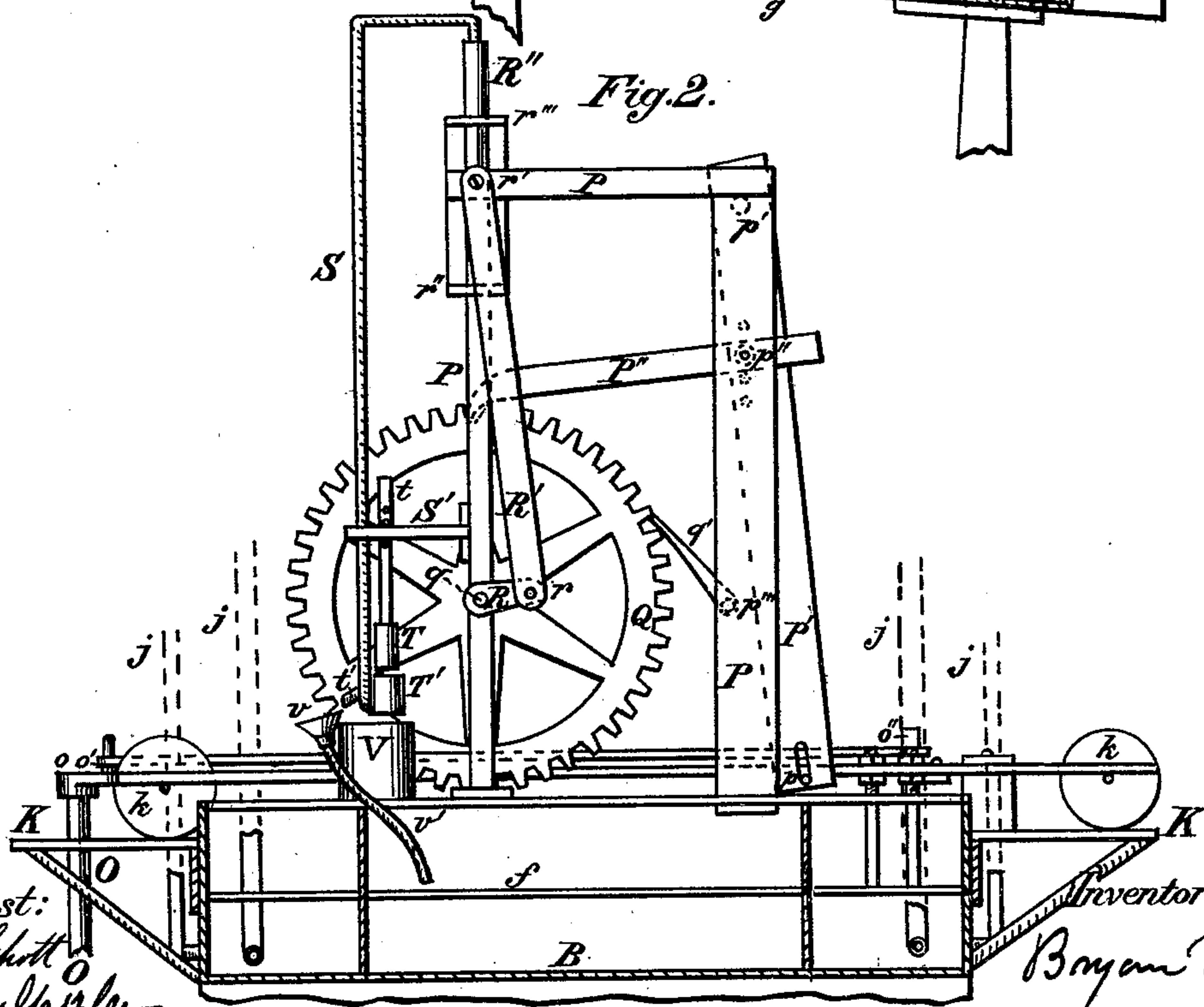
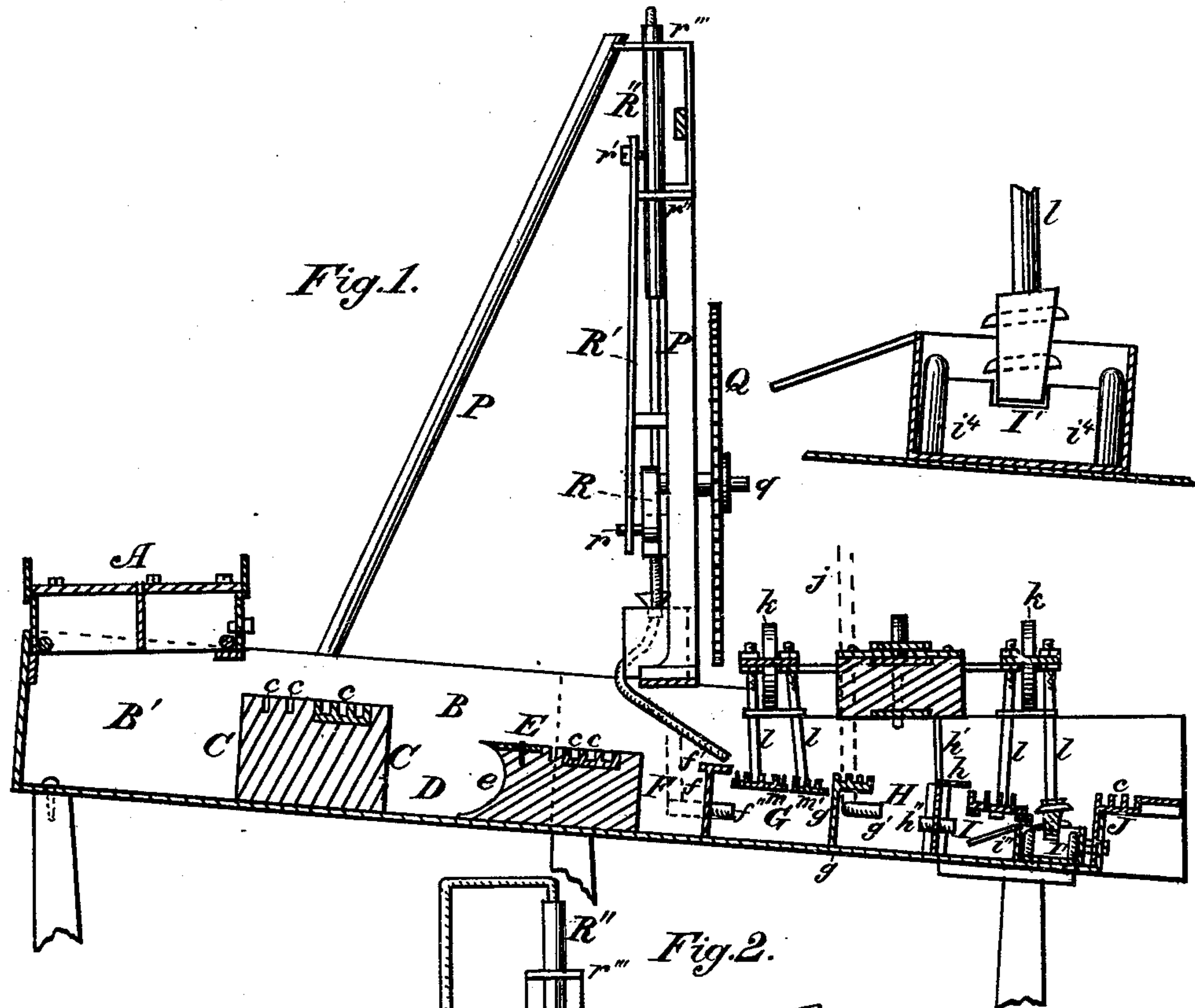


B. TYSON.
COMBINED WASHER AND AMALGAMATOR.
 No. 189,528. Patented April 10, 1877.



Attest:
 J. H. Schott
 J. Mason Boszler

Inventor:
 Bryan Tyson

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Fig. 4.

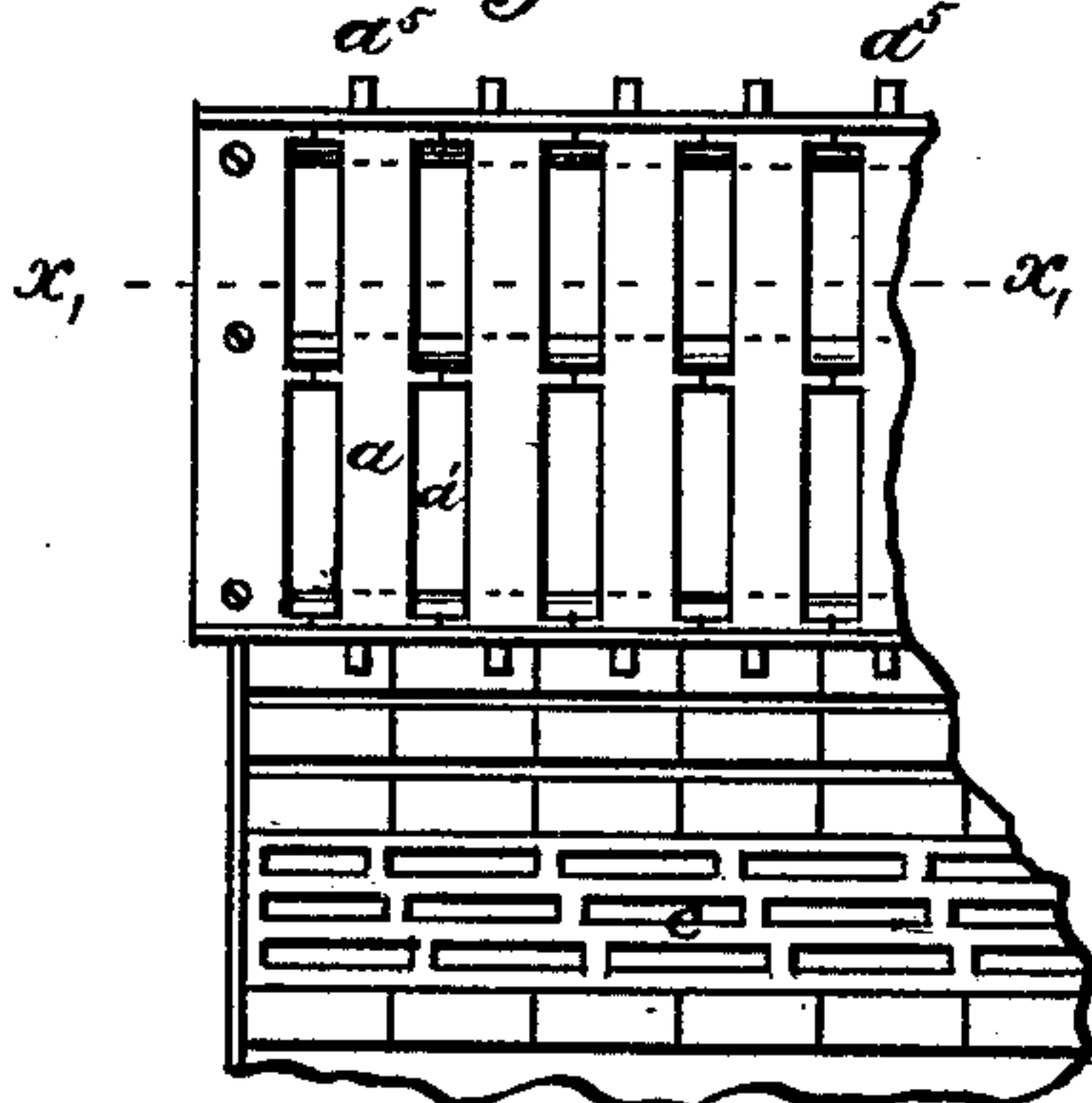


Fig. 5.

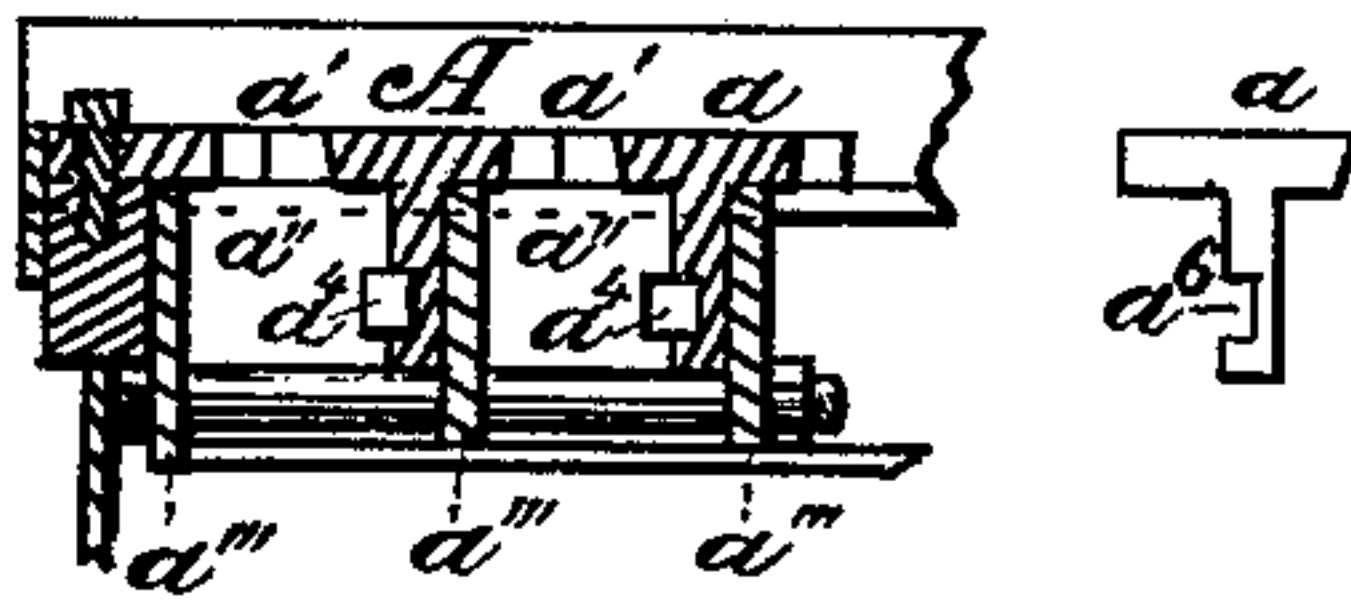


Fig. 7.^a

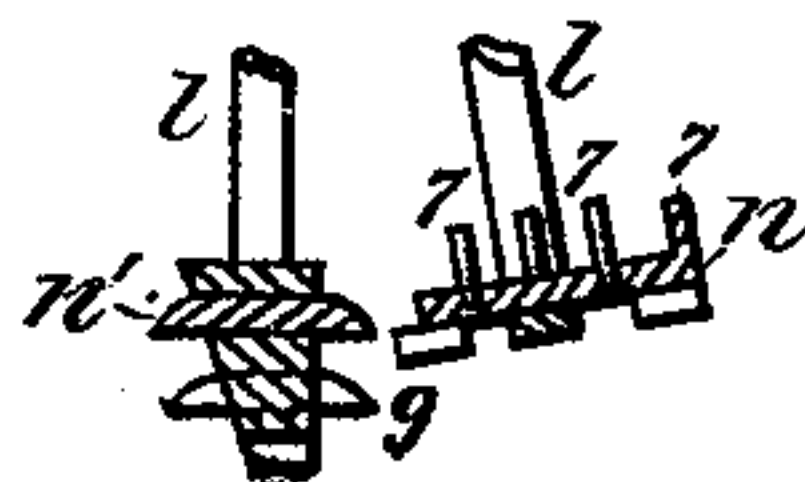


Fig. 7.

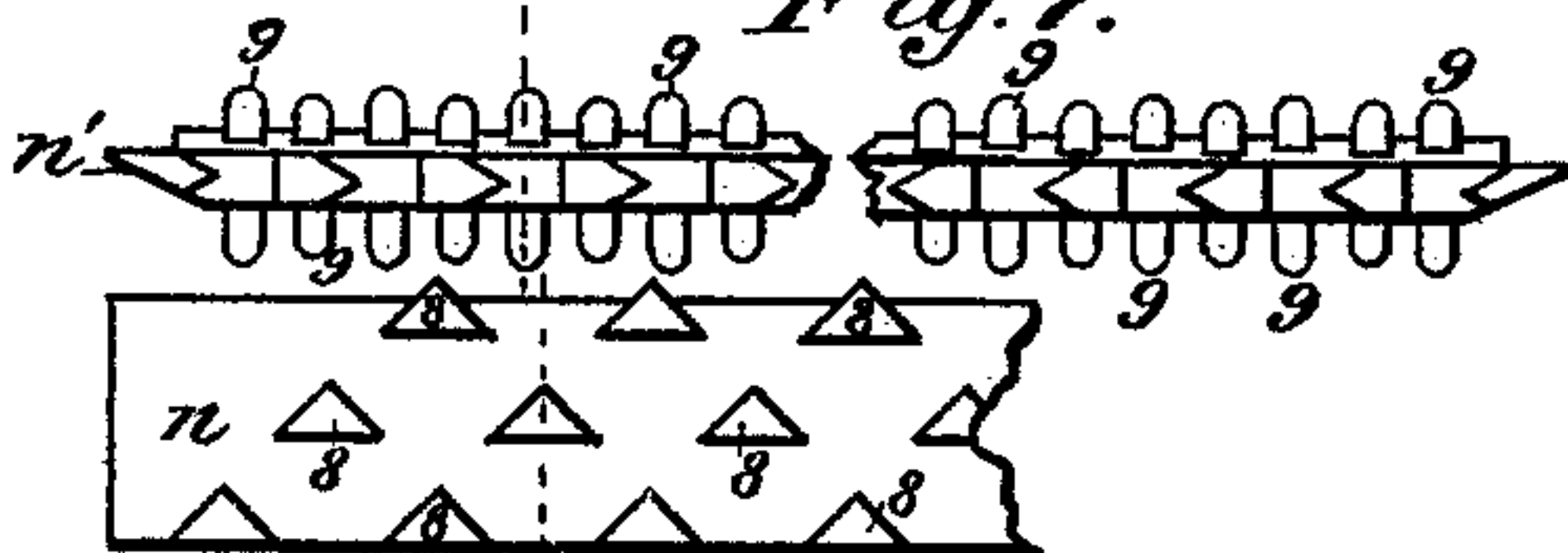


Fig. 6.^a

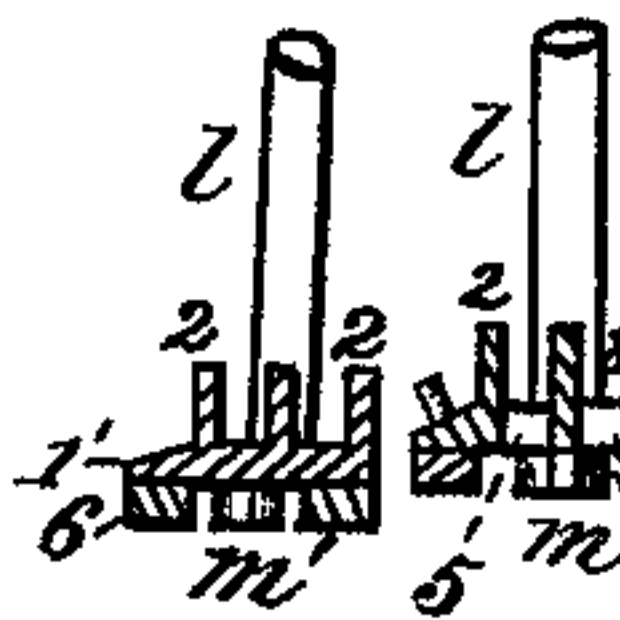


Fig. 6.

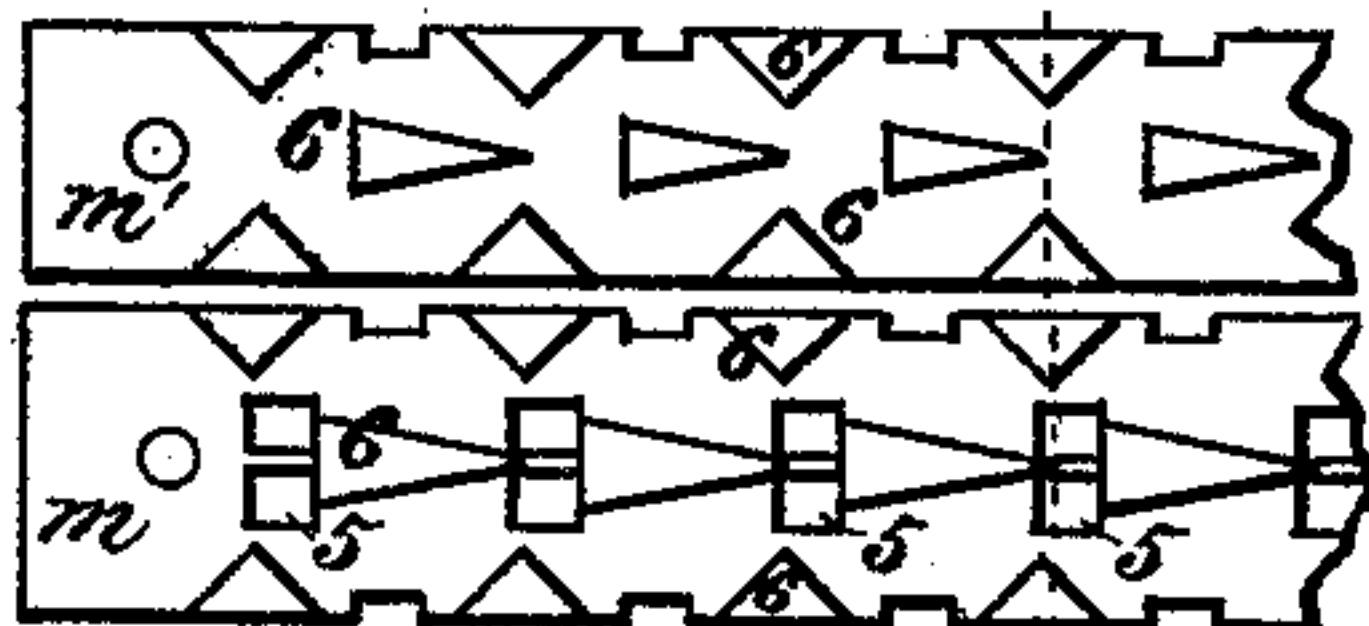


Fig. 8.

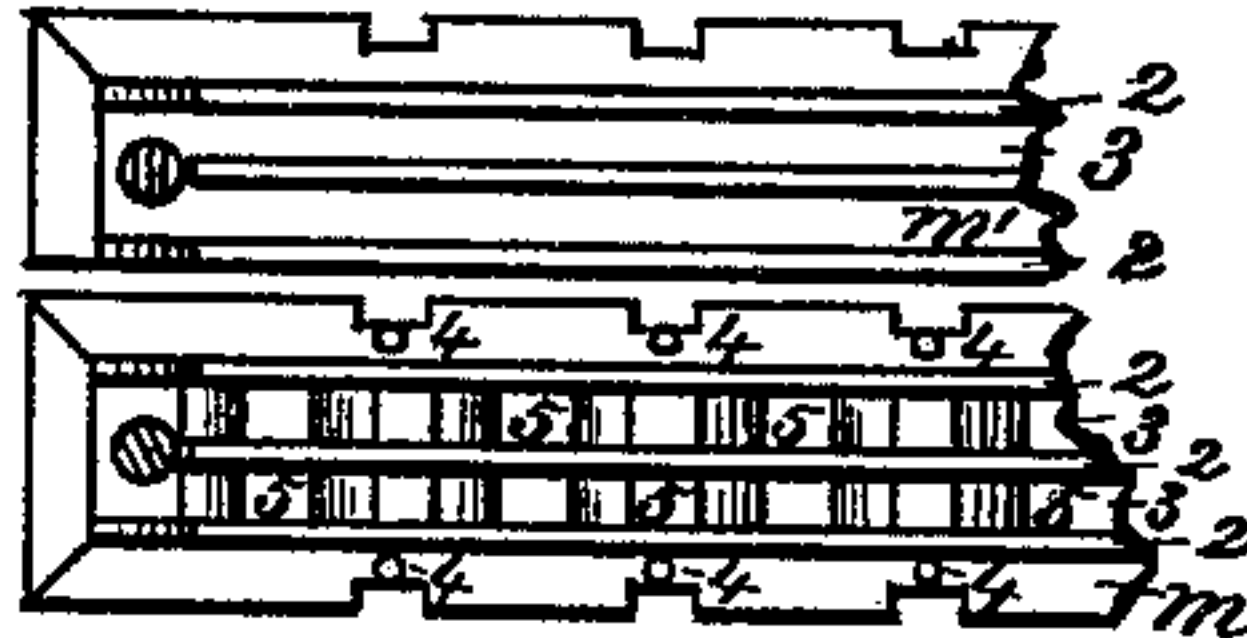
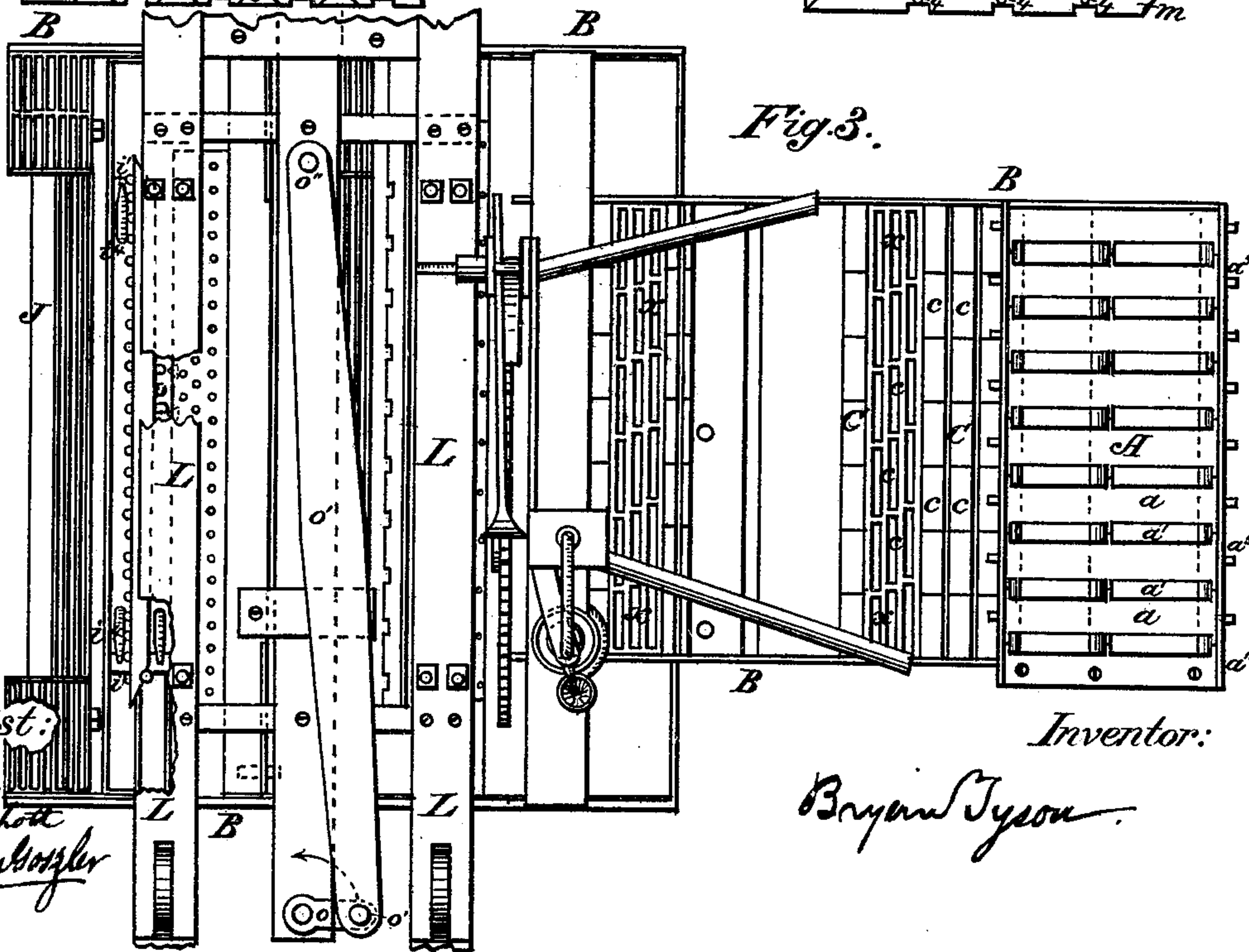


Fig. 3.



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UNITED STATES PATENT OFFICE

BRYAN TYSON, OF WASHINGTON, DISTRICT OF COLUMBIA.

IMPROVEMENT IN COMBINED WASHER AND AMALGAMATOR.

Specification forming part of Letters Patent No. 189,528, dated April 10, 1877; application filed March 3, 1877.

To all whom it may concern :

Be it known that I, BRYAN TYSON, of the city and county of Washington, in the District of Columbia, have invented certain Improvements in Combined Washer and Amalgamator, as improvements upon my previous patents, dated November 3, 1874, and numbered 156,448, and September 28, 1875, and numbered 168,116; and it consists in the construction of the several parts of the machine, as will be fully hereinafter described.

In the drawings, Figure 1 represents a longitudinal sectional view; Fig. 2, a side view; Fig. 3, a top or plan view. Fig. 4 is an enlarged top view of some of the details. Fig. 5 is a sectional view, through line *xx* of Fig. 4. Fig. 6 is a broken view of the under side of a portion of the first or upper pair of agitators. Fig. 7 is also a part view of the under side of lower pair of agitators. Fig. 6^a is a cross-sectional view of Fig. 6. Fig. 7^a is a cross-sectional view of Fig. 7, and Fig. 8 represents a section of the upper side of Fig. 6.

A represents the receiving-grate, upon which the earth that contains the gold or other mineral is first placed, and it is sustained upon the top of the washer, and is composed of a series of grate-bars, *a*, and openings *a'* between the grate-bars, as is seen in Fig. 3, which may extend entirely across the lower flume, or only a part of the width, as may be desired. The grate-bars *a* and the frame *a''*, in which they are placed, are of such construction that said bars can be readily removed from the frame, others replaced and secured in their position by a simple key, *a⁵*. The frame of this grate is composed of uprights *a'''* that go transversely across the grating, and these unite at their ends with the plates *a''*, which have mortises *a⁴* to receive holding-key *a⁵*, that passes through the side plates *a''* and into grooves *a⁶* in the side of the web of the grate-bar *a*. By this construction the grate-bars can be removed from the frame by simply taking out the holding-keys that hold them, and they can be replaced at any time, and when replaced the keys put in their place, and the grate-bar is again secured in the frame.

B B are the sides or inclosures of the machine, and support the grating and other

parts, and is preferably made of wood, and supported upon any foundation that will give to it the proper slope and position; and this inclosure may be in any desirable form, but the form shown in plan view, Fig. 3, is the one adopted.

This inclosure or receiver is divided longitudinally into several parts, of which *B'* forms the upper or receiving one, and is located underneath the grating, and is the part or section to receive the sand or earthy matter that contains the gold as it falls or is carried by the water through openings *a'* between the grate-bars *a*.

C is a riffle extending transversely across the receiver, and prevents the water and heavier material from passing out of the division *B'* until it flows over the top of the riffle, which is two-thirds, more or less, as high as the sides of the receiver. This riffle is of considerable length down the current, and has numerous grooves or pockets, *c*, upon its upper surface in a direction across the water-current for the reception of quicksilver, the purpose of which is to catch such particles of gold as may, in passing over the riffle, fall into the grooves, and where such particles will remain until they are removed therefrom. The top surface of the riffle has usually been constructed of blocks of wood set on end; but I prefer the removable metal grating, as seen at *x*, in Fig. 3, as such grating wears longer, and is easier removed from its seat to clean up.

D is the next part or division that receives the water, and what the water carries over the riffle *C*.

E is a breakwater or riffle that interferes with the flow of water and dirt, and is of peculiar construction. The side nearest the head of the flume is concave, as seen at *e*, Fig. 1, the curvature of which leaves a sharp edge projecting backward against the inflowing current of water at its top edge, which tends to break the onward flow of the water and partially turn the current back, so as to cause a more gentle flow of water over another of the metal riffle-grates *c*, similar in construction to riffle *C*, situated a short distance below and seated in the top side of the breakwater *E*.

F is another division which receives the on-

ward flow of water and earthy matter from the riffle E, while partition or riffle *f* interrupts the continuous flow onward to the tail of the machine, a flat top plate being attached to its upper edge and made to project more or less on either side.

G is another division to receive the onward flow, being terminated on the lower side by a partition or riffle, *g*, having its top grooved for the reception of quicksilver, which will catch such particles of gold as may fall therein.

H is another division, and has partition or riffle *h* on its lower side, over which the water flows.

I is another and last division of the washer, and receives the current after it passes over riffle *h*, and within which is a trough, I', the sides of which are about half the height of riffle *h*. This trough I' has at a distance from each end transverse blocks *i'* of proper depth, and which have a central transverse groove, *i''*, on their top edges. *i'''* are backwardly-inclined pieces at the ends of and extending from the top edge of trough I' on the upstream, side, back, and down toward the bottom of the washer. *i⁴* are four nozzles or pipes within the trough to produce jets of water at the outer part of the trough for the purpose of keeping the sand loose over the quicksilver previously placed in the two end compartments of said troughs.

Water-pipes *f''* through riffle *f*, *g'* through sides B B, and *h''* through riffle *h* are all for agitating the water and preventing any inconvenient accumulation of sand in immediate vicinity, and are all supplied, including *i⁴*, by pipes *j j*, that connect with the pipes and nozzles, and are supplied from a common reservoir by any known method.

J is the last riffle located at the tail of the washer, the top of which is supplied with a grooved plate to be wholly or with only a portion of the grooves upstream filled with quicksilver as a means of catching such particles of fine gold as may not have been previously arrested in the manipulations to which it has been subjected. If only a portion of the grooves be filled with quicksilver those not filled will serve to catch such quicksilver as may be washed down from above.

K K are ways upon which the carrying-wheels *k k* travel, that support the frame L L of a reciprocating agitator.

The agitators, of which there are two or more pairs, are suspended below the frame L by the suspending-rods *l l*. The first or upper pair are represented by *m m'* in Figs. 6 and 8, and are composed of bars 1 and 1' that reciprocate across the washer. These bars have upwardly-projecting ribs 2 on their top side, which form intermediate grooves 3. A series of projecting pins, 4, are also provided on each bar. While the bar *m* has between the ribs a series of mortises, 5, through it, as seen in broken Fig. 8, the lower bar *m'* may be made either plain or with similar mortises 5, preferably, however, with the mortises. The

ribs 2 will be required in either case. But both bars of the pair have their under sides furnished with downwardly projecting angular-shaped pieces 6 to prevent an inconvenient accumulation of sand under the agitators, and also to serve the purpose of scouring rusty gold; so as to cause it to amalgamate with quicksilver. Bar *m* is a little higher than bar *m'*, with a space between the bars, as seen in Fig. 6^a, both, however, being on any required grade.

The second pair of agitators are also composed of bars *n* and *n'*. Upper bar *n* is set to be inclined slightly down and forward, with a series of upwardly-projecting pins, 7, on the top and angular blocks 8 upon the bottom side of the bar, some of which project beyond its edge and toward the bar *n'*.

The lower bar *n'* is angular in form, with its widest edge at the top, and has projecting pins 9 upon its sides and angular projections upon its bottom edge, as seen in Figs. 7 and 7^a.

These agitators are put in reciprocation by an upright revolving crank-shaft, O, crank *o*, and pitman *o'*, that is attached to the crank at one end, while the other end is pivoted to frame L at *o''*. The shaft O may be revolved by any convenient power.

P is a frame raised above and upon the washer, and is provided with mechanism for automatically supplying quicksilver to the washer.

P' is a vibrating arm attached to reciprocating frame L at *p*, and to frame P at *p'*. P'' is a driving-pawl pivoted to arm P' at *p''*, so that its free end will engage a toothed wheel, Q, which is journaled in frame P by a crank-shaft, *q*, and revolves freely therein. *q'* is a holding-pawl pivoted to frame P at *p'''*, so that its free end will engage with the teeth of wheel Q and hold it from a backward movement.

R is a crank on shaft *q*, to which is attached pitman R' at *r*, and the pitman is pivoted at its upper end to a guide-rod at *r'*. This guide-rod works in guide-plates *r''* and *r'''* to give a perpendicular reciprocation to the outer limb of the rod R''. S is the outer limb of rod R, and reciprocates in a guide-arm, S', that extends from, and is fast to, frame P.

T is plunger attached to a rod, *t*, that is adjustable in arm S', and has a small groove in one side. (Not shown in drawings.) Attached to the lower end of the reciprocating rod S is a cup, T', with a spout, *t'*, that communicates with the inside of the cup.

V is a cistern to hold quicksilver, open at the top, and resting on the top of the washer, of a diameter larger than the cup T', so that the cup can freely enter into the cistern, and, as the wheel Q revolves, the crank reciprocates the arm with the cup thereon, and the cup is forced downward into the cistern and submerged in the quicksilver, which fills the cup, when the further revolution of the wheel causes the cup, now full of quicksilver, to

rise, so that the plunger will enter the top of the cup and force the quicksilver out of the cup, by the groove in the plunger, through the spout, when it will fall into the funnel *v*, thence through pipe *v'*, and be delivered upon riffle *f*.

The operation of my device is as follows: The water, sands, and other débris containing gold or other minerals is washed down from the mine by the method known as "hydraulic," and this water, usually from eight hundred to two thousand inches, flows over the grate-bars designated by A. The construction of said bars is such as to cause the sand and débris containing gold or other minerals to pass through openings between the bars, the gold being afterward separated from the sands by means of mechanism hereinafter described. The larger stones will be washed over and beyond said bars, fall into the dump below, and pass on. The water and débris passing through the spaces between the bars, will be again united with that which has passed over the dump at the nearest practicable point below it.

The grate-bars are usually twenty-four in number, having spaces between them from three-eighths to one-half inch, and reach across the flume leading from the mine, being usually from three to six feet in length.

This plan for grate-bars has many advantages over any heretofore known to have been used. Each bar is composed of two pieces, both being preferably made of cast metal. The top bars should be made of white or other hard metal, and may be chilled. The bottom bars may be made of soft tough metal, such as Scotch pig.

I set forth in the washer, commencing just beyond the section covered by the grate-bars, a portion of a device now in common use in California, called an "under current." Said device is composed of wooden blocks, say, twelve inches long, stood endwise, having small interstices between, say, one-half inch, and reaching across the washer, into which quicksilver is poured to arrest and catch the gold. A pit twelve inches deep is thus formed immediately beyond the grate-bars, into which the sands and other débris containing gold will fall.

The block plan, as shown, is defective in several particulars. In the first place, the edges situated up stream soon become worn by the action of the sand and gravel, and when thus worn, the gold, when striking against them, is more apt to rebound and pass on. I have introduced as an improvement on this plan a metallic grooved riffle, containing three or more grooves, divided into a number of compartments, and preferably made of some hard cast metal. Said compartments are to be filled with quicksilver, for the purpose of catching and amalgamating such gold as may by the action of the water be washed therein. This riffle will wear but little in comparison with the blocks,

and having three or more grooves, it will be almost impossible for any gold that is heavy enough to be saved by any ordinary process to jump all of said grooves without falling into some one of them.

I usually employ three of these metallic riffles above the agitators—two above the breakwater, and one a short distance below.

By the time the water reaches the second grooved riffle, (not shown in drawings,) it will have acquired such speed as to permit but little, if any, more gold to settle in any further descent. To remedy this I introduce a breakwater, which again causes the water and sands to flow gently until the next grooved riffle is passed over.

A few feet beyond the grooved riffle, situated next to and below the breakwater, we cross the washer with a riffle-bar some eight or nine inches deep. This riffle-bar serves as another breakwater, and again secures a more gentle flow of water over the residue of the works. The first pair of reciprocating agitators is situated near this point, between two riffle-bars, the one above referred to being the upper bar. When in operation these agitators serve to keep the sand loose, and thus cause a precipitation of the passing gold and quicksilver coming from above.

By the use of the angular projections on the under sides of these agitators I accomplish the following results: The sands under said agitators are kept loose, and thus unnecessary wear prevented. The rusty gold is scoured, and thus made to amalgamate with quicksilver. The gold and quicksilver are worked by the action of the agitators to the sides of the washer, where they find a safe and permanent place of deposit (we mean until taken out) in the cavities in the sand blown out by the jets of water on either side.

At each end of these reciprocating agitators we have horizontal jets of water. These jets, by forcing out the sands in their immediate vicinity, answer the double purpose of causing the agitators to run much easier and with but little or no wear of the points thereof, the portions that heretofore have worn the most. The cavities formed have already been referred to as safe receptacles for gold and quicksilver.

For the purpose of more regular and thorough amalgamation, I employ an automatic device for feeding quicksilver into the washer at some point on the riffle-bar situated above the first pair of agitators.

The construction of the washer is such as to cause eddies at each side opposite the ends of the agitators, the washer being widened a short distance above the first pair of agitators, and by obstructions placed immediately above the second or lower pair to secure this effect. The angular projections on the bottom side of the upper pair of agitators are so shaped as to work the gold and quicksilver principally to the sides of the washer, where an extension of the grooved riffle immediately below makes

it about double width at those points. Should any gold and quicksilver, instead of settling in the cavities in the sand, formed as aforesaid, be blown over by the jets of water onto the grooved riffle, which has previously been supplied with quicksilver, excellent facilities will be offered for such gold or quicksilver to settle therein, as the current is very gentle in comparison with that flowing down the main channel.

The obstruction plates or guards placed at the ends of riffle *h*, which is located immediately above the lower pair of agitators, have a tendency to cause inconvenient accumulations of sand in the vicinity of the grooved riffle, situated immediately below the first or upper pair of agitators. To remedy this impediment I introduce at each end of the grooved riffle a jet of water flowing from under the said grooved riffle down stream. These jets will not only remedy said defect, but form two more cavities in the sand for the reception of such gold and quicksilver as may pass over the aforesaid grooved riffle.

But little gold will be caught in the aforesaid grooved riffle, except at the ends thereof.

The gold-bearing debris next passes onto the second and last pair of agitators, where it is again subjected to action nearly similar to that received from the first pair, the principal difference being this: The first agitator of the last pair settles the gold and quicksilver onto the plate before passing it onto the lower or last agitator; the second one settles them still lower, until they are brought in contact with the angular projections on the bottom of the same, by which they are worked to either end, until brought over the deposits of quicksilver in each end of the trough *I'*, when the action of the agitator, aided by jets of water, causes them to settle into said deposits of quicksilver. The grooved riffle, situated just below, and which has previously been supplied with quicksilver, is for the purpose of catching such gold and quicksilver as may not have been precipitated and saved above. It furnishes excellent facilities, as the gold and quicksilver will mainly, owing to the action of the agitators above, pass down at or near the sides of the washer, where the current is comparatively weak.

The pins on the top surface of the upper one of the lower pair of agitators serve to impede the force of the water, and thus afford greater facilities for the gold and quicksilver to settle thereon previously to being passed onto the next or lowest agitator.

The agitators furnish one other important advantage in the saving of gold and quicksilver. The agitators, by keeping the sand loose immediately above them, cause the sand to wash down to a lower grade, and, consequently, give the current in the vicinity a more gentle flow than it would otherwise have. Thus, in the vicinity of the upper grooved riffles and blades, where there is no machinery, it has been found necessary, in

order to prevent the sand from clogging and remaining behind, to place the wooden blocks and grooved riffles on an incline at the rate of ten inches in twelve feet; but in the vicinity of the agitators a fall at the rate of five inches in twelve feet is ample.

What I claim is—

1. The removable grate-bar *a*, provided with the groove *a*⁶ in the side of the web part, as and for the purposes described.

2. In a machine for washing and amalgamating gold, the grate to receive the gold-bearing earth, composed of the sides *a''*, transverse plates *a'''*, grate-bars *a*, and keys *a*⁵, all constructed and arranged as and for the purposes substantially as described.

3. The combination, with the riffle-arrest *O*, of the removable grate *X*, seated in its upper face, and provided with a series of parallel grooves or pockets, substantially as herein set forth.

4. The riffle or arrest *E*, provided with a concave, *e*, in its upstream face, as and for the purposes substantially as described.

5. The riffle *f*, having a projecting top, *f'*, in combination with reciprocating agitator-bars *m* and *m'*, as and for the purposes described.

6. The reciprocating bars *m* and *m'*, provided with angular projections 6 on their under sides, substantially as and for the purposes described.

7. The reciprocating agitator-bars *m* and *m'*, having ribs 2 and intervening grooves 3 on their upper sides, substantially as and for the purposes described.

8. The reciprocating agitator-bars *m* and *m'*, provided with mortises or holes 5, formed transversely through the bars, substantially as and for the purposes described.

9. The agitator-bars *m* and *m'*, provided with ribs 2, intervening grooves 3, and mortises 5, as and for the purposes described.

10. The reciprocating agitator-bar *n*, having a series of pins on its top side, and angular projections on its under sides, substantially as described.

11. The reciprocating agitator-bar *n'*, angular in form, and with pins projecting from its sides, substantially as described.

12. In a machine for washing and amalgamating gold, a reciprocating agitator, composed of the frame *L*, agitator-bars *m* and *m'* *n* and *n'*, constructed as described, in combination with two or more grooved riffles, such as *f g h*, and trough *I'*, as and for the purposes described.

13. The trough *I'*, having transverse blocks *i*¹ and nozzles *i*⁴, in combination with the agitator-bars *n'*, as and for the purposes substantially as described.

14. The final riffle *J*, with the grooves or grating on its top, constructed as shown, in combination with the trough *I'*, provided with the water-nozzles *i*⁴, and the reciprocating agitator-bar *n'*, as and for the purposes described.

15. The combination, with the water-pipes

f'' and riffle *f*, of reciprocating agitators *m m'*, in the manner and for the purpose described.

16. The combination, with agitators *m m'* and riffle *g*, of the bent water-pipe *g'*, giving a jet of water forward of riffle *g'*, in the manner and for the purpose substantially as described.

17. The combination, with agitators *n n'* and trough *I'*, provided with inclined plates *i''*, of the water-pipe *h''*, giving a jet of water upon said plates *i''*, as and for the purposes described.

18. In a machine for washing and amalgamating gold, the automatic device for supplying quicksilver in the operation, consisting of the combination of the adjustable plunger *T*, reciprocating cup *T'*, cistern *V*, funnel *v*, and pipe *v'*, substantially in the manner and for the purpose described.

BRYAN TYSON.

Witnesses:

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