

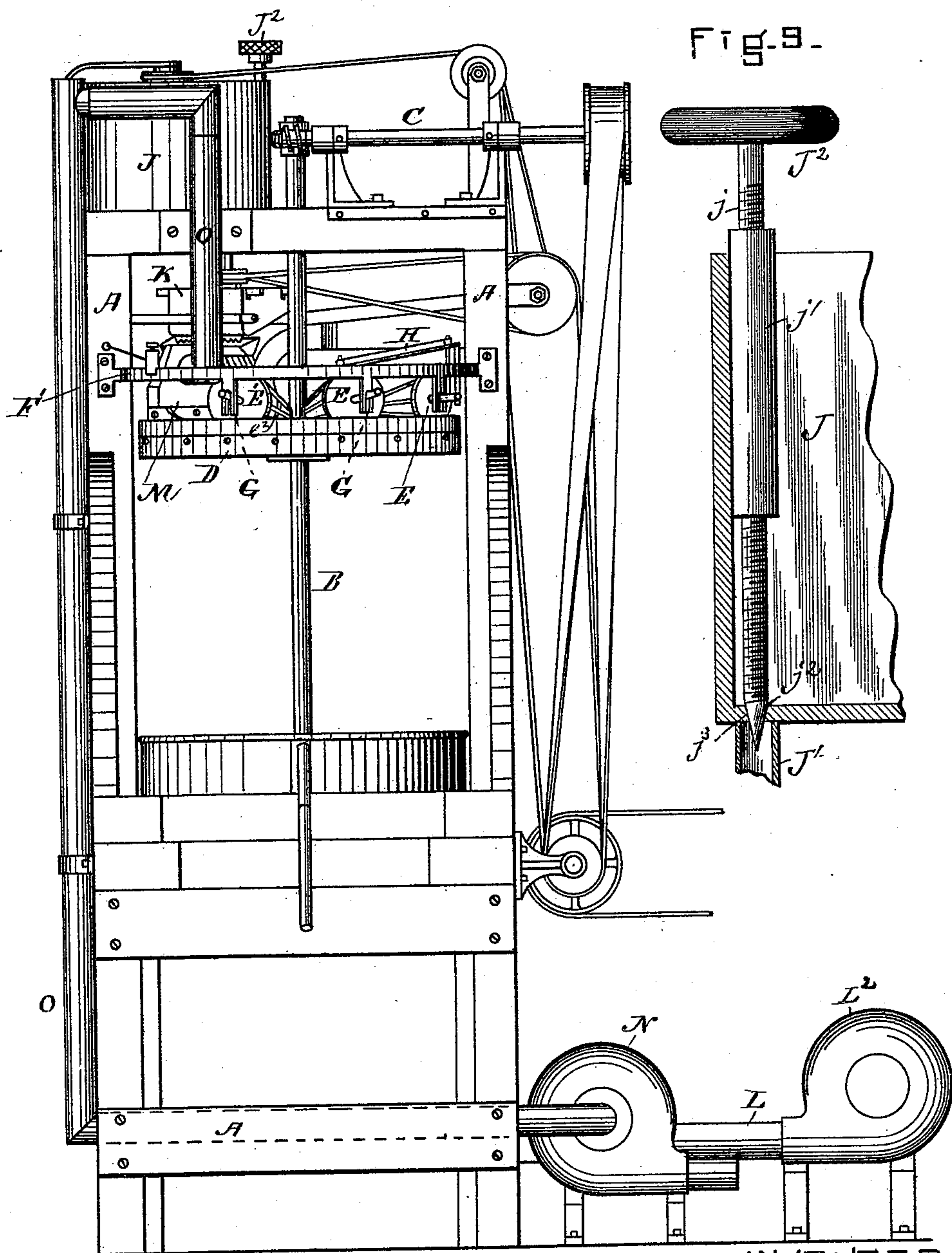
(No Model.)

4 Sheets—Sheet 1.

A. B. KITTSON.  
AMALGAMATOR FOR GOLD OR SILVER ORES.

No. 497,669.

Patented May 16, 1893



WITNESSES.

*H. Selden Spring*  
*W. H. Sweet*

Fig. 1.

INVENTOR.

*Alfred B. Kittson*  
*per*  
*Chas. Reed*  
(Attorney)

(No Model.)

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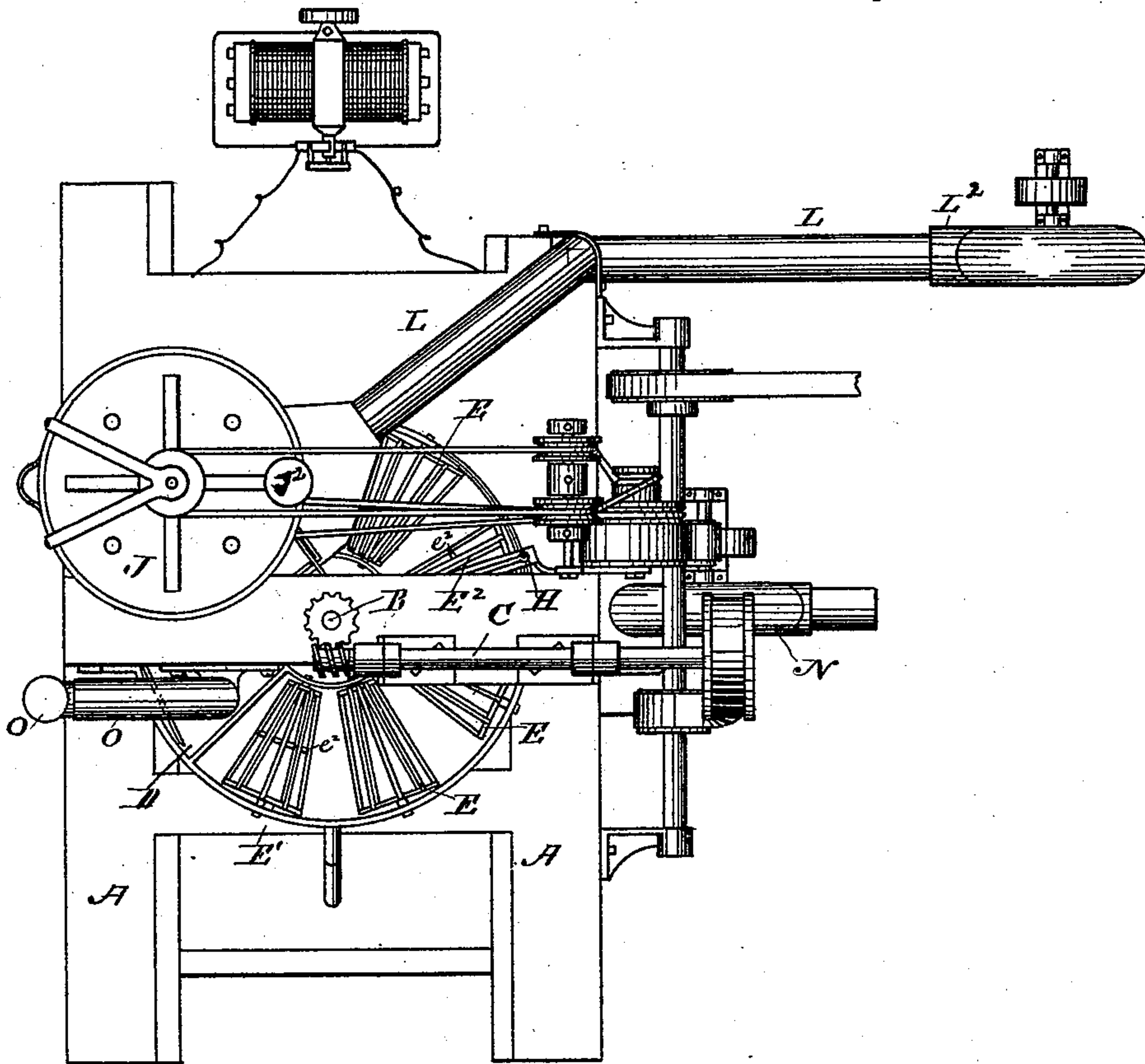


FIG. 2.

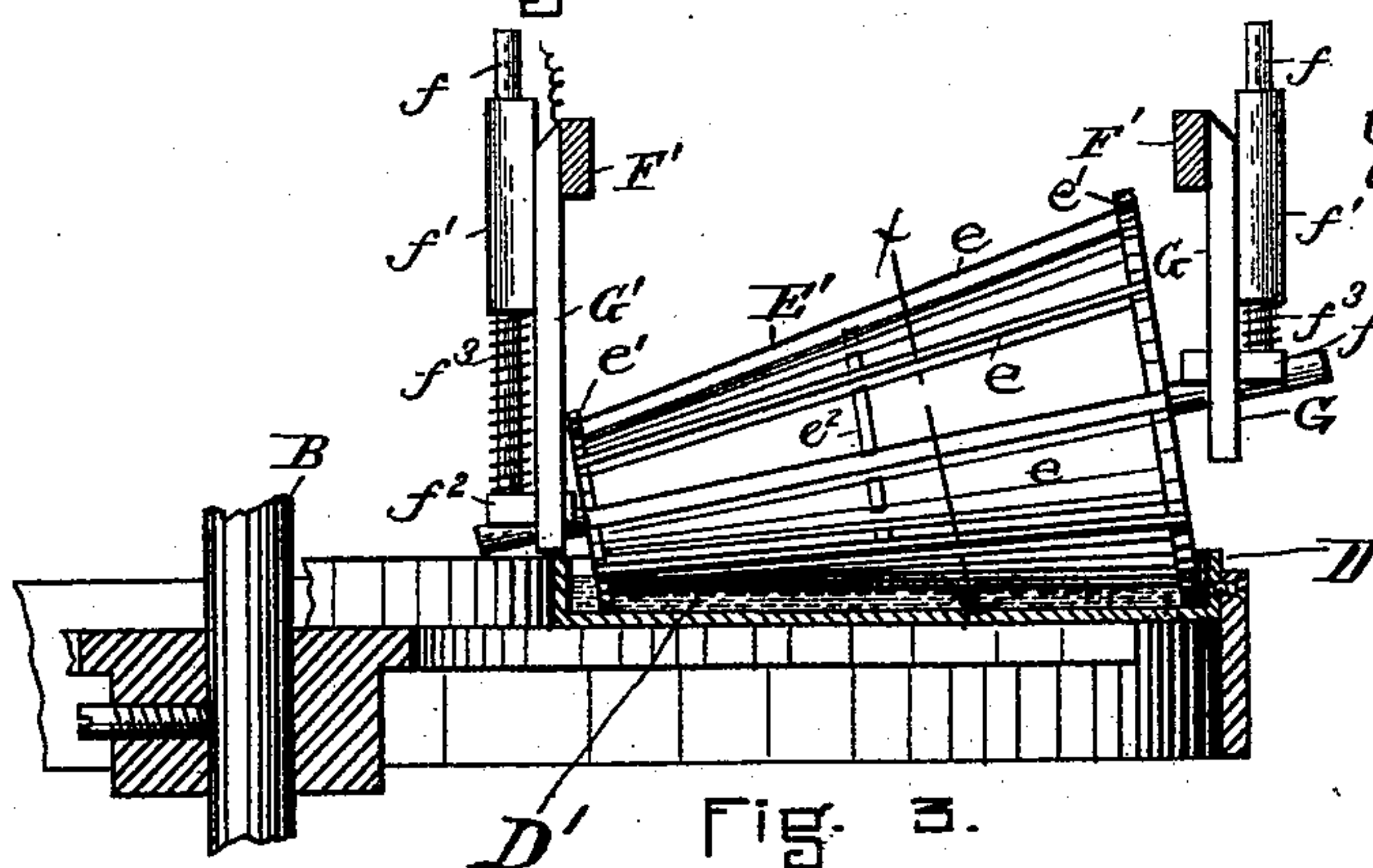


FIG. 3.

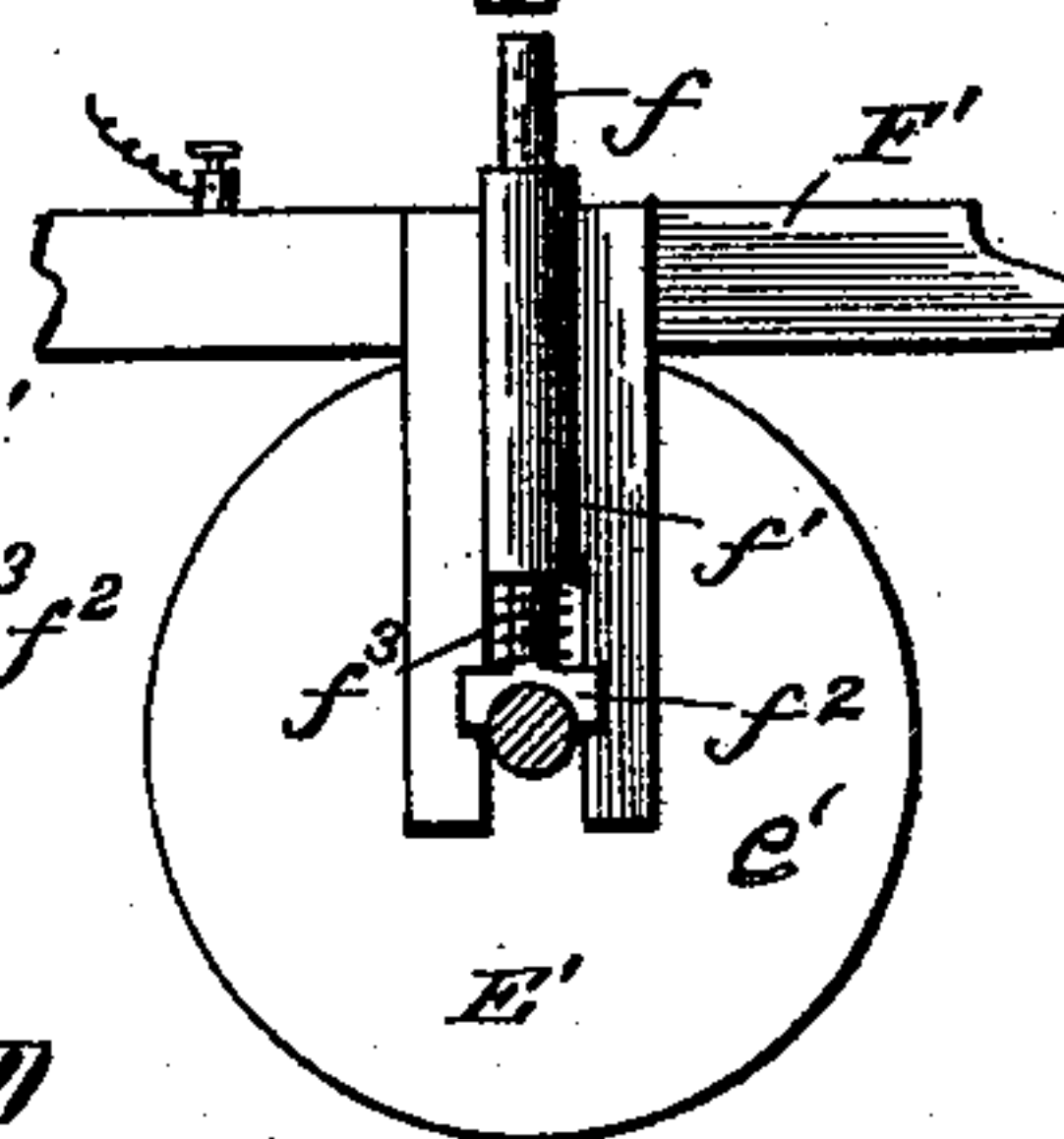


FIG. 3.

WITNESSES.

H. Selden Irving  
W. H. Sweet

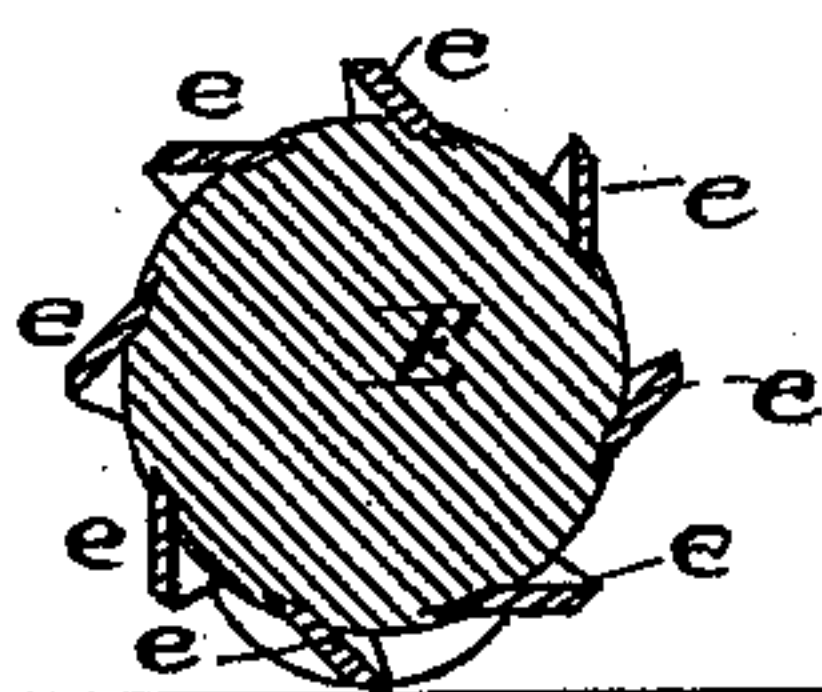


FIG. 4.

INVENTOR.

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per

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(attorney)



(No Model.)

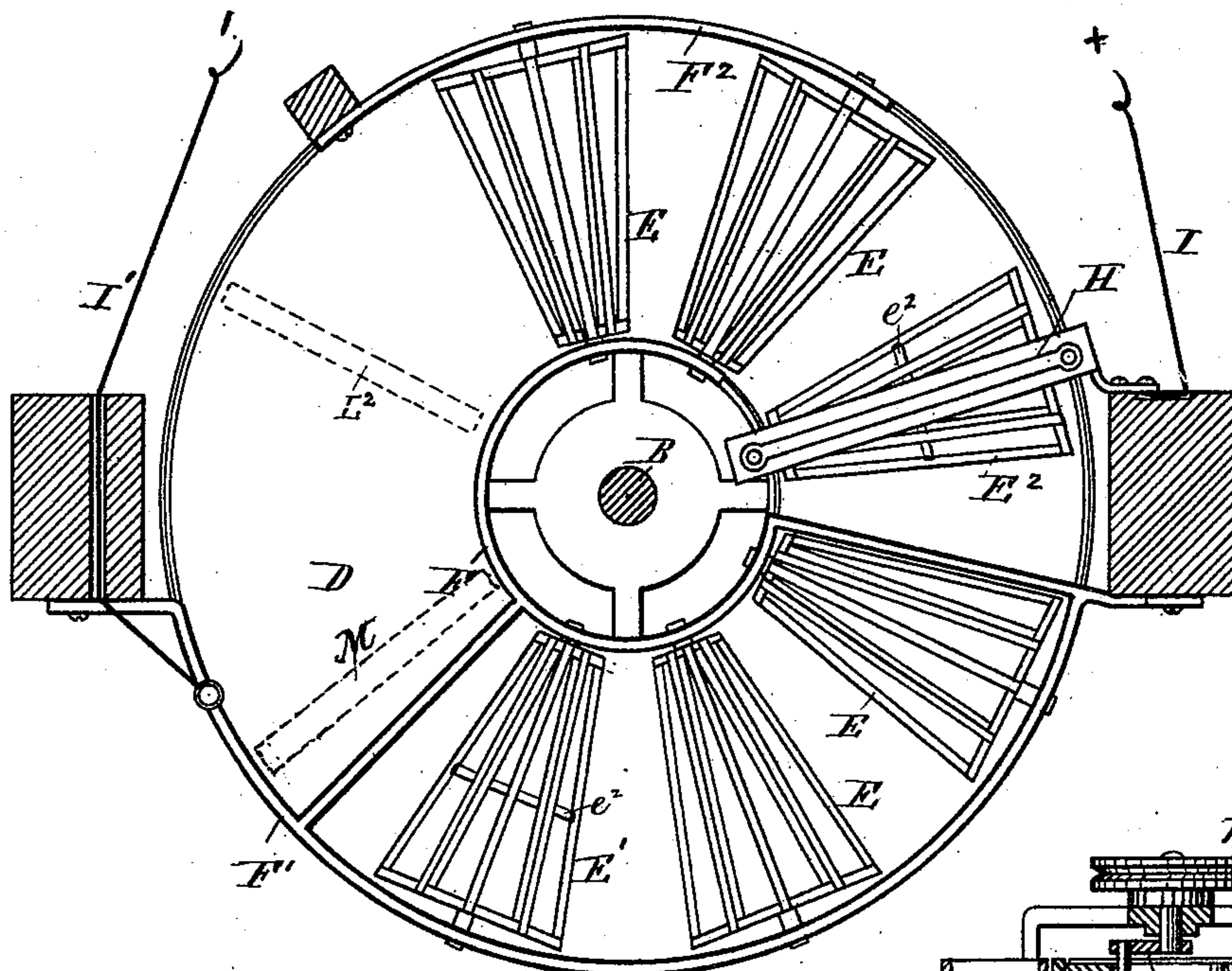
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A. B. KITTSO N.

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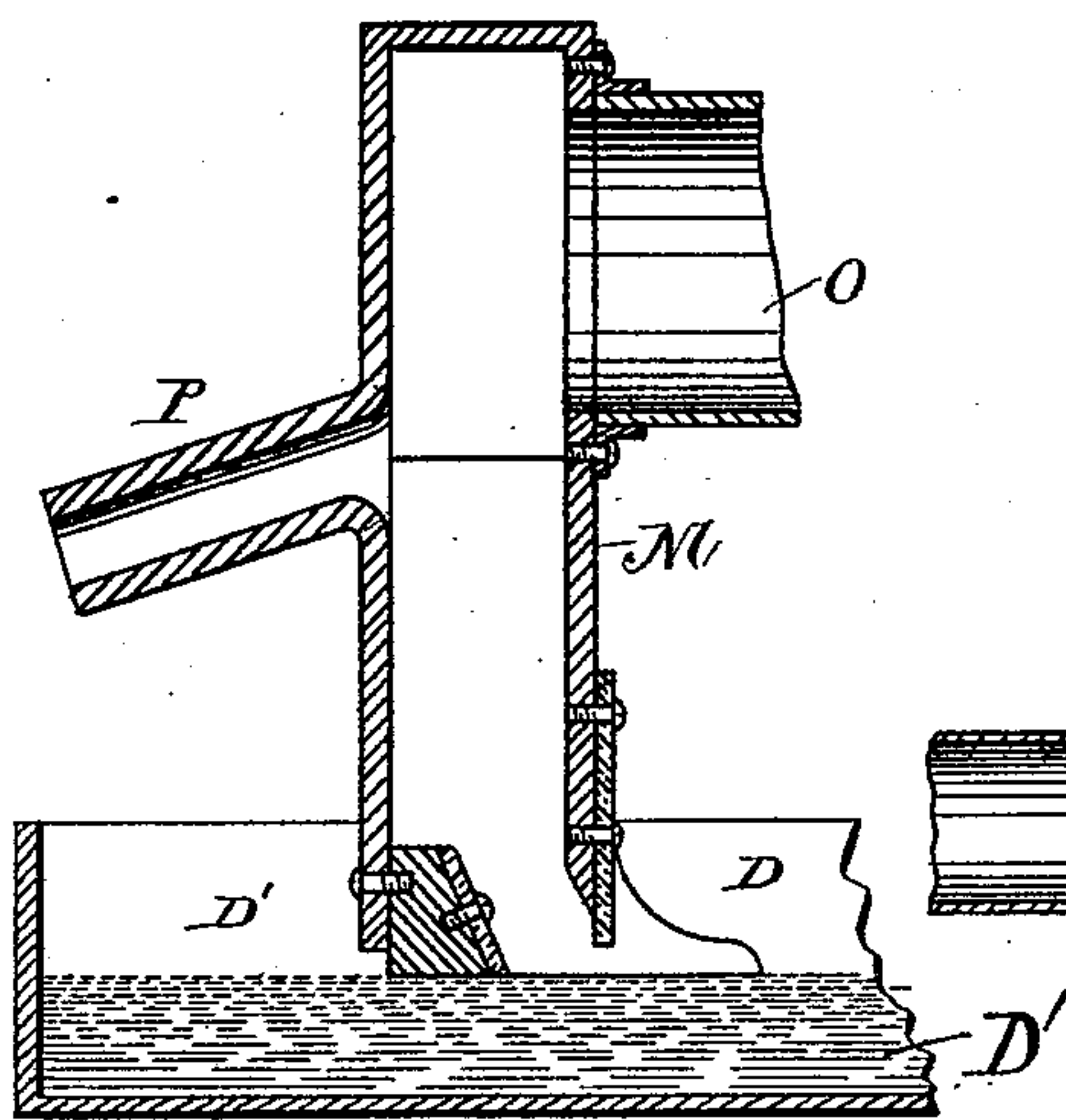


Fig-6-

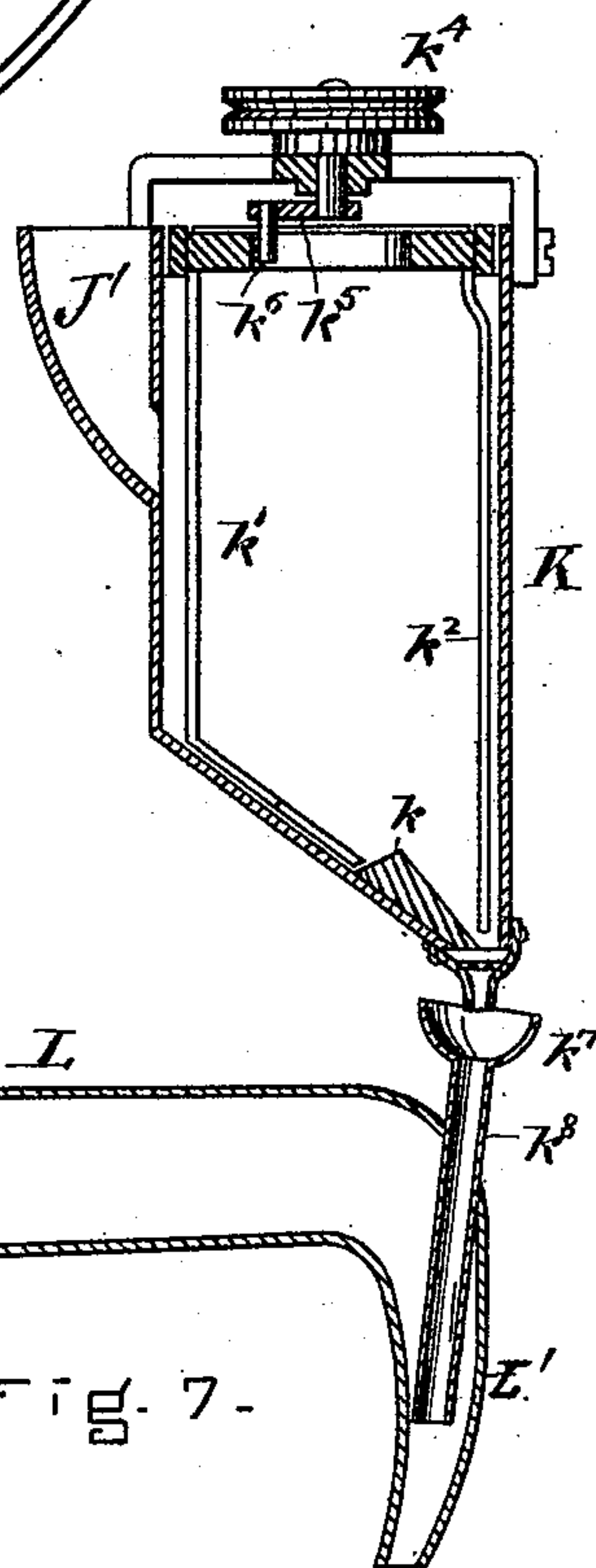


Fig. 7.

WITNESSES.

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(No Model.)

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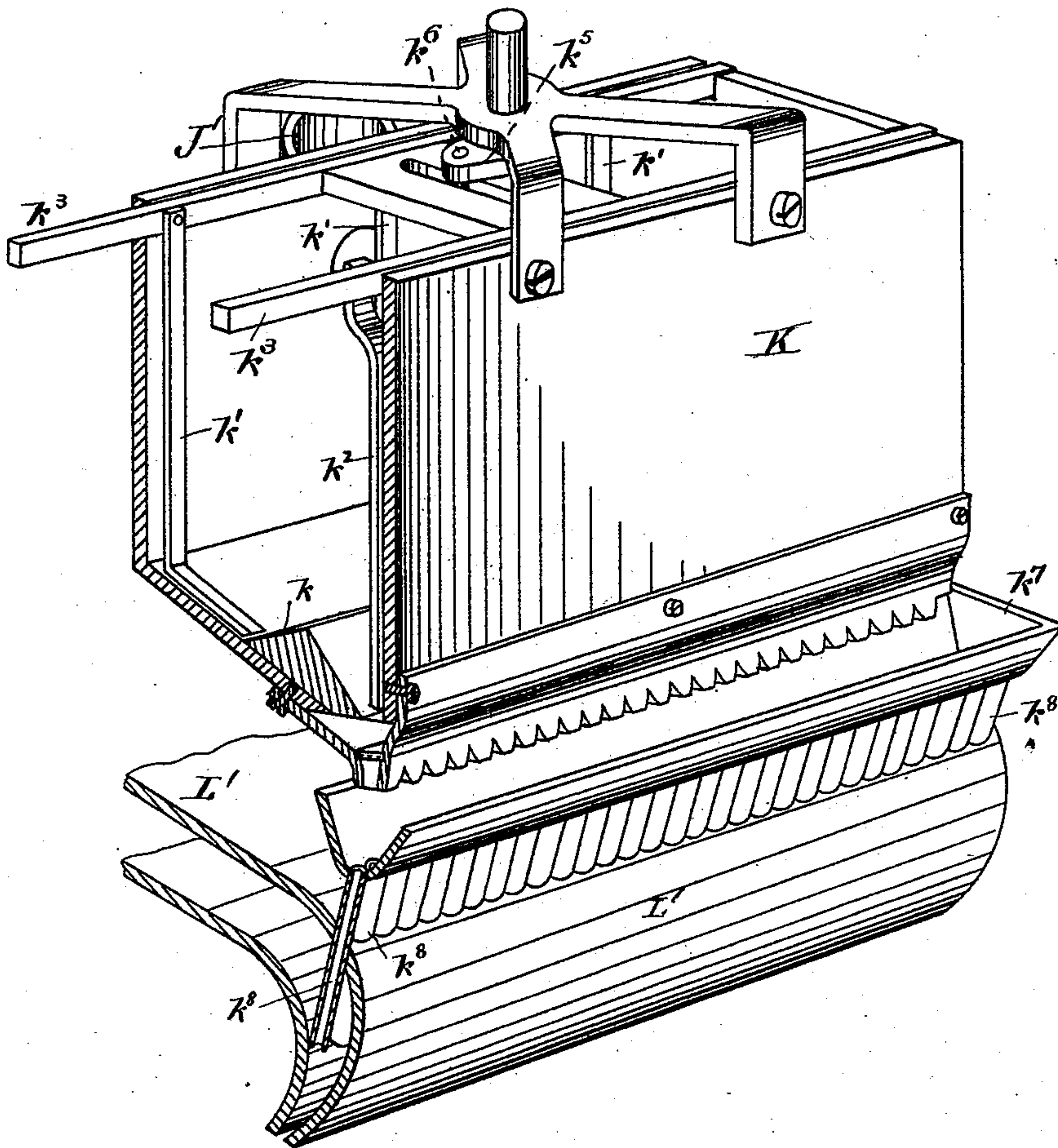


Fig. B.

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INVENTOR.

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C. M. Reed.  
(Attorney)



# UNITED STATES PATENT OFFICE.

ALFRED B. KITTSOON, OF BOSTON, MASSACHUSETTS.

## AMALGAMATOR FOR GOLD OR SILVER ORES.

SPECIFICATION forming part of Letters Patent No. 497,669, dated May 16, 1893.

Application filed November 15, 1889. Renewed April 14, 1892. Again renewed November 4, 1892. Serial No. 450,940.  
(No model.)

*To all whom it may concern:*

Be it known that I, ALFRED B. KITTSOON, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented an Improvement in Amalgamators for Gold or Silver Ores, of which the following is a specification, reference being had to the accompanying drawings, in which like letters represent like parts.

In the amalgamators hitherto in use the powdered ore is usually carried by a rapid current of water over the surface of the mercury or is mingled with it when in violent agitation. In the former case a large proportion of the finest gold remains suspended in the water and is carried over the mercury without touching it, while in the latter the particles of gold are either imperfectly mingled with the mercury so that many of them do not come in contact with it at all, or are carried past it before it has time to amalgamate. In either case there is a loss of a considerable portion of the gold especially of the finer particles.

The object of my invention is to so construct and operate the apparatus employed that substantially every particle of the powdered ore may be brought into intimate contact with the mercury and allowed to remain in contact with it for a sufficient time to permit of complete amalgamation.

In the accompanying drawings—Figure 1 is a side elevation of my apparatus. Fig. 2 is a top or plan view of the same. Figs. 3 and 3\* are side and end views respectively of one of the rollers and its connections. Fig. 4 is a cross section of the same, through the line  $x$   $x$  Fig. 3. Fig. 5 is a plan or top view of the amalgamating pan with its rollers. Fig. 6 is a longitudinal section of the exhaust and discharge pipes. Fig. 7 is a transverse section of the distributor and feeding apparatus. Fig. 8 is a perspective view of the distributor and feeding apparatus with one end removed. Fig. 9 is a detail enlarged view of a part of the mixer and of the tube leading to the distributor.

A, represents a wooden frame suitably constructed to sustain the working parts of the machine.

B. is an upright shaft made to revolve by power applied through the horizontal shaft C. by means of suitable gearing. Upon the shaft B. is suspended the flat, shallow amalgamating pan D. containing a continuous body of mercury D' to the depth of from an eighth to a quarter of an inch. The pan is made annular in form as shown in Fig. 5.

In the pan D. are several conical wooden rollers E. E' E<sup>2</sup> having their faces slightly immersed in the mercury, the rollers E' E<sup>2</sup> having on their faces the longitudinal metallic ribs  $e$ , and the rollers E. similar longitudinal ribs made of some non conducting material, the object of the rolls being to force the ore into closer contact with the mercury, without agitating, breaking, or displacing the same. Attached to the rollers at each end are projecting disks  $e'$  made of some non conducting material resting upon the bottom of the pan D. These disks project beyond the bodies of the rollers sufficiently to keep the surface of the rollers a little below the level of the mercury in the pan. During the revolution of the rolls, a portion of the ore and mercury is retained between the end disks  $e'$  and the longitudinal ribs that are at the time dipping into the ore and mercury, while the portion of the rollers between said disks and ribs forces or depresses the ore into the mercury. In other words the ore and mercury are prevented from being pushed or forced away from the rolls by the smooth rounded peripheries of the same, by means of the end disks and longitudinal ribs, which virtually act as a flanged lid or box retaining the material between the walls of the same.

Above the pan D. is the metallic frame F. F'. F<sup>2</sup>. consisting of the inner curved frame F. and the segmental frames F'. F<sup>2</sup>. attached to the frame A. in the manner shown in Fig. 5. From this frame are suspended the bars G. G', each having a slot in its lower end adapted to receive one end of the axles of the rollers E. E' and performing the double function of keeping the rollers in place and causing them to revolve with the motion of the pan D. The roller E<sup>2</sup> is similar in construction to the others but is insulated from them by being suspended in the frame H. separately attached to the frame A. and consisting of an upper



bar parallel with the axle of the roller as shown in Fig. 5 and suitable downwardly projecting arms to retain the ends of the axle.

The positive pole of an electric battery or dynamo is connected by the wire I. with the roller  $E^2$  and the negative pole by the wire I' through the frame F'. with the roller  $E'$ . thereby establishing an electric current through the unbroken body of mercury between the rollers  $E'$ ,  $E^2$ . by which the process of amalgamation is greatly facilitated. For this purpose the axles of the rollers  $E'$ ,  $E^2$ , which are made of steel or other conducting material, are connected with the longitudinal ribs  $e$  on the faces of the rollers by a copper disk  $e^2$  about midway of the length of the rollers. The electrical connection between the frame F'. and the roller  $E'$  is insured by small metallic bars  $f$  which slide in metallic sleeves  $f'$  that are connected with the frame F' just over the ends of the axle, and metallic blocks  $f^2$  secured to the lower ends of said bars and which blocks are made to press upon the axles of the rollers by means of spiral springs  $f^3$ , (see Figs. 3 and 3\*.) The rollers  $E$ . are insulated from the frame F. F'. there being no conducting medium between the axles and the ribs upon the surface of the rollers.

Attached to the frame A. above the amalgamating pan is the mixer J. consisting of a cylindrical reservoir in which the ground ore and water are thoroughly mixed by a series of arms placed on a horizontal revolving shaft. From the mixer J the mingled ore and water passes through the pipe J' into the distributor K, the flow being regulated by a gate or valve  $J^2$  in the outlet pipe. Any well known gate or valve may be used for this purpose, but I have shown in Fig. 9, a threaded rod  $j$  passing through an internally threaded sleeve  $j'$ , which is secured to the inner wall of the mixer J; the lower end of said rod being conically tapered as at  $j^2$ , and adapted to enter and be withdrawn from a corresponding tapering hole  $j^3$  in the bottom of the mixer. The distributor K consists of a box of a length corresponding with the width of the annular portion of the amalgamating pan, and mounted over it in the line of the radius of curvature. The bottom of the distributor is made sloping and broken near the middle by a bar or dam  $k$ . as shown in Fig. 8 which checks the flow of the ore and retains it while it is being distributed along the length of the pan by the arms  $k'$ . The distribution is still further continued at the bottom of the box by the arms  $k^2$ . The arms  $k'$  and  $k^2$  are suspended from horizontal bars  $k^3$  joined by a connecting plate and resting in slots near the top of the distributor K. A reciprocal motion is communicated to them from the pulley  $k^4$  by means of the arm  $k^5$  having a projecting button  $k^6$  working in a suitably formed slot in the plate connecting the bars  $k^3$  whereby the arms  $k'$   $k^2$  are made to move reciprocally in the direction of the length of the distributor K. The ore and water thus thoroughly com-

mingled and evenly distributed pass out into a trough  $k^7$  and from this through a series of short pipes  $k^8$  into a broad flattened discharge portion  $L'$  of a pipe L. extending radially across the annular portion of the amalgamating pan as shown in dotted lines in Fig. 5 and having its mouth about one sixteenth of an inch above the surface of the mercury therein. A strong current of air is forced through the pipe L. by means of an ordinary fan blower,  $L^2$  the effect of which is to force the ore as it leaves the pipes  $k^8$ , down through the outlet of the pipe  $L'$ , and slightly below the level of the mercury and into intimate contact with it. It serves also to blow away any ore which there may be upon the surface of the mercury at the mouth of the pipe thereby insuring a clean surface of mercury for the reception of the ore coming from the pipe. The ore floating upon the surface of the mercury is first retained between the two end disks and the longitudinal ribs that are dipping into the mercury, and the ore between said disks and ribs is then pressed down and brought into closer contact with the mercury by the action of the rollers  $E$ .  $E'$ .  $E^2$ . as the revolution of the pan brings the ore under them until it passes the roller  $E'$ , by which time substantially all the precious metal in the ore has become amalgamated with the mercury, leaving only the refuse matter upon the surface. This refuse matter is removed by means of the exhaust pipe M. the rear wall of which just touches the surface of the mercury behind the roller  $E'$ , while the front wall is somewhat shorter so as readily to admit the floating matter as it is swept into it by the revolution of the pan D. The height of the pipe may be regulated in any well known manner. The pipe M. is flattened in form, the longer diameter extending radially across the annular portion of the pan D. A powerful exhaust is produced in this pipe by a blower N. connected with it by the tube O. The refuse ore and water are drawn up by the exhaust from the surface of the mercury into the discharge pipe P. the mouth of which opens into a reservoir below the level of the pan D. and is kept covered with water. The force of the exhaust should be so regulated that the ascending stream of ore and water shall not enter the tube O.

It is essential to the successful operation of my machine that the pan D. should revolve somewhat slowly. In practice I have obtained the best results when a speed of less than two revolutions per minute was employed, but I do not limit myself to this.

I have described above the process of treating wet ores with my apparatus. Dry ground ores may also be operated upon with good results, but in that case I prefer to remove the refuse matter by a direct exhaust through the blower without using the separate discharge pipe P. and also to discard the air blast in the feed pipe L.

I do not claim broadly the use of a revol-



ing pan of mercury in an amalgamator, my invention consisting principally in the use of a pan so constructed and arranged that the surface of the mercury is kept substantially level throughout the revolution of the pan.

What I claim, and desire to secure by Letters Patent, is, in an amalgamator for gold and silver ores—

1. The described method of treating pulverized ores, consisting in delivering the same in a thin film or sheet upon the surface of a quiescent body of mercury, and then holding and pressing such ore without material agitation of the mercury or ore into and beneath the surface of the mercury, all as and for the purposes set forth.

2. In an amalgamator the combination of an amalgamating pan adapted to contain a continuous body of fluid mercury, and means for revolving said pan, with a series of conical rollers arranged radially across the pan in substantially stationary bearings, and means at each end of said rollers for supporting the same and preventing the rollers or any lateral extension from the peripheries of the same from coming in contact with the bottom of the pan, all substantially as and for the purposes set forth.

3. In an amalgamator the combination of an amalgamating pan and means for revolving the same, with a feeding tube having an opening extending radially across one side of said pan and above the bottom of the same, and with means for forcing a current of air and ore combined through said tube, whereby said ore may be spread over and subjected to the action of a continuous body of unbroken mercury contained in the pan, all substantially as and for the purposes set forth.

4. In an amalgamator the combination of an amalgamating pan and means for revolving the same, with a feeding tube having an opening extending radially across one side of said pan and above the bottom of the same, and an exhaust pipe having its receiving end extending radially across the pan below its upper edge and above its bottom, whereby said ore may be spread over, subjected to the action of, and sucked up from the top of a continuous body of unbroken mercury contained in the pan and having its surface in close proximity to the receiving end of the exhaust pipe, all substantially as and for the purposes set forth.

5. The combination of an amalgamating pan adapted to contain a continuous body of fluid mercury and means for revolving said pan,

with a series of conical rollers furnished with projecting longitudinal ribs, and arranged radially across the pan in substantially stationary bearings, and means at each end of said rollers for supporting the same and preventing said rollers and ribs from coming in contact with the bottom of the pan, all substantially as and for the purposes set forth.

6. In an amalgamator the combination of an amalgamating pan containing a continuous body of fluid mercury covering the bottom of the same, with two metallic conductors both of which are partially immersed in said mercury and insulated from said pan, one conductor being connected with the positive pole and the other with the negative pole of an electric battery, whereby a continuous current may be transmitted from one of said conductors to the other directly through the mass of mercury between them, all as set forth.

7. The combination of an amalgamating pan and means for revolving the same, said pan containing a continuous body of fluid mercury covering the bottom thereof, a series of conical rollers supported radially across said pan in substantially stationary bearings, with the lower surfaces of their perimeters slightly immersed in the mercury but not in contact with the bottom of the pan, two of said rollers being provided with electric conductors both of which are slightly immersed in the mercury and said conductors being connected respectively to the positive and negative poles of an electric battery, whereby an electric current may be transmitted directly from one of said rollers to the other through the mercury between them, said rollers being insulated from the pan, all as set forth.

8. The combination of an amalgamating pan and means for revolving the same, said pan containing a continuous body of fluid mercury covering the bottom thereof, with two conical rollers supported radially across said pan and slightly immersed in the mercury but not in contact with the bottom of said pan, said rollers being furnished with longitudinal metallic ribs connected together and with the axle by a suitable conducting medium, and each roller being mounted on a metallic frame insulated from the other and from the pan, and connected through its axle with one of the poles of an electric battery, all as set forth.

ALFRED B. KITTSOON.

Witnesses:

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CHAS. M. REED.