to form transverse steps. Fig. 13 is an elevation thereof, showing this stepped arrangement. Fig. 14 is a plan of a further arrangement of riffles adapted for use with this invention in which a number of longitudinal steps are provided having parallel longitudinal riffles upon each one thereof. Fig. 15 is an elevation of the structure shown in Fig. 14. Fig. 16 is a plan of a table provided with parallel riffles alternately extended and formed in separated sections. Fig. 17 is a plan of the table having riffles extending from corner to corner thereof parallel with the direction of vibration and at right angles to the feed, and Fig. 18 is an elevation of a preferred arrangement of the table-support.

Like letters of reference refer to like parts in the several figures of the drawings.

The letter A designates a base or sill of any suitable construction upon which an adjusting-frame B is mounted and adapted to carry upon its upper face the concentrating-table C, above which a feed-hopper D is disposed at one end and supported by any suitable form of standards, such as shown at A′. The adjusting-frame B is pivotally mounted at one end upon the base A by means of the connection B′ and is provided at its opposite end with a bracket B^2, through which the upper end of a threaded adjusting rod or post B^3 passes, which rod is provided with a traveling nut B^4 thereon, having a suitable handle B^5 for rotating the same. The rod B^3 is secured at its lower end B^6 to the base, and the traveling nut upon the rod adjusts one end of the frame B so as to vary the longitudinal inclination of the table. The adjusting-rods are disposed upon opposite sides of the table at one end thereof, and the traveling nut B^4 upon each rod is provided with a sprocket-wheel B^7, from which a chain B^8 extends to the nut upon the opposite rod.

Upon the adjusting-frame B of the table

supports E are disposed and consist of short rods E′, having round-head ends adapted to seat in a socket E^2 upon the frame B and a similar socket E^3 upon the under face of the table at one side thereof, while the rod E′ at the opposite side is seated at its upper end in a socket E^4 upon the under face of the table and at its lower end in a socket E^5, carried by an adjusting-screw E^6, mounted in a threaded bracket E^7, suitably secured to the adjusting-frame B. This screw is provided with a sprocket-wheel E^8, from which a chain E^9 extends to the adjuster at the opposite end of the frame in order to effect a transverse adjustment of the table. The rods at opposite ends are connected together by a bar E^{10}, which causes a simultaneous movement of the bearings in the longitudinal vibration of the table.

The table is provided at its upper portion with a series of parallel slats C′, extending longitudinally thereof to provide air-outlets between the same. These slats may be of any desired cross-section—for instance, tapering upwardly, as shown in Figs. 3 and 6. Resting upon the slats is a pervious top C^2, formed of cloth or any desired material adapted to permit the passage of air therethrough under pressure, and upon the upper surface of this pervious top a series of ribs or riffles C^3 is disposed, each of the same being preferably in alinement with the slat C′ beneath it and secured thereto in any desired manner. Various arrangements and characters of riffles may be used, as will be hereinafter described in connection with the modifications shown in this case; but a preferred form is illustrated in Fig. 7, where the riffle tapers downwardly from the hopper end of the table to the discharge end, as shown at C^4. The table is normally inclined transversely of its length, which inclination may be adjusted by the means hereinbefore described, and a suitable protecting-rib C^5 is provided at one side and end of the table, while the opposite side is formed with a discharging-flange C^6 and the discharge end with a similarly-inclined flange C^8. If desired, the slats may be supported between their ends by means of cross-bars C^8, as shown in Fig. 1, and any preferred method of introducing an air-blast beneath the slats may be used, one form being shown in Fig. 1, wherein a tapering bottom C^9 of air-tight character is provided beneath the slats, and communicating therewith is a feed-pipe F, extending to a suitable compressing device F′, such as a fan, and having above its discharge a baffle-plate F^2 to prevent a direct pressure through the table above the discharge from the pipe. This pipe may be of a flexible character adjacent to its connection with the table, as shown at F^3, so as to permit a vibration of the table without affecting the relation of the pipe thereto.

The tapering bottom C^9 of the air-chamber varies the capacity or area thereof at the ends, so as to maintain an equal pressure of air at all points, and also provides means for conducting the fine dust which may pass through the pervious top to a central point, where it may be removed whenever necessary.

For the purpose of imparting a longitudinal reciprocation or vibration to the table a bracket G is secured to the under side at the hopper end thereof and a pitman-rod G′ pivotally secured at one end to said bracket and at its opposite end to an adjustable connecting-sleeve G^2, having its free end pivotally connected to a crank-arm G^3, having its shaft G^4 mounted in a bearing G^5 upon the base of the machine. For the purpose of providing a vertical adjustment of the pivoted end of the connecting-sleeve G^2, and thus regulating the extent of throw or vibration of the table, an adjusting-screw G^6 is mounted in the vertical member of the crank-arm and provided at its lower end with a handle G^7, while the free end of the connecting-sleeve is pivotally secured to a traveling nut G^8 by the pivot-pin G^9. The horizontally-disposed end G^{10} of the crank-arm is provided with an antifriction-roller G^{11}, disposed beneath an operating-cam H, mounted upon a shaft H′, suitably journaled at its opposite ends in standards H^2. This shaft is provided with a cone driving-pulley H^3, connected by the belt H^4 with a similar oppositely-disposed cone-pulley H^5 upon the shaft H^6, also journaled at its opposite ends in the standards H^2. The shaft H^6 is provided at one end with the driving-pulley H^7, connected to any suitable source of power, and at its opposite end with a similar pulley H^8, connected by a belt H^9 with a driving-pulley H^{10} upon the end of the shaft D′, carrying the feed-roller D^2 beneath the hopper. For the purpose of adjusting the belt H^4 upon the cone-pulleys for regulating the driving speed of the several parts a belt-shifter I is provided comprising a screw-shaft I′, mounted in a bearing I^2 upon one standard and provided with a loop I^3, surrounding the belt, while the free end of the shaft is guided in its movement by means of a supporting-rod I^4, carried by the opposite standards, upon which a collar I^5 is adapted to slide. The reciprocating mechanism for the table is held under proper tension by means of a spring J, extending from the bracket G to a fixed support J′, carried upon the frame B and provided with a connecting-rod J^2, having a threaded adjusting-screw J^3 mounted in the fixed support J′ and provided with a hand-wheel J^4 for adjusting the tension of the spring to hold the crank-arm in contact with its operating-cam and for restoring the table after its movement by said cam.

The shaft D′ of the feed-roller D^2 beneath the hopper D is mounted at its opposite ends in bearings A^3, carried upon the standards A′, and for the purpose of disconnecting this feed-

roller from its driving mechanism whenever desired a clutch D^3 is slidably keyed upon the shaft D′ and provided with a handle D^4, pivoted thereto at D^5 and pivoted at its lower end in a fixed arm D^6, extending from one of the bearings A^3. The feed-roller D^2 is provided with a series of longitudinal recesses or corrugations D^7, which may be of any desired depth or area, depending upon the feed desired upon the table, and the roller is disposed beneath the opening at the bottom of the hopper. At one side of this opening a flexible strip B^8 is disposed to prevent escape of material at the rear of the roller, and upon the front of the hopper an adjustable discharge-gate D^9 is slidingly mounted and adapted to be adjusted by a hand-wheel D^{10}, threaded upon the upper end D^{11} of the operating-rod for the gate and disposed between the arms of the bracket D^{12}, as shown in Fig. 3.

In Figs. 1 and 2 the table-supports E are shown as disposed in a vertical plane extending through the frame D and the table C, the result of which causes the table to reciprocate longitudinally and also to descend toward a lower parallel horizontal plane in its movement away from the hopper. It has been found very desirable, and preferable in many cases, to incline the supports toward the head or feed end of the table, so that the table rises into a parallel horizontal plane at each forward stroke and returns to the initial plane upon the return stroke. In Fig. 18 an arrangement of the parts for accomplishing this object is shown, wherein the supports E are inclined obliquely to a vertical plane through the table and frame and toward the feed end of the table. It has also been found preferable in many cases to provide an equal forward and return movement instead of the quick forward and slow return secured by the cam H in Figs. 1 and 2 and the spring J coöperating therewith. In order to secure this equal movement, an eccentric O may be secured upon the driving-shaft H′ and surrounded by a strap O′, having a depending arm O^2, pivotally connected at its lower end O^3 to the crank-arm G^3 by means of the free arm G^{10} thereof, while the weight of the table is balanced by a spring J, connected to a support J′, similar to that shown in Fig. 1. The crank-arm G^3 is similar in construction to that heretofore described, as are the other parts of the table and support, the only differences in construction and arrangement being the diagonal disposition of the supports E and the eccentric connection, whereby the table vibrates backward and forward longitudinally and is given simultaneously a rising-and-falling movement in a vertical plane.

The form of air-supply shown in Fig. 1 provides for a constant pressure; but the invention is equally applicable for use in connection with an intermittent pressure, and for this purpose any desired form of air-blast may be used, for instance, as shown in Figs. 5 and 6. The table C may be provided beneath the slats C′ with an apertured partition K, the opening therein extending longitudinally of the table and being provided with upwardly-movable valve-plates K′ to admit the passage of air into the chamber beneath the slats and pervious top C^2, while beneath this partition K the perforated bottom plate K^2 of the bellows is disposed and provided with the movable section K^3, flexibly connected at K^4 with the stationary portion of the bottom. This movable portion K^3 is provided with transverse openings K^5, having valves K^6 above the same and provided upon its under surface with the pivoting-bracket K^7, connected to any suitable driving mechanism—for instance, a crank-arm L, similar to that shown in connection with the driving mechanism the horizontal member L′ of which is connected by a rod L^2 with the bracket K^7—while the vertical member is provided with a sleeve L^3, mounted thereon for longitudinal adjustment. This sleeve is adjustably connected to a pitman L^4, extending to a boxing L^5, disposed about a cam L^6, located upon the driving-shaft H′ of the mechanism hereinbefore described. In this form of table, whereon the ore is floated or suspended by the air passing upward through the pervious top, any desired form or arrangement of riffles may be used, and for the purpose of showing the applicability of a number of forms now in use upon washers which are adapted to be disposed upon the pervious table herein used we have illustrated in Fig. 8 a series of longitudinal riffles M of equal length extending parallel toward the foot of the table and terminating so as to leave a rectangular unriffled space M′. In Fig. 9 a similar arrangement of riffles M^2 is shown extending the entire length of the table.

Fig. 10 shows the longitudinal riffles M^3 with advancing terminals, leaving a triangular unriffled space M^4, while Fig. 11 shows the riffles M^5 disposed diagonally to the sides of the table with advancing terminals, leaving an unriffled space M^6 above and below the riffles and also at one end thereof.

Fig. 12 illustrates a form of table having steps M^7 extending transversely in different horizontal planes, the riffles M^8 being disposed longitudinally of the table and the unriffled space M^9 provided upon the lowest step. The tendency of the gangue in the movement of the table when operating upon very fine material is to flow back toward the head of the table, and the stepped arrangement (shown in Fig. 13) prevents this objection.

Fig. 14 is a top plan of a table provided with a number of longitudinal steps N, having

parallel longitudinal riffles N′ thereon, and for the purpose of allowing the material to be returned toward the head of the table as it passes from one level to the next below the usual chutes or gutters N^2 are provided, as shown in Fig. 15.

In Fig. 16 a table is shown having riffles N^3 in separated portions, the alternate riffles terminating at different lengths, while an unriffled portion N^4 is provided at one end of the table.

In Fig. 17 the riffles N^5 extend entirely across the table from one corner to the other, while the vibrations of the table are in line with the riffles and the feed at a right angle thereto.

As before stated, the invention is not confined to the use of any one of the forms herein shown, they being illustrated for the purpose of demonstrating the adaptability of the table to the different arrangements of the riffles now in use in various forms of concentrators.

The table C is inclined transversely and also longitudinally, the foot or discharge end being slightly higher than the feed or hopper end, thus causing the material to travel upwardly thereon in its movement toward the discharge end of the table. This is essential when operating upon fine ores in order to retard the too rapid travel of the values which would otherwise occur. In other characters of ores and those of larger size mesh it may be desirable that the table be perfectly flat longitudinally or even slightly lower at the foot end, and the adjusting means applied to the frame for varying the longitudinal inclination of the table is to adapt the same for use with different sizes and grades of ore. The vibrating means for the table herein shown cause the same to be drawn back slowly and returned forward quickly by the tension of the spring; but, if desired, this movement can be completely reversed and an upward or lifting movement may be given the table, if preferred, by adjusting the supports to slope the table toward the head or hopper end thereof. If it be desired to drop the table slightly at each forward stroke, the supports are given a slight inclination toward the foot or discharge end of the table, as shown in Fig. 18, while the length of stroke or travel of the table is adjustable by the hand-wheel and screw operating in the vertical arm of the crank-lever, as shown. The form of this vibrating mechanism herein disclosed is merely intended to illustrate a desirable construction; but the invention is not specifically confined thereto. The ore or material to be concentrated is fed by the roller beneath the hopper upon the head end of the table in predetermined quantities and falls between the tapering riffles upon the upper surface of the pervious top of the table. The air passing upward through this top stratifies the different minerals, while the longitudinal vibration in connection with the inclination of the table retains this stratification so as to discharge the different results of the concentration at different points upon the table.

The present invention provides a dry concentrator adapted to treat ores in a similar manner to the wet tables heretofore used and to secure a much more efficient and rapid operation with a minimum loss of the values in the tailings which pass from the table. The separating medium used to float or support the ore being air adapts the invention for use in the many mining localities where water is often entirely absent, thus rendering a wet separation impracticable and avoiding the necessity of transporting the ore, frequently at a great cost, to a mill or separating plant at a distance from the mine. Furthermore, very often the ores carry matter soluble in water, which either prevents a separation being effected by thickening the pulp, and thus floating out the values, or the values themselves may be soluble, or partially so, and thus pass over the table in solution. Nothing in ores being soluble in air, it will be apparent that the formation of such a pulp or thickening of a solution which occurs in wet separation is entirely avoided. An ore may carry a value very soft as compared to the gangue or other values, which results in this value being slimed in crushing and floated on the surface of the water. Under certain conditions ores will slime to such an extent as to be impossible of commercial treatment by any wet method, either mechanical or chemical. In the present table any size mesh of material can be treated, however fine. The finer or more packy the material the better results are obtained when a constant pressure of air is used. In the use of water flowing over a table there is a tendency to mix the values and cause loss by washing them off the table. As the water flows over the table it causes eddies and whirls, each disturbing the stratifications on the table, and as the clear water flows over the clean-up space at the lower end it washes down the strata toward the discharge side, causing them to overlap, with the result that a large portion of the concentrates must be returned for a further treatment. This water also washes the values which have a tendency to come out high up on the table down toward the discharge side, causing the values to pass off the table within a few inches of the gangue or dross, and considerable loss results from this cause. By introducing the separating medium or air through the pervious table-top there is no whirling or eddying of the ore, which is simply rested or floated on a cushion of air sufficiently strong to float the gangue, but not strong enough to blow the mass about. The ore being floated, the motion of the table causes the values to settle to the bottom and stratify, the particles having the greatest specific gravity lying upon the bottom against one

or more of the riffles. After the stratification of the ore has been effected there is nothing to disturb this, and the mass flows downward toward the foot end of the table, while the particles reach a portion of the sloping or tapering riffles low enough to allow them to pass over and to arrange themselves in well-defined zones, according to their specific gravity. It will be readily seen that there is nothing to disturb these zones as they travel across the clean-up or unriffled space at the foot of the table, so that a perfect separation is effected whereby the heaviest and most valuable values will pass off the table high up on the feed side and away from the gangue or strata of lesser specific gravity and value. Attention is also called to the fact that the use of air, being a much lighter medium than water, causes the particles of ore being separated to have a greater effective weight in a lighter medium than a heavier. A particle of mineral when suspended in water displaces a greater weight thereof than of air, and the apparent weight of the mineral is less than when in air, so that the difference in effective weight between the mineral and gangue is considerably less when immersed in water than when in air, thus making it possible to separate particles of nearer the same specific gravity in air than in water. Also the natural cohesive force is the same in water as in air, and with the lessened effective weight in water between the particles the more difficult it is for the water to break this cohesive effect and separate the values from the gangue, while the action may be readily accomplished in the air-separating medium. This use of air also permits the use of the invention in very cold climates, as there is no medium used in the concentration which could freeze and interfere with the action of the device. Another serious defect experienced in wet concentrating-tables having a blank or unriffled space at the foot end is when the ore mass reaches this space, it is greatly reduced in bulk, passing over the same in a very thin layer, and in order not to wash this layer of thin material down into the waste material the water must be handled very carefully and must flow very evenly over the ore. This is very difficult to accomplish, and as the result the water frequently does not cover the entire layer of ore, but runs in streams and streaks across the table, changing its course when obstructed by a mass of ore or by a change in the feed or water supply. The portions of ore left uncovered by the wash-water quickly dry and are floated away when next brought in contact with the water, as it is almost impossible to sink very fine dry ore in water. In dry ore-concentrators it has heretofore been very difficult to effect a very satisfactory separation, as no efficient means have been provided to secure a stratification of the mass and the subsequent separation of the strata.

Among the important features by which the efficient action of the present invention is secured and the difficulties in the prior art obviated is the pervious top through which the air passes to cause the ore to stratify, the riffles upon said top by which the gradual separation of the strata can be effected, and the longitudinal vibration which causes the material to travel from the head to the foot of the table.

A further important feature is the use of the tapering riffles upon a dry concentrating-table having a pervious top, said riffles being either of advancing terminals or otherwise arranged. It will therefore be obvious that changes may be made in the details of construction and configuration without departing from the spirit of the invention as defined by the appended claims.

Having described our invention and set forth its merits, what we claim, and desire to secure by Letters Patent, is—

1. The combination of an inclined pervious floor having its surface provided with longitudinally-disposed riffles, means for maintaining successive zones of separated material, and means for maintaining beneath the floor a uniform upward pressure of air through the pervious floor and the material upon it.

2. The combination of an inclined pervious floor having its surface provided with riffles and an unriffled plain space at their discharge ends, and means for maintaining beneath the floor a uniform upward pressure of air through the pervious floor and the material upon it.

3. The combination of a pervious inclined floor having its surface provided with longitudinally-disposed riffles, means for maintaining an upward pressure of air through the pervious floor, means for causing the spread and travel over it of granular or pulverulent material, and means for maintaining a stratification of the particles and for causing said strata to emerge beyond the mass as successive zones and for maintaining the graduation of the particles at the delivery portion of the floor.

4. The combination of a pervious floor having part of its surface divided into longitudinal channels, means for causing the spread and travel over it of granular or pulverulent material, means for maintaining a stratification of the particles and for causing said strata to emerge beyond the mass and channeled surface as successive zones and for maintaining said zones, and means for maintaining an upward pressure of air through the pervious floor and the material upon it.

5. In a dry concentrator, the combination of a pervious inclined floor provided upon its upper surface with longitudinal riffles and a substantially unriffled portion, with means for maintaining an upward uniform pressure of air through the pervious floor and the ma-

terial thereon, and means for feeding said material relative to said riffles.

6. In a dry concentrator, the combination of a pervious inclined floor provided upon its upper surface with longitudinal riffles and a substantially unriffled portion, with means for maintaining an upward uniform pressure of air through the pervious floor and the material thereon, and means for longitudinally vibrating said floor substantially parallel to the riffles thereon.

7. In a dry concentrator, the combination of a pervious inclined floor provided upon its upper surface with longitudinal riffles and a substantially unriffled portion, with means for maintaining an upward uniform pressure of air through the pervious floor and the material thereon, means for longitudinally vibrating said floor substantially parallel to the riffles thereon, means for adjusting the transverse inclination of said floor, and means for longitudinally inclining said floor.

8. In a dry concentrating-table, a pervious floor, means for maintaining an upward pressure of air through said floor and the material thereon, riffles extending longitudinally of said floor and diminishing in height toward the discharge end thereof where they terminate at different distances relative to a line transversely of the floor, and means for producing a feed of material upon said table.

9. In a dry concentrating-table, a pervious floor, means for maintaining an upward pressure of air through said floor and the material thereon, riffles extending longitudinally of said floor and diminishing in height toward the discharge end thereof where they terminate at different distances relative to a line transversely of the floor, and means for longitudinally vibrating said floor.

10. In a dry concentrating-table, a riffled pervious floor, means for feeding material upon said table, means for maintaining an upward pressure of air through said floor and the material thereon, an air-chamber beneath said floor having a bottom inclined upwardly toward each end of the table, and an air connection disposed centrally of said bottom.

11. The combination of an inclined pervious floor having its surface provided with longitudinal riffles and means for maintaining zones of separated material at the delivery ends thereof, means for maintaining an upward pressure of air through the pervious floor and the material upon it, and an oscillating support for said floor to permit the rising and descending movement in the vibration thereof.

12. The combination of an inclined pervious floor having its surface provided with longitudinal riffles and means for maintaining zones of separated material at the delivery ends thereof, means for maintaining an upward pressure of air through the pervious floor and the material upon it, and an oscillating support for said floor constructed and arranged to produce a rising movement thereof during the forward stroke toward the discharge end and a descending movement in the return stroke toward the feed end thereof.

13. The combination of an inclined pervious floor having its surface provided with longitudinal riffles and means for maintaining zones of separated material at the delivery ends thereof, means for maintaining an upward pressure of air through the pervious floor and the material upon it, a frame beneath said floor, a supporting member having a pivotal bearing in said frame and floor and disposed obliquely toward the feed end of the table, and means for imparting a reciprocatory movement to said table.

In testimony whereof we affix our signatures in presence of two witnesses.

HENRY M. SUTTON.
WALTER L. STEELE.
EDWIN G. STEELE.

Witnesses:
OLIVER V. STEELE,
JAMES F. DAVIES.