(No Model.) 5 Sheets—Sheet 1.

# J. R. BROWN.

## GOLD AMALGAMATING MACHINE.

No. 577,505. Patented Feb. 23, 1897.

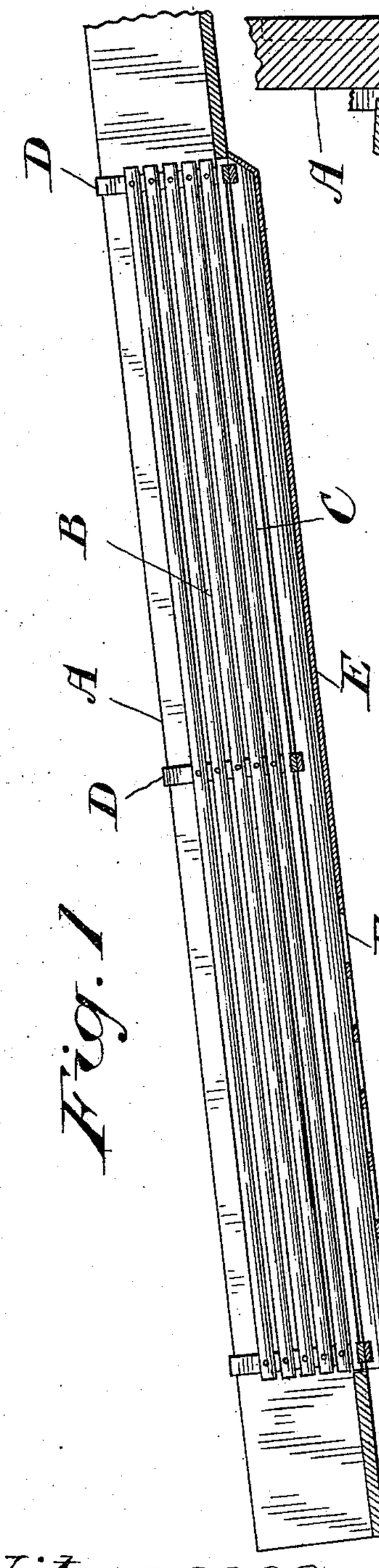


Fig. 1

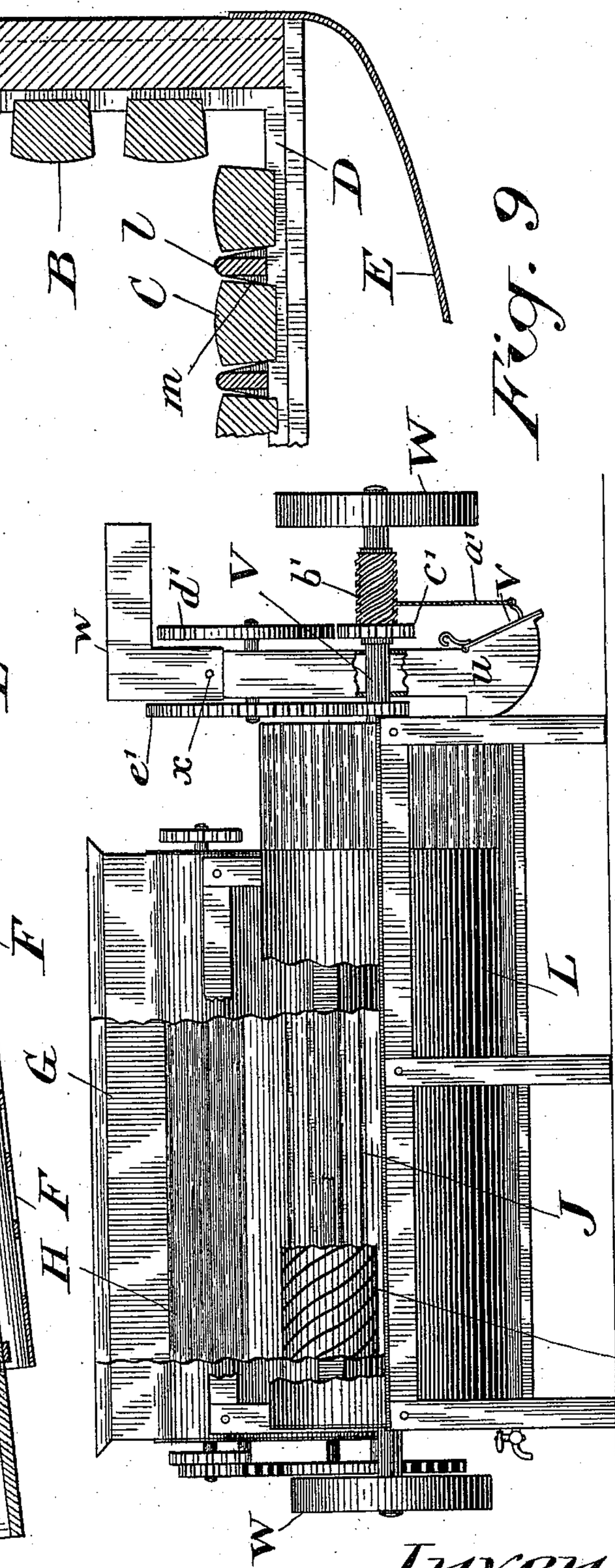


Fig. 2

Witnesses
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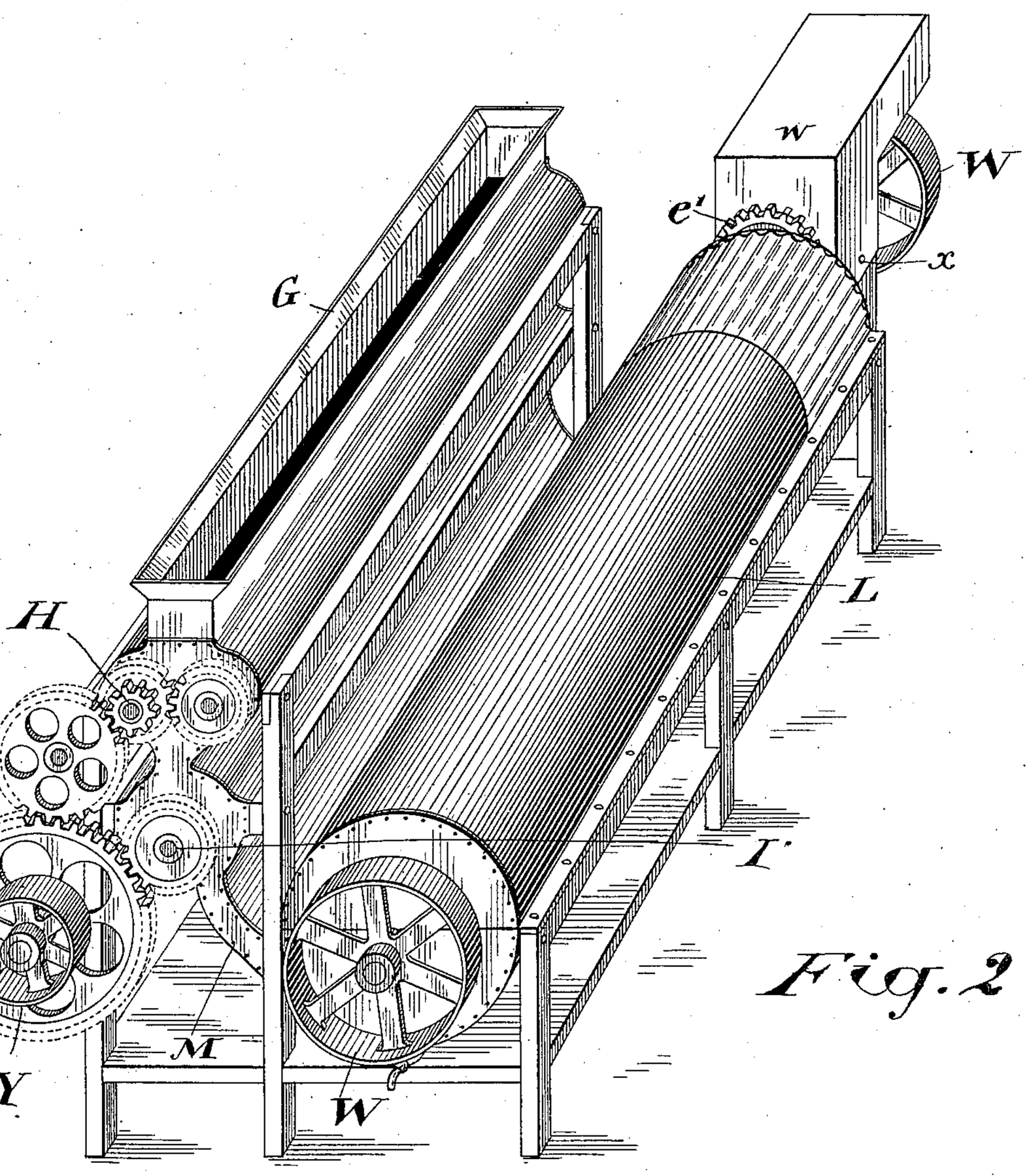


Fig. 2

Witnesses
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(No Model.) 5 Sheets—Sheet 3.

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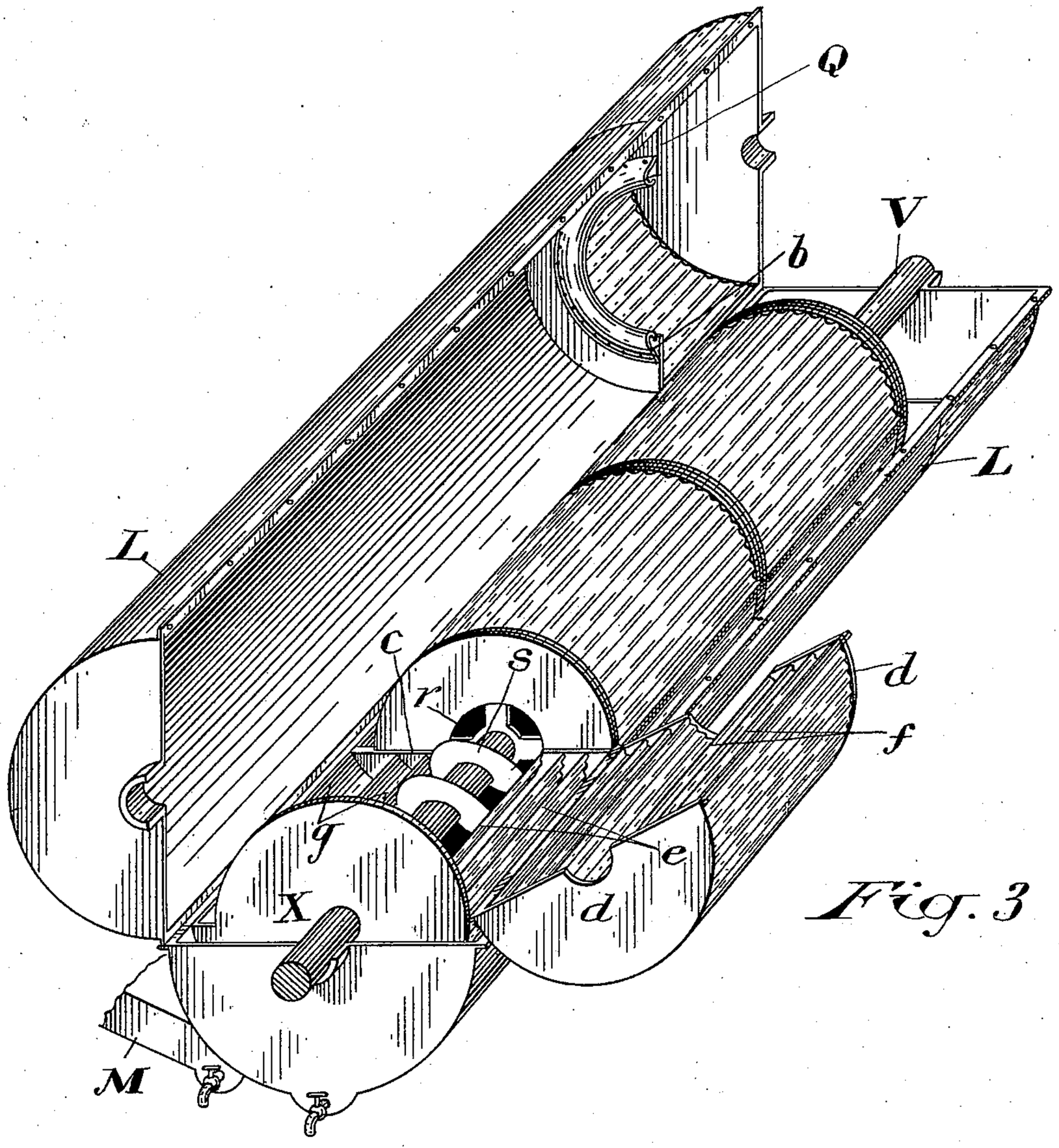


Fig. 3

Witnesses

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## GOLD AMALGAMATING MACHINE.

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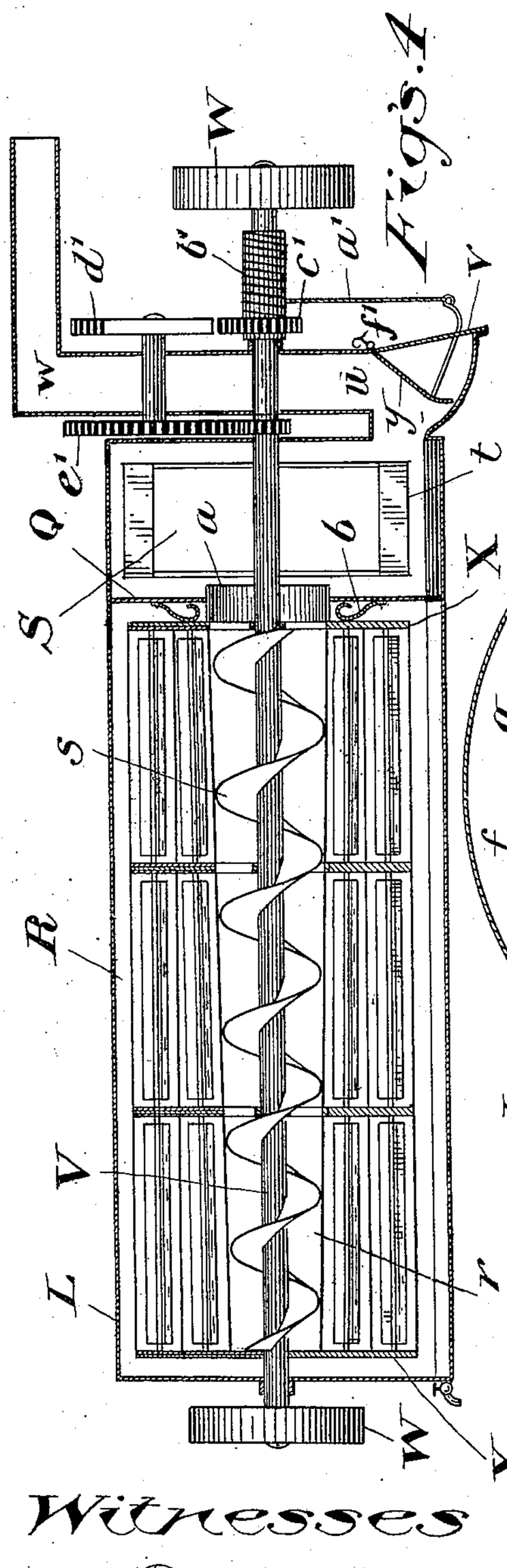


Fig. 4.

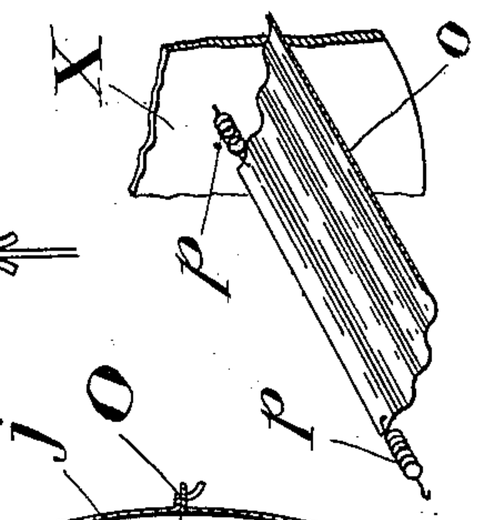


Fig. 6.


Fig. 7.

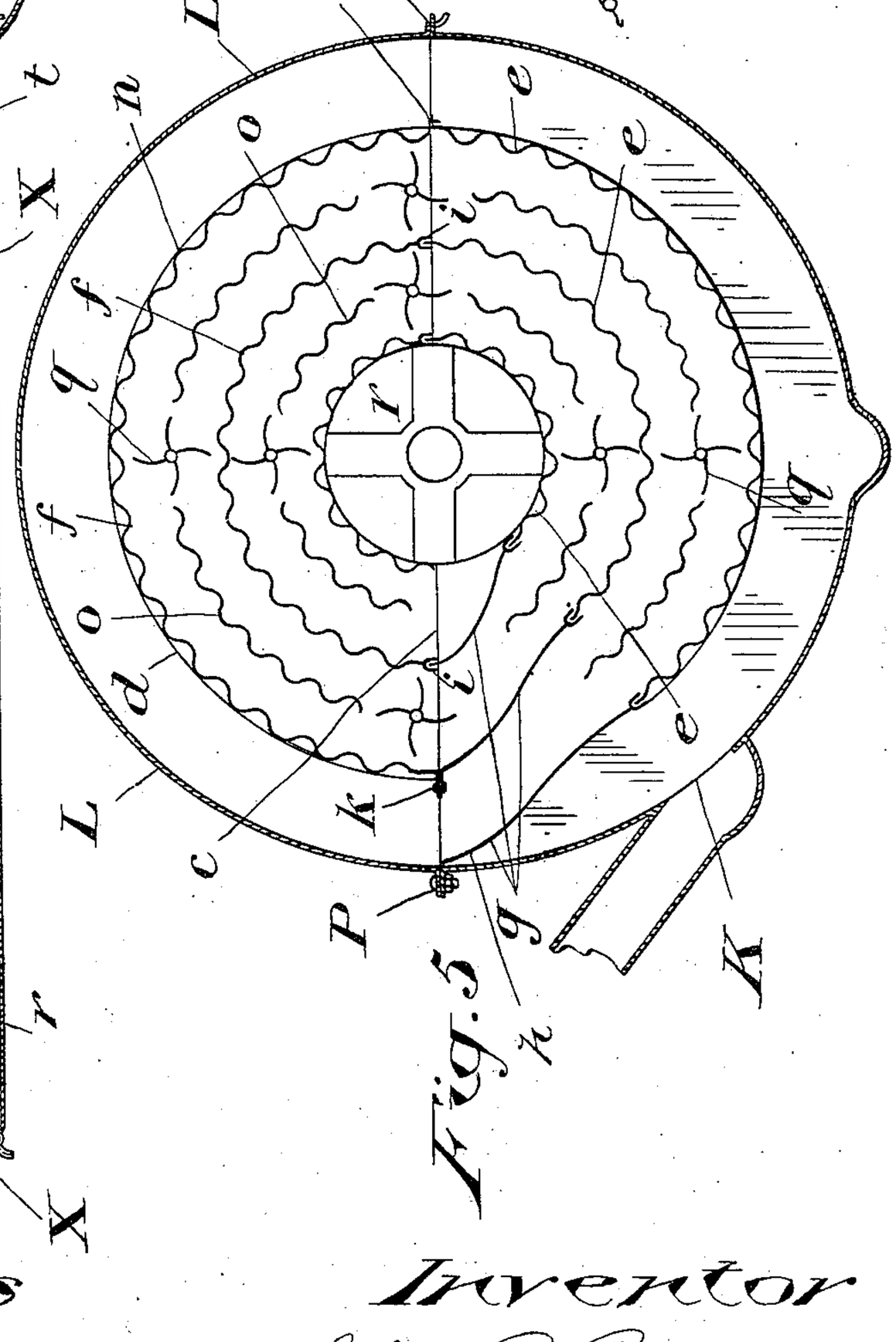


Fig. 5.

Witnesses

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# J. R. BROWN.

## GOLD AMALGAMATING MACHINE.

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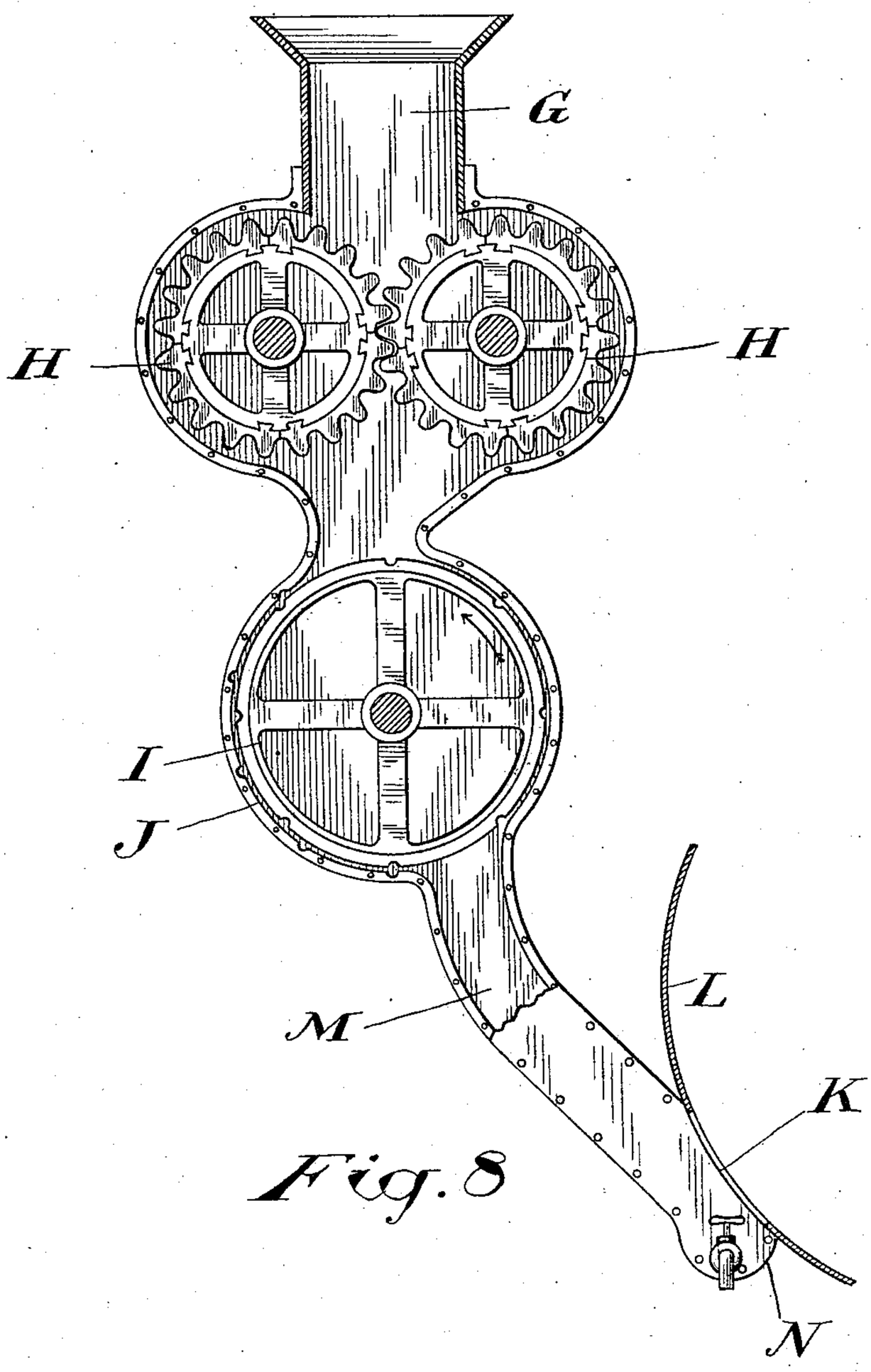


Fig. 8

Witnesses
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# UNITED STATES PATENT OFFICE.

JOHN R. BROWN, OF HARRISON HOT SPRINGS, CANADA.

## GOLD-AMALGAMATING MACHINE.

SPECIFICATION forming part of Letters Patent No. 577,505, dated February 23, 1897.

Application filed October 21, 1895. Serial No. 566,400. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN REITTER BROWN, of Harrison Hot Springs, in the Province of British Columbia, Canada, have invented a certain new and Improved Gold-Amalgamating Machine, of which the following is a specification.

The object of my invention is to devise suitable apparatus for economically and rapidly separating and saving fine, coarse, or rusty gold in hydraulic, placer, or river-dredge mining and quartz-milling, and particularly where black sand predominates to such an extent that the ordinary methods are too slow or will not economically separate the gold, which is often of a flaky or very light description; and it consists, essentially, of an amalgamator constructed so that both sides of nearly all the plates used therein are available for amalgamation, of a crushing and feeding device, of separating sluice-boxes, and of such details of the construction of the apparatus as are hereinafter more specifically described and then definitely claimed.

Figure 1 is an elevation, partly in section, of my apparatus, showing more particularly the sluice-box and grinding and feeding apparatus. Fig. 2 is a perspective outside view of the amalgamating-cylinder and feeding and grinding device. Fig. 3 is a perspective view of the amalgamator, showing the interior construction, the grinding and feeding apparatus being removed. Fig. 4 is a longitudinal section of the amalgamator. Fig. 5 is an enlarged cross-section of the same. Fig. 6 is a detail of the connecting-clip used between the plates of the two halves of the inner amalgamating-cylinder. Fig. 7 is a detail of one of the vibrating plates of the amalgamator. Fig. 8 is a cross-section of the grinding and feeding device. Fig. 9 is a sectional view of a portion of the sluice-box.

In the drawings like letters of reference indicate corresponding parts in the different figures.

In Fig. 1, A is the end of a sluice-box of ordinary construction conveying the tailings from a hydraulic or other mine.

B is a screen formed of a series of iron bars C, connected to U-shaped pieces D, resting within the sluice-box. The space between the bars may be varied by the introduction of reducers *l* between them, which may be made of various sizes and are retained in a central position in the openings by means of the wings *m*. (See Fig. 9.)

Below the screen B the bottom of the sluice-box is removed and a curved trough E, of sheet metal, is connected to the sides of the sluice-box. This trough receives the fine tailings containing the gold which pass through the screen B, coarser tailings passing on over the end of the sluice-box. As most of the water passes through the screen with the finer tailings, the end of the sluice-box may be given an extra downward deflection to facilitate the discharge of the coarse tailings to the dump.

Near the end of the trough E are a series of perforations F, located over the hopper G of the amalgamator. This hopper directs the tailings between the crushing-rollers H, which are formed with intermeshing corrugations, as shown. The corrugated faces of these rollers are preferably formed in removable sections; but this is an ordinary method of forming crushing-rollers. (See Fig. 8.) From the crushing-rollers the crushed tailings pass between the attrition-roller I and its bed J, still further reducing them and removing rust from the gold and disturbing the cleaving affinity of the gold to the black sand in the tailings, making the gold more impressionable to the action of the amalgamating-plates and mercury in the cylinders to which it now passes. The attrition-roller is preferably spirally grooved and its bed longitudinally grooved, as indicated in Figs. 1 and 8, to facilitate the grinding process.

K is the feed-opening in the side of the outer cylinder L of the amalgamator. This opening extends for about three-quarters of the length of the amalgamator and is located in different positions according to the nature of the material to be operated upon. To this opening the reduced tailings are carried by the passage-way M, which has a mercury-pocket N formed therein just below the feed-opening K. The cylinder L is preferably of copper, formed in two parts connected together by a suitable hinge O at one side and flanged at P, so that the two halves may be secured by suitable clamps or bolts. (See

Figs. 2, 3, and 5.) The cylinder is also divided into two parts by the partition Q, so as to form an amalgamating-chamber R and an agitating-chamber S, which are provided with mercury-pockets and preferably provided with taps, as shown, by means of which the mercury may be withdrawn. (See also Fig. 4.)

Extending from end to end of the outer cylinder L and having its bearings thereon is a shaft V, having driving-pulleys W W, rigidly secured to its ends. On this shaft, within the outer cylinder, are four disks X. The disk farthest from the agitating-chamber is solid, while the others are formed with central openings, gradually increasing in diameter toward the agitating-chamber. The disk X, next to the partition Q, has a circular flange *a* formed around its central opening and extending through an opening in the partition Q into the agitating-chamber S.

*b* is a spring-metal packing-ring secured to the partition Q around its central opening and pressing against the adjacent disk X, so as to prevent the passage of any tailings between the two. As the partition Q is preferably formed in two parts like the cylinder L, the packing-ring is similarly formed, though if the partition be made in one piece the packing-ring will also be so formed. Each disk X is shouldered at *c*, so that semicircular disks *d* may rest thereon, the outer disks being shouldered on the inside only, while the central disks have shoulders formed on each side thereof. (See Figs. 3, 4, and 5.)

Attached in any suitable way to the disks X are a series of concentric corrugated curved plates *e*, which extend from the shoulder *c* at the right-hand side in Fig. 5 to within a short distance of the shoulder *c* at the left-hand side of the figure. A similar series of curved plates *f* are connected to the semicircular disks *d*, so as to complete the circles commenced by the corrugated plates connected to the disk X.

At the left-hand side of the cylinder, Fig. 5, three plates *g* are connected to the edges of the corrugated plates *e* and extend up to the shoulder *c*, where the outer plate extends outwardly to the inside of the outer cylinder L, while the other two connect their respective plates *e* with the next outer corrugated plates *f* on the semicircular disks *d*. It should be mentioned that the disks X are formed with extensions *h*, to which the outer plates *g* are connected. The connections between the plates *g* and the corrugated plates *e* and *f* on the left-hand side of the cylinder are formed by means of spring-clips *i*, (see Figs. 5 and 6,) and the corrugated plates *e* and *f* are similarly connected at the right-hand side of the cylinder.

A hinge connection similar to that of the outer cylinder is formed between the outer corrugated plates *e* and *f* at *j*, and a similar flange connection *k* between the outer corrugated plates *f* and the central plate *g*. The hinges may be located at either side of each cylinder, but they are preferably arranged so that the cylinders will open, as in Fig. 3.

From the construction just described it will be seen that the disks and corrugated plates form an inner cylinder *n*, divided into three sections, each of which may be opened up to permit of the amalgamation of the copper plates or the cleaning of the same.

To further increase the amalgamating-surface of the inner cylinder, a number of corrugated vibrating plates *o* are arranged between the curved corrugated plates *e* and *f*. These plates are connected by means of springs *p* to the disks X. (See Figs. 5 and 7.) Between these vibrating plates are arranged revolving current-diverters *q*, consisting of a series of curved vanes attached to the steel spindles journaled in the disks X and *d*. As will be seen, the curves of these vanes are reversed on alternate diverters, so that they will throw the current of water and tailings passing through the machine alternately from one side of one vibrating plate to the other side of the following plate.

As the cylinder *n* is continuously revolved by means of the pulleys on the ends of its shaft B the tailings and water coming through the feed-opening K enter the spiral coil formed by the peculiar construction of the cylinder and are gradually worked through to the central space *r*. Surrounding the shaft V and revolving therewith is a spiral conveyer *s*, which gradually conveys the tailings into the agitating-chamber S through the circular flange *a*. Attached to the shaft V in this chamber are a series of beaters *t*, which agitate the tailings and bring them in contact with the corrugated plates forming the sides of the chamber. From this chamber the tailings pass out to the discharge *u*, which is provided with a discharge-gate *v* at its bottom for heavy tailings. The upper part *w* of the discharge *u* fits over the lower portion and may be set at any height by means of a pin or bolt *x*. By regulating this upper part of the discharge the effect of gravity on the tailings discharged may be regulated, the heavier tailings remaining at the bottom of the discharge *u*, from which they are periodically and automatically discharged through the discharge-gate *v*. An inner gate *y* is rigidly connected to the gate *v* and is held in position by strengthening-braces. This gate *y* serves to close the discharge while the outer gate *v* is open, and thus prevent the escape of tailings which should pass up through the upper part *w* of the discharge, the curve of the bottom of the discharge being such that the inner gate will permit the passage of the heavier tailings when the outer gate is closed, but will entirely close the outlet when the outer gate is open. The discharge-gate *v* is opened at regular intervals by means of a cord *a'*, which is wound upon a spirally-grooved pulley *b'*, loose on the shaft V.

$c'$ is a pinion fast on the pulley $b'$. This pinion is rotated at regular intervals by means of the segmental gear $d'$, which is driven, as indicated, by a train of gearing $e'$ from the shaft V. The gate $v$ is thus held open for a length of time depending upon the extent of the segmental gear $d'$ and the speed of the shaft V. The discharge-gate is closed by the action of the curved spring $f'$, when the pulley $b'$ is left free to revolve. Said spring has one of its ends bearing against the frame of the discharge $u$ and its other end acting against the gate $v$, as shown in Figs. 1 and 4. A spiral spring or a weight might of course be substituted.

As will be seen on reference to Fig. 2, the grinding and attrition rollers are driven by a suitable train of gearing from a gear-wheel fast to the driving-pulley Y.

In describing the construction of my machine I have largely set out its method of operation, but some further details will be necessary. When the tailings or pulp is fine, as from a stamp-mill where it has to pass through fine meshes, and when the gold is free from rust, &c., the hopper can be placed directly on top of the amalgamating-cylinder and the grinding mechanism may be dispensed with, but otherwise it will be found necessary. The feed-opening in the amalgamating-cylinder may also be varied from that shown in the drawings, depending altogether on the class of work for which the machine is intended. When the machine is to be used with gritty tailings, rusty gold, or gold mixed with black sand, necessitating the use of the grinders and attrition-rollers, it is advisable to place the feed-opening in the position shown.

It should be mentioned that all parts of the amalgamator with which the tailings containing gold come into contact are preferably formed of copper. Before the machine is started in operation the cylinders are opened up and the inside of the outer cylinder and the agitating-chamber thoroughly amalgamated. Both sides of all the plates of the inner cylinder are also thoroughly amalgamated and the mercury-pockets filled with mercury. The amalgamator is then closed and the halves of the cylinder clamped together.

When it is deemed necessary to "clean up" the machine and to collect the amalgam, the cylinders are again opened up and the inner corrugated plates and the vibrating corrugated plates of the inner cylinder removed and scraped, the outer corrugated plates being scraped while in position. The inside of the outer cylinder and of the agitating-chamber are also thoroughly scraped. The mercury from the mercury-pockets is also drawn off and together with the scrapings of the cylinders subjected to the usual process for the extraction of the gold. It will of course be understood that the details of construction of the machine may be widely varied without departing from the spirit of my invention, but I have set forth that construction which I deem preferable.

What I claim as my invention is—

1. In a machine of the class specified, a plate-amalgamator comprising an outer cylinder with a feed-opening therein, a central shaft, an inner cylinder carried by said central shaft and consisting of a longitudinal spiral coil, the said spiral coil commencing at the inside of said outer cylinder and terminating in an inner longitudinal coil or cylinder, and a series of curved plates supported in the spaces between the coils of the spiral, the said inner coil or cylinder being tapered longitudinally whereby the tailings are discharged by gravity at the larger end of the tapered coil, substantially as and for the purpose specified.

2. In a machine of the class specified, an amalgamator comprising an outer cylinder with a feed-opening therein, in combination with an inner cylinder carried by a shaft comprising a longitudinal spiral of corrugated metal, the outer coil of which ends close to the inside of the outer cylinder while the inner coil is tapered to discharge the tailings at one end; and a series of curved corrugated plates supported by coil-springs in the space between the coils of the spiral, substantially as and for the purpose specified.

3. In a machine of the class specified, an amalgamator comprising an outer cylinder with a feed-opening therein, in combination with an inner cylinder carried by a shaft and comprising a longitudinal spiral of corrugated metal, the outer coil of which ends close to the inside of the outer cylinder while the inner coil is tapered to discharge the tailings at one end; a cylinder with corrugated sides forming an agitating-chamber into which the tailings are discharged from the aforesaid coil; a revoluble beater located in the said chamber; and a discharge-spout connected to the chamber at or near its bottom and opening at or above its top, substantially as and for the purpose specified.

4. In a machine of the class specified, an outer amalgamating-cylinder having an inner cylinder therein, formed of a longitudinal spiral coil, disks connected to and supporting said spiral coil, all of said parts being formed in two detachable parts, and means for connecting said parts together, whereby one half of said parts may be swung away from the other half and again placed together with the divided spirals properly joined, substantially as described.

5. In a machine of the class specified, an inner amalgamating-cylinder comprising two disks X connected to the shaft V; a series of curved plates $e$ connected to the disks X to form one half of a longitudinal spiral; two semicircular disks $d$ fitting against the inner sides of the upper halves of the disks X; a series of curved plates $f$ connected to the semicircular disks $d$ to complete the said spiral coil; and a spiral conveyer within the inner

coil of the spiral and revolving therewith to discharge the tailings through an opening formed in one of the disks X, and semicircular disks *d*, substantially as and for the purpose specified.

6. In a machine of the class specified, an inner amalgamating-cylinder comprising two disks X connected to the shaft V; a series of curved plates *e* connected to the disks X to form one half of a longitudinal spiral; two semicircular disks *d* fitting against the inner sides of the upper halves of the disks X; a series of curved plates connected to the semicircular disks *d* to complete the said spiral, the inner coil of the spiral being tapered to discharge the tailings through an opening formed in one of the disks X, and semicircular disks *d*, substantially as and for the purpose specified.

7. In a machine of the class specified, an inner amalgamating-cylinder comprising two disks X connected to the shaft V; a series of curved plates *e* connected to the disks X to form one half of a longitudinal spiral, two semicircular disks *d* fitting against the inner sides of the upper halves of the disks X; a series of curved plates connected to the semicircular disks *d* to complete the said spiral, and a spiral conveyer within the inner coil of the spiral and revolving therewith to discharge the tailings through an opening formed in one of the disks X and semicircular disks *d*, the inner coil being tapered to facilitate the discharge, substantially as and for the purpose specified.

8. In a machine of the class specified, an inner amalgamating-cylinder section comprising the disks X, X; the extensions *h;* the curved plates *e;* the plates *g;* the semicircular disks *d;* and the curved plates *f;* the inner coil of the spiral formed by the plates *e* and *f* being tapered to discharge the tailings through a central opening in one of the disks X and semicircular disk *d*, substantially as and for the purpose specified.

9. In a machine of the class specified, an inner amalgamating-cylinder section comprising the disks X, X; the extensions *h;* the curved plates *e;* the plates *g;* the semicircular disks *d;* the curved plates *f*, and the spring-clips *i*, substantially as and for the purpose specified.

10. In a machine of the class specified, an inner amalgamating-cylinder section comprising the disks X, X; the extensions *h;* the curved plates *e;* the plates *g;* the semicircular disks *d;* the curved plates *f;* the spring-clips *i;* hinge *j;* and flanged connection *k*, substantially as and for the purpose specified.

11. In a machine of the class specified, an inner amalgamating-cylinder section, comprising the disks X, X; the extensions *h;* the curved plates *e;* the plates *g;* the semicircular disks *d;* the curved plates *f;* the spring-clips *i;* hinge *j;* flanged connection *k;* corrugated vibrating plates *o*, and springs *p*, substantially as and for the purpose specified.

12. In a machine of the class specified, an inner amalgamating-cylinder section, comprising the disks X, X; the extensions *h;* the curved corrugated plates *e;* the plates *g;* the semicircular disks *d;* the curved corrugated plates *f;* the spring-clips *i;* hinge *j;* flanged connection *k;* corrugated vibrating plates *o;* springs *p;* and current-diverters *q*, substantially as and for the purpose specified.

13. In a machine of the class specified, the combination of an outer cylinder L, an inner cylinder *n* carried by a shaft B and revolving in said cylinder L, an agitating-chamber S, a partition Q separating the inner cylinder from the agitating-chamber, end disk X of cylinder *n*, and the spring packing-ring *b* between said partition Q and disk X, substantially as and for the purpose specified.

14. In a machine of the class specified, the combination of the outer cylinder L, and the agitating-chamber S divided longitudinally; the partition Q; the inner cylinder *n;* the hinge O and flanges P, substantially as and for the purpose specified.

15. In a machine of the class described, a lower tailings-discharge, a gate for said discharge and a spring for normally holding said gate closed, in combination with means for automatically opening said gate at predetermined intervals, said means being constructed and arranged to gradually open said gate and to allow it to suddenly close, substantially as and for the purpose specified.

16. In a machine of the class described, a lower tailings-discharge closed by an outer hinged gate; and an inner gate connected to the said outer gate adapted to close the discharge when the outer gate is open, in combination with means for normally holding the said gate closed and means for automatically opening it at predetermined intervals, substantially as and for the purpose specified.

17. In a machine of the class described, a lower discharge with a curved bottom, in combination with an outer gate closing the said discharge; an inner gate rigidly connected to the outer gate and swinging over the curved bottom which is so shaped that the inner gate closes the discharge when the outer gate is open; a spring adapted to hold the outer gate closed and means for automatically opening it at predetermined intervals, substantially as and for the purpose specified.

18. In a machine of the class described, the combination of a discharge *u*, having a discharge-gate *v* connected therewith, a driving-shaft, having a pulley *v'* thereon, a cord or chain connecting said pulley and the discharge-gate *v*, a pinion on said driving-shaft and connected with said pulley, a segmental gear *d'* arranged to engage with said pinion *c'*, and a train of gearing connecting said segmental gear and said driving-shaft, whereby the rotation of said shaft causes the segmental gear to intermittently operate the pinion *c'* and its pulley, winding the cord or chain

$a'$ and opening the discharge-gate $v$, substantially as described.

19. In a machine of the class described, the combination of a discharge $u$, having a discharge-gate $v$ connected therewith, a driving-shaft as V having a pinion $c'$ and pulley $v'$ loosely journaled thereon, a cord or chain connecting said pulley and said discharge-gate $v$, a segmental gear $d'$ arranged to engage with said pinion $c'$, a train of gearing interposed between said segmental gear and said driving-shaft for operating the former, and a spring $f'$ arranged to normally keep the discharge-gate $v$ closed, whereby the rotation of said shaft causes the segmental gear to intermittently operate the pinion $c'$ and its pulley, thus winding the cord or chain $a$ and opening the discharge-gate $v$, substantially as described.

20. In a machine of the class specified, the combination with discharge $u$, of an adjustable upper part $w$, a lower discharge-gate $v$, normally held closed by a spring $f'$, inner gate $y$, and means for automatically opening the outer gate at predetermined intervals, said means being arranged to gradually open said outer gate and permit it to rapidly close, substantially as and for the purpose specified.

Harrison Hot Springs, B. C., September 30, 1895.

JOHN R. BROWN.

In presence of—
R. S. BYRN,
R. D. FINLAYSON.