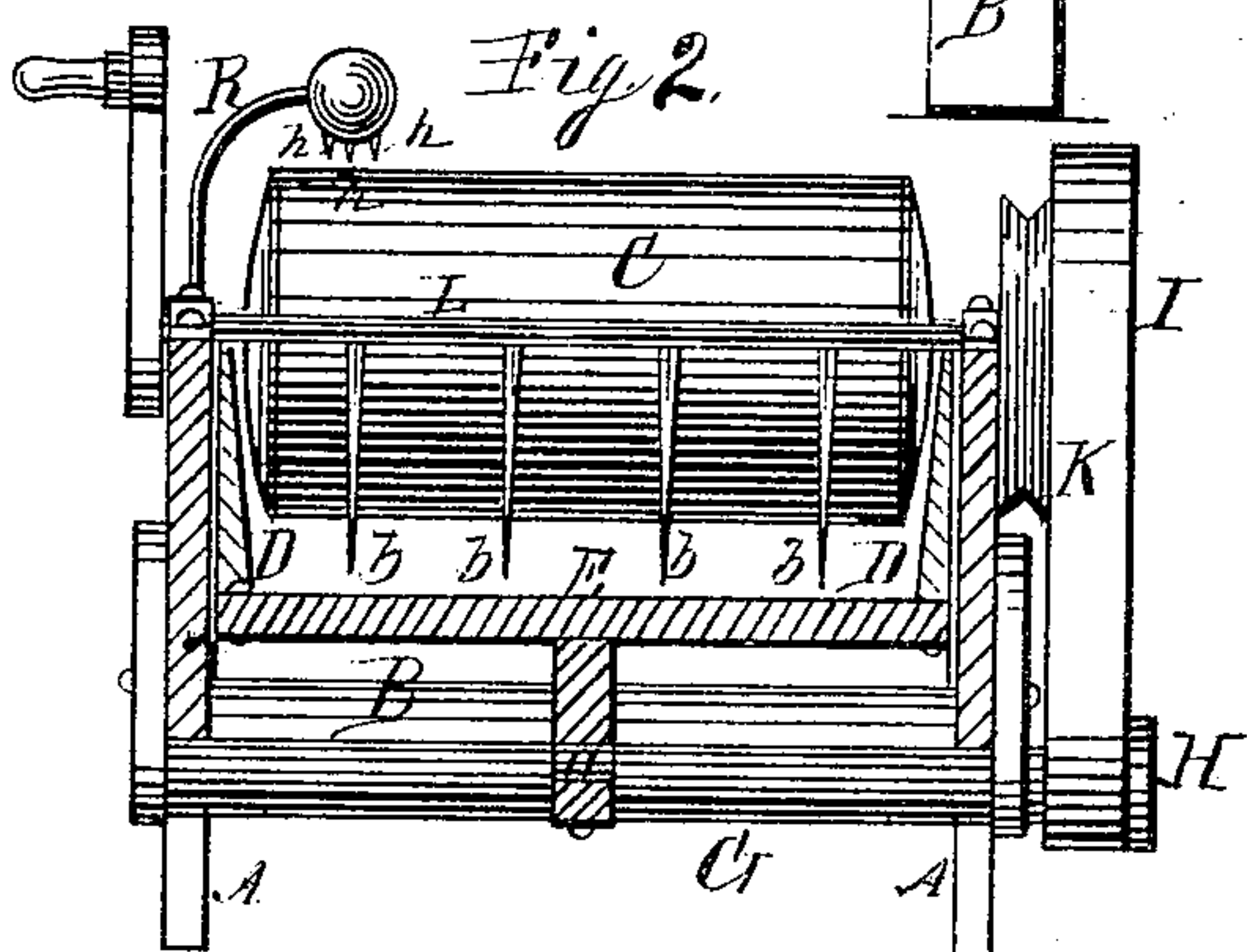
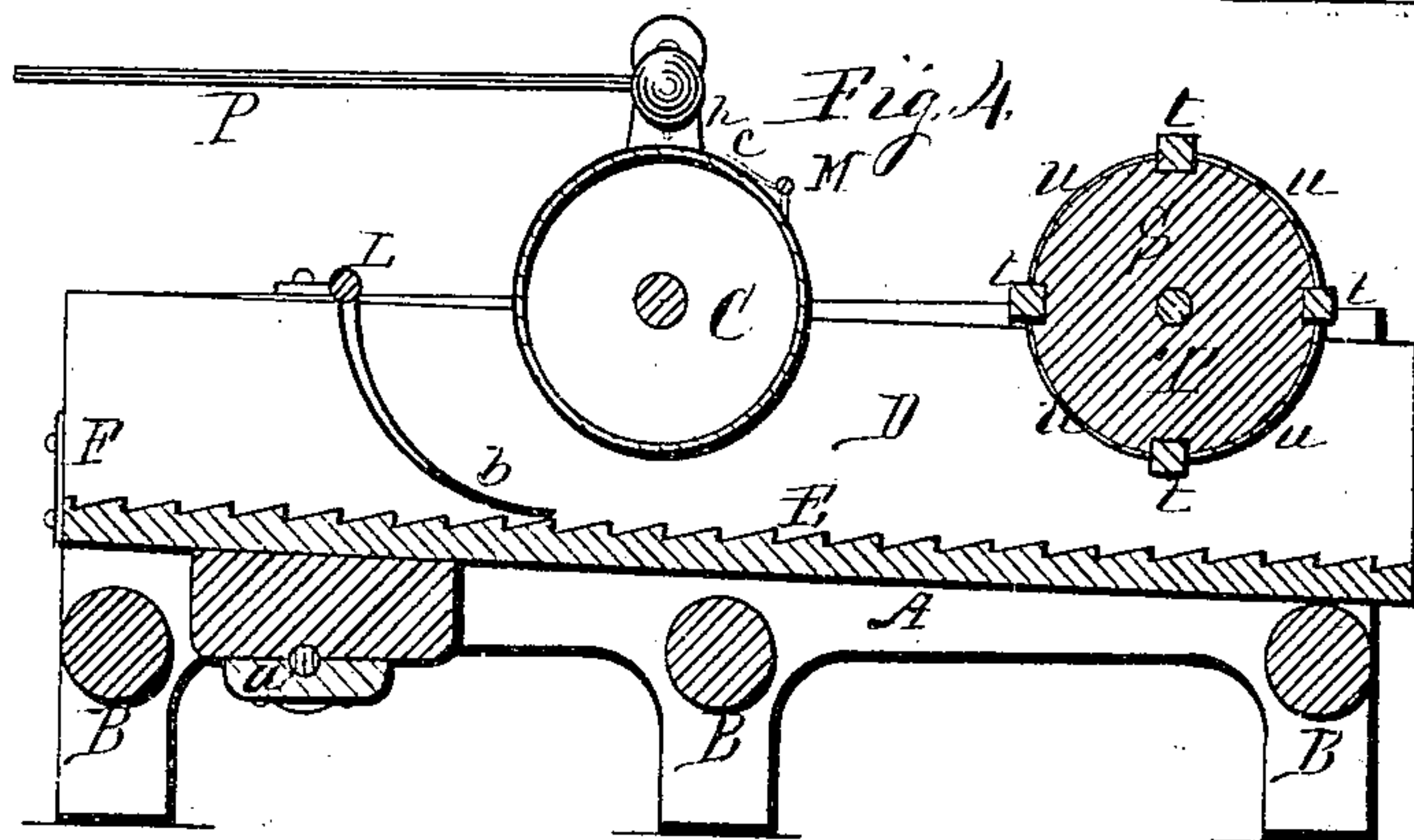
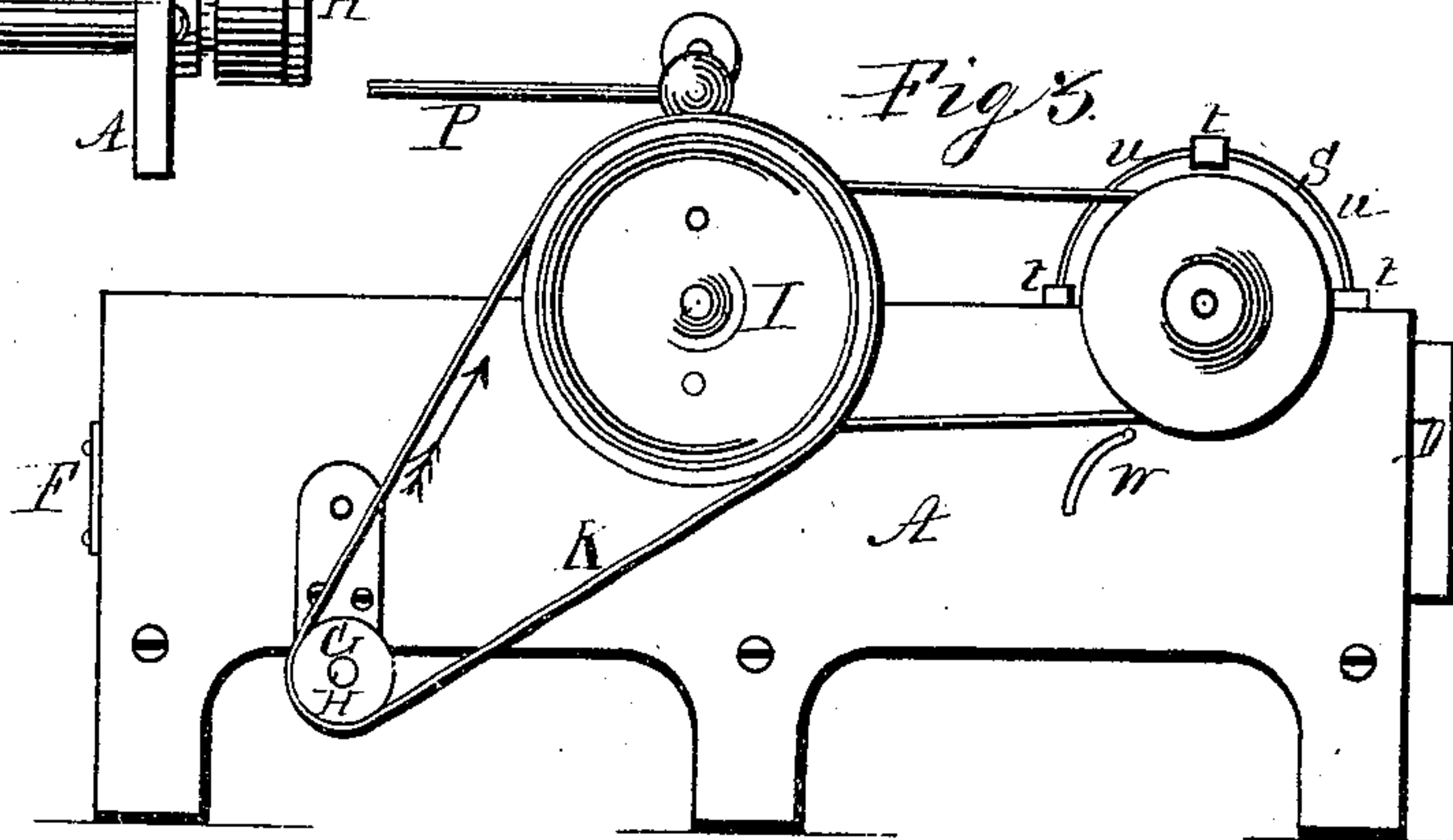
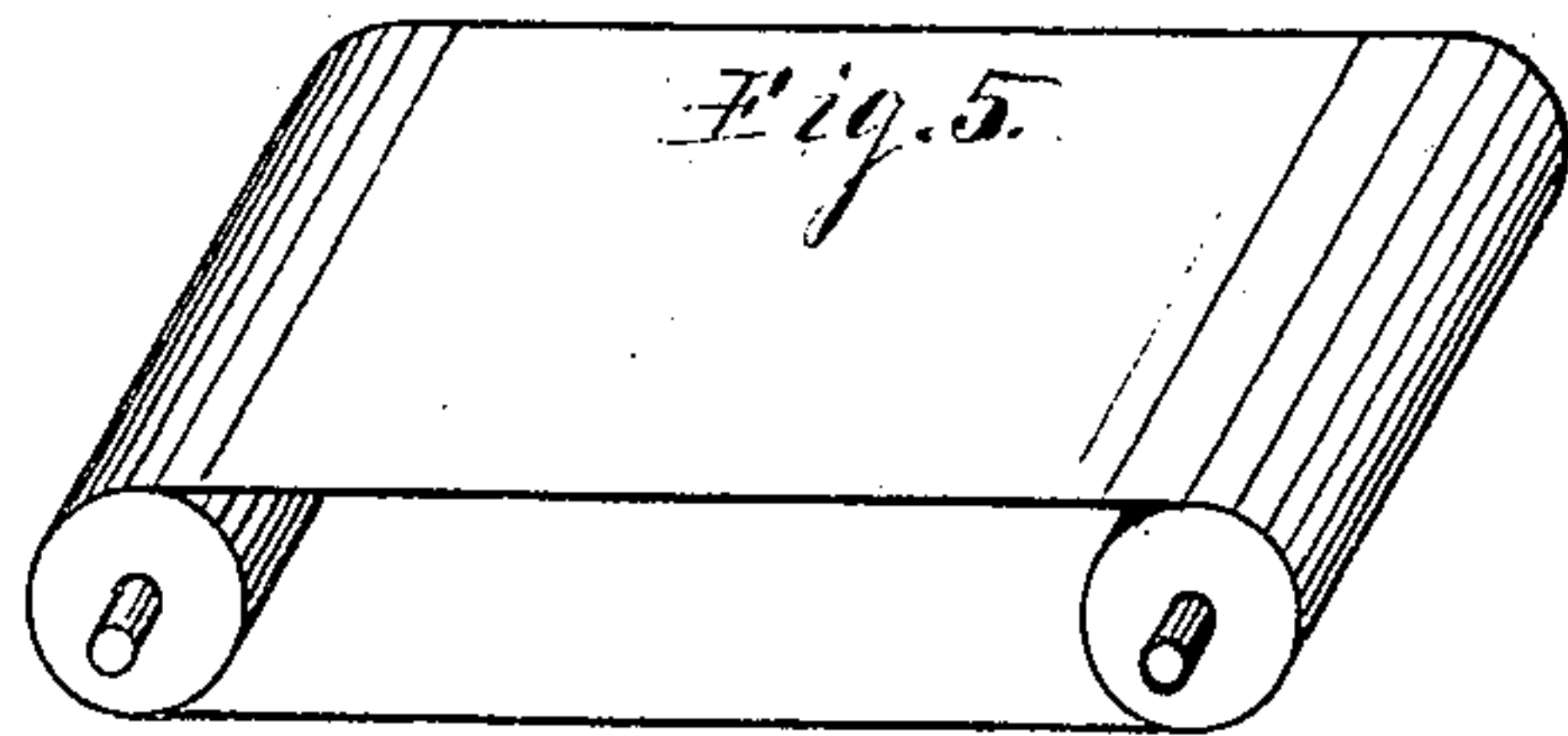
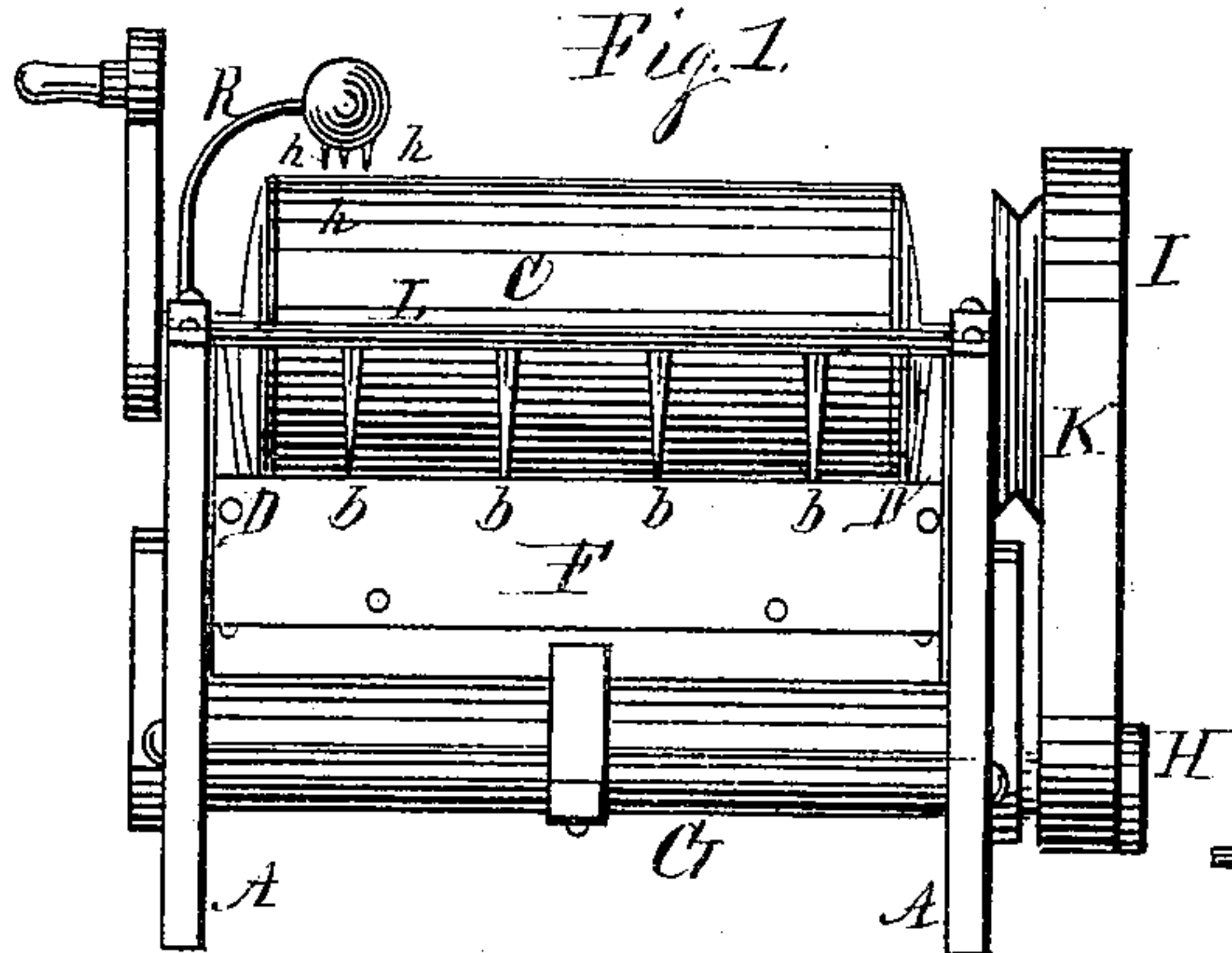


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SEPARATING AND COLLECTING METALS BY ELECTRICITY.

No. 245,299.

Patented Aug. 9, 1881.

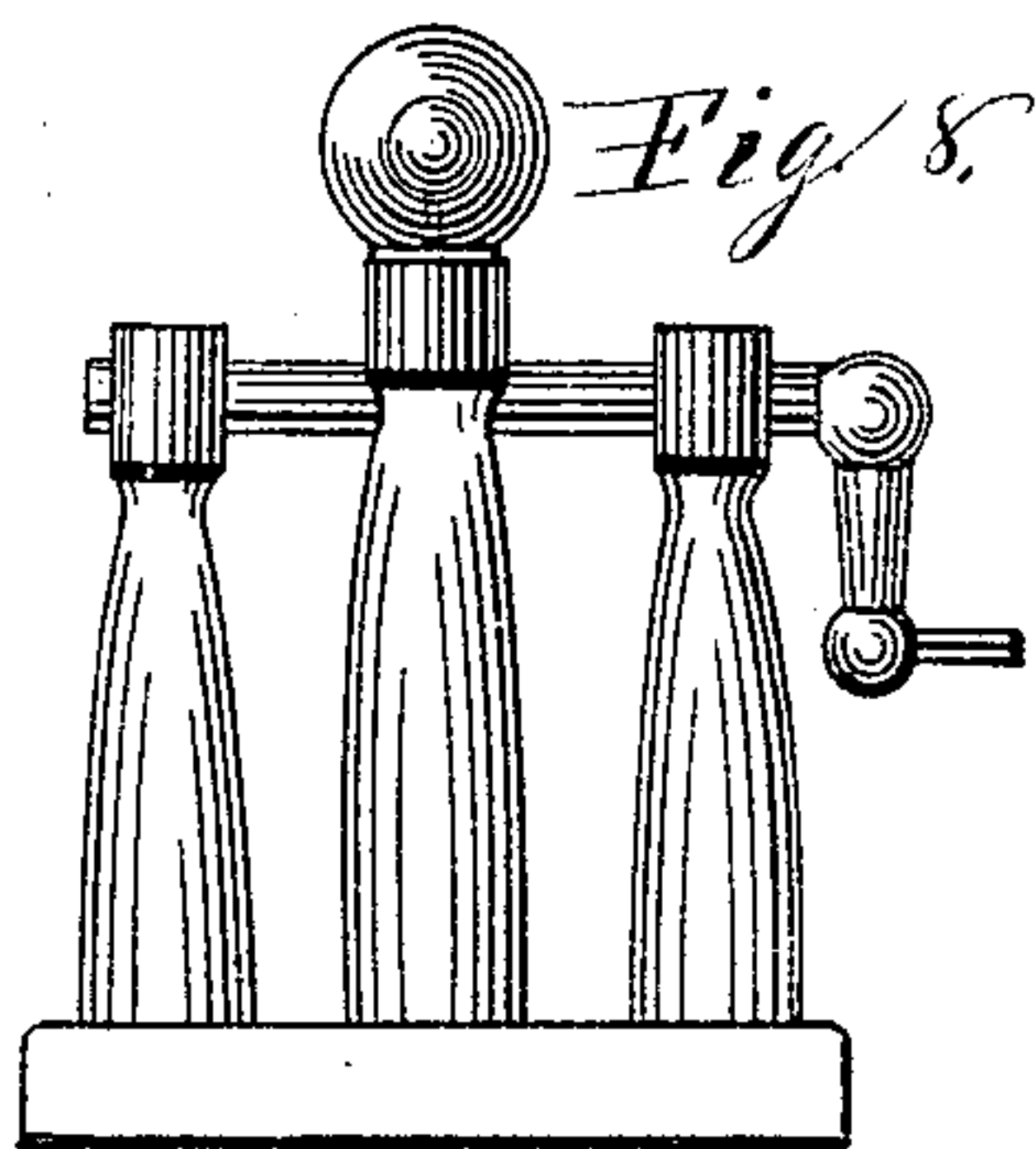
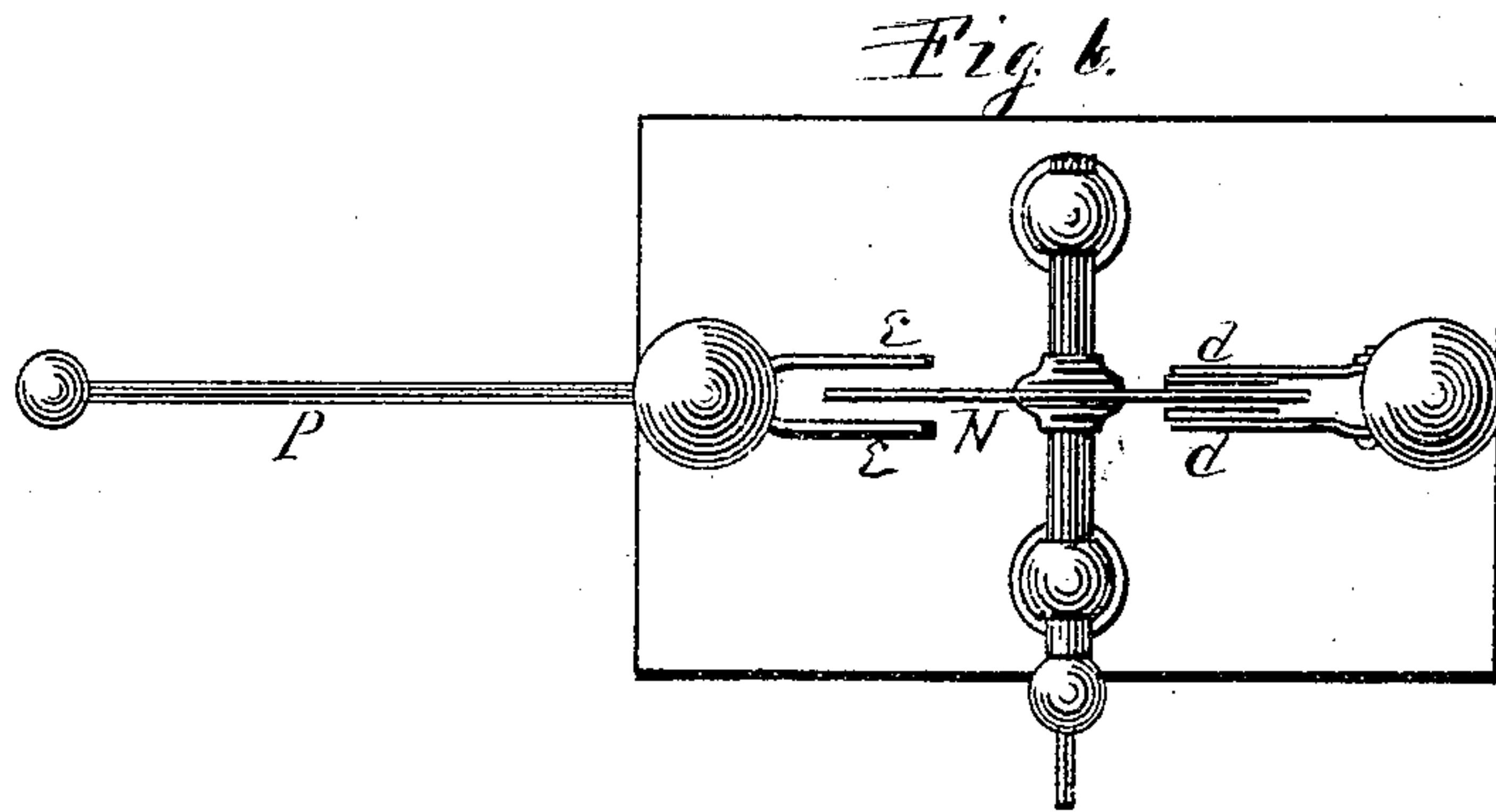
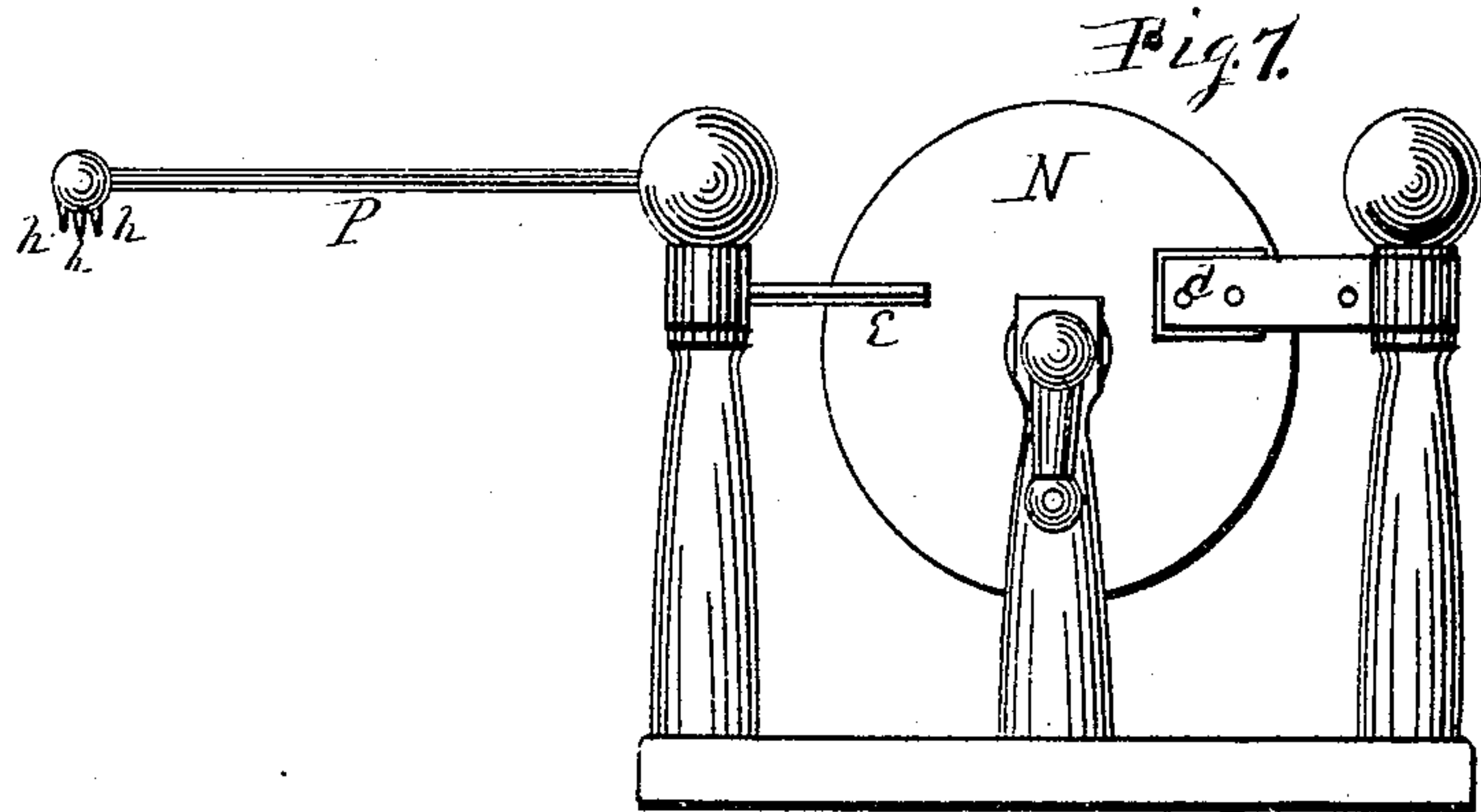


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# UNITED STATES PATENT OFFICE.

CHRISTIAN C. HILL, OF CHICAGO, AND ELIAS H. WHITED, OF ENGLEWOOD,  
ILLINOIS.

## SEPARATING AND COLLECTING METALS BY ELECTRICITY.

SPECIFICATION forming part of Letters Patent No. 245,299, dated August 9, 1881.

Application filed January 8, 1880.

*To all whom it may concern:*

Be it known that we, CHRISTIAN C. HILL, of Chicago, and ELIAS H. WHITED, of Englewood, all in the county of Cook and State of Illinois, have invented a new and useful Improvement in Separating Gold and other Metals from the Earths in which they are Contained, which improvements are fully set forth in the following specification.

10 The object of our invention is to separate metals from the earthy matter in which they are contained, and collect them, even when so finely divided that they cannot be practically collected by any hitherto-known methods, and  
15 that even these finely-divided particles of metal may be rapidly collected in the dry state, and thus dispense with the use of water. To accomplish this object we employ any suitable material, in plate or other suitable form, and  
20 apply to its surface a sufficient coating of mercury, or any other suitable amalgam of which mercury forms a component part, producing an amalgamated surface substantially such as is now employed in mining operations in collecting metals. These amalgamated surfaces  
25 we place in any suitable or convenient position, and connect with them in a suitable manner any source of frictional electricity, or any apparatus which, when in operation, will so disturb the existing equilibrium of electricity as  
30 to charge the amalgamated surfaces sufficiently to produce in them the well-known properties of attraction and repulsion. We then cause metal-bearing earth, suitably crushed or powdered, to pass within such a distance of the  
35 amalgamated and electrified surface that by virtue of the existing electrical attraction the powdered particles will impinge upon the amalgamated surface, and by virtue of the affinity  
40 existing between the amalgams and the metallic particles of the earth so treated they will be absorbed by the amalgam and held to the surface, and the earthy matter will be repelled and cast off by the electrical repulsion that sets  
45 in upon the contact of such particles with the amalgamated surface. The amalgam, when more or less saturated or loaded with metals collected, may be removed from the surface by scraping or otherwise and treated by any  
50 known process to separate the collected metal

or metals from the amalgam. This process may be repeated *ad libitum*.

It is not our purpose to confine ourselves to any specific mechanical device, combination, or arrangement of devices to effect our improved  
55 result, as these may be varied according to the demands of any particular case or locality without departing from the gist of this part of our invention, so long as moving electrified amalgams are employed to produce the separation  
60 by electrical attraction and repulsion.

In the accompanying drawings, Figure 1 represents an end elevation of one form of an apparatus capable of use as a separator in carrying out our improved process, of which Fig. 65  
2 is a vertical transverse section, showing the connection of the chute or shaker. Fig. 3 is a side elevation of the apparatus; Fig. 4, a lengthwise vertical central section; and at Fig. 5 we have represented a form of a carrier capable of use as a substitute for the vibrating chute  
70 or shaker. Fig. 6 is a plan view, Fig. 7 a side elevation, and Fig. 8 an end elevation, of a well-known form of a frictional electrical machine. 75

The main supporting-frame of our separator may be made of any suitable material in any practical form; but in this instance it consists of the vertical sides A, suitably separated, and are firmly held in such relative position by  
80 means of the cross-rounds B, suitably joined thereto, forming a rectangular open-box-like frame.

C represents a cylinder of suitable dimensions, composed of any suitable material, and  
85 is insulated from the shaft or bearings on which it is mounted to revolve in the box-like supporting-frame. The peripheral surface of this cylinder is composed of material adapted to receive a suitable coating of amalgam to produce an  
90 amalgamated surface substantially the same as surfaces employed in mining operations to collect the metallic particles, and is employed in this machine for like purposes, rendered more efficient by the aid of attraction and repulsion  
95 produced by a current of frictional electricity placed in connection therewith.

A chute or shaker composed of vertical sides D, corrugated bottom E, and end piece, F, of suitable material, properly joined to each other 100



to produce an open-box-like shaker of rectangular form in plan and of proper size, is placed in the supporting-frame immediately under the cylinder, slightly inclined, being lowest at its open end, near which it is supported in such a manner as to permit it to move lengthwise of the frame freely, and is supported near its closed end on an eccentric bearing, *a*, of the shaker-shaft *G* in such a manner that the rotary motion of the shaft will impart a reciprocating vibratory motion to the shaker. The outward projecting end of the shaker-shaft *G* is provided with a pulley, *H*, and the shaft of the cylinder *C* with a larger pulley, *I*. These pulleys are connected with a belt, *K*, through which the motion imparted to either shaft will be transmitted to the other, and when moved in the direction indicated by the arrow will impart such a movement to the shaker as to cause its contents to be carried from its closed end in an upward throwing manner under the revolving cylinder, to be discharged at its open end. This shaker is designed to receive the crushed or powdered metal-bearing earths, which are to be placed in the shaker near its closed end, to be carried by its shaking movement under the amalgamated and electrified cylinder, when the metallic particles will be separated and the refuse carried over its open end.

At *L* is represented a transverse shaft having its bearings in the supporting-frame, and is provided with a suitable ground-connection or its equivalent, and is armed with depending conducting-fingers *b*, the free ends of which curve under the cylinder in contact, or nearly in contact, with the powdered earths contained in the shaker. These fingers may be readily adjusted to any proper height by rotating the shaft in its bearings. This conductor provides for the distribution or equalization of the electricity carried from the cylinder by the repelled particles. This same object may be readily accomplished by providing the shaker with a suitable ground-connection.

At *M* is represented a transverse shaft supported in brackets rising from the main frame, and supports a suitable flexible rubber, *c*, under which the cylinder revolves, and is employed to detach from the cylinder earthy or foreign particles which may be mechanically held in contact with the cylinder.

In the several Figs. 6, 7, and 8 is represented one of the well-known forms of a frictional electrical machine, in which *N* represents the usual glass disk, mounted to revolve in the usual manner between the friction-pads *d*, placed one on each side of the disk.

*e* represents the prime conductor, the arm *P* of which is provided with suitable distributing-points, *h*, and is placed in electric contact with the cylinder supported on the bracket *R*, which rises from the supporting-frame.

By means of a suitable pulley placed upon the shaft of the glass disk and upon the shaft of the cylinder, and connected by a suitable belt, motion imparted to either the cylinder-

shaft, the shaker-shaft, or to the shaft of the glass disk would be transmitted to the others, and would put in operation the complete machine; or the several parts may be separately connected to the prime mover, or may be operated by hand.

From the foregoing it will be seen that with the combined machine in motion the electricity put in motion by the electrical machine will be conducted to the cylinder, which, when electrified, will possess the power of attraction and repulsion, and the prepared or powdered metallic bearing-earths contained in the shaker will be agitated within the sphere of its attraction and the particles will be attracted to the surface of the cylinder, and the metallic particles will be absorbed and held by the affinity existing between them and the amalgam, and the foreign substances will be repelled to distribute the electricity to the particles contained in the shaker, to be conducted to the earth through the conducting-fingers *b* and their connection with the earth. This process will be continued with the motion of the combined machines until the amalgam becomes saturated or loaded, when the machine may be stopped and the loaded amalgam removed from the cylinder and treated by any of the known methods to separate them. The cylinder may then be recoated and the process repeated at the pleasure of the user.

At *S* we have represented a different form of cylinder capable of use in carrying out our improved process, and under many circumstances may be found more desirable than the one hereinbefore described. It consists of a non-conducting core, *T*, provided with outward-projecting non-conducting lengthwise ribs *t*, between which are removably-placed segmental plates *u*, capable of being properly amalgamated. These, when loaded, may be removed and other amalgamated segments put in their place, and thus continue the process. In the employment of this form of cylinder it will only be necessary to electrify that portion of the cylinder which is in working contact with the prepared earth, which is readily accomplished by means of the conductor *w*, which may be put in connection with the electrical machine.

We do not herein claim, broadly, the method of separating substances by an electrified body irrespective of the construction and principle of operation of the apparatus employed; but we hereby reserve the right to file a separate application embracing broad claims to such process, should we, upon further research and investigation, become assured that such subject-matter was novel with us at the date of our invention.

We claim as our invention—

1. The process of separating and collecting metals, consisting, essentially, in subjecting metal-bearing earths to the action of an amalgamated surface charged with frictional electricity, substantially as set forth.



2. The process of separating and collecting metals, consisting in subjecting metal-bearing earths to the action of a moving amalgamated surface charged with frictional electricity, substantially as set forth.

3. A moving electrified and amalgamated surface employed in the process of separating and collecting metals, substantially as hereinbefore set forth.

4. The combination, with an amalgam, of an electrical machine or apparatus to electrify the amalgam to produce electrical attraction and repulsion employed in the separation and collection of metals, as hereinbefore set forth.

5. The combination, with an amalgamated surface, of an electrical machine or apparatus operating to electrify the surface to produce electrical attraction and repulsion, and employed in separating and collecting metals, substantially as hereinbefore set forth.

6. An amalgamated moving surface, in combination with an electrical machine or apparatus operating to electrify the moving surface to produce in it electrical attraction and repulsion, and employed in separating and collecting metals, substantially as hereinbefore set forth.

7. The combination, substantially as hereinbefore set forth of an electrical machine, a moving amalgamated surface, and a moving

carrier, operating substantially as and for the purpose hereinbefore set forth.

8. The herein-described combination of a revolving cylinder having an amalgamated peripheral surface, an electrical machine placed in electrical connection therewith, and a reciprocating vibratory shaker placed beneath the revolving cylinder, these several parts operating substantially as and for the purpose hereinbefore set forth.

9. The combination, with the herein-described revolving cylinder and the reciprocating vibratory shaker, of suitable conductors provided with a ground-connection or its equivalent, substantially as and for the purpose hereinbefore set forth.

10. The combination, with the herein-described revolving cylinder, of a flexible rubber, c, retained in contact with the cylinder under sufficient tension to remove earthy or foreign particles which may be mechanically held in contact with the cylinder, substantially as set forth.

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