

E. GATES.

APPARATUS FOR SEPARATING GOLD FROM MAGNETIC SANDS.

(Application filed Mar. 19, 1900.)

(No Model.)

2 Sheets—Sheet 1.

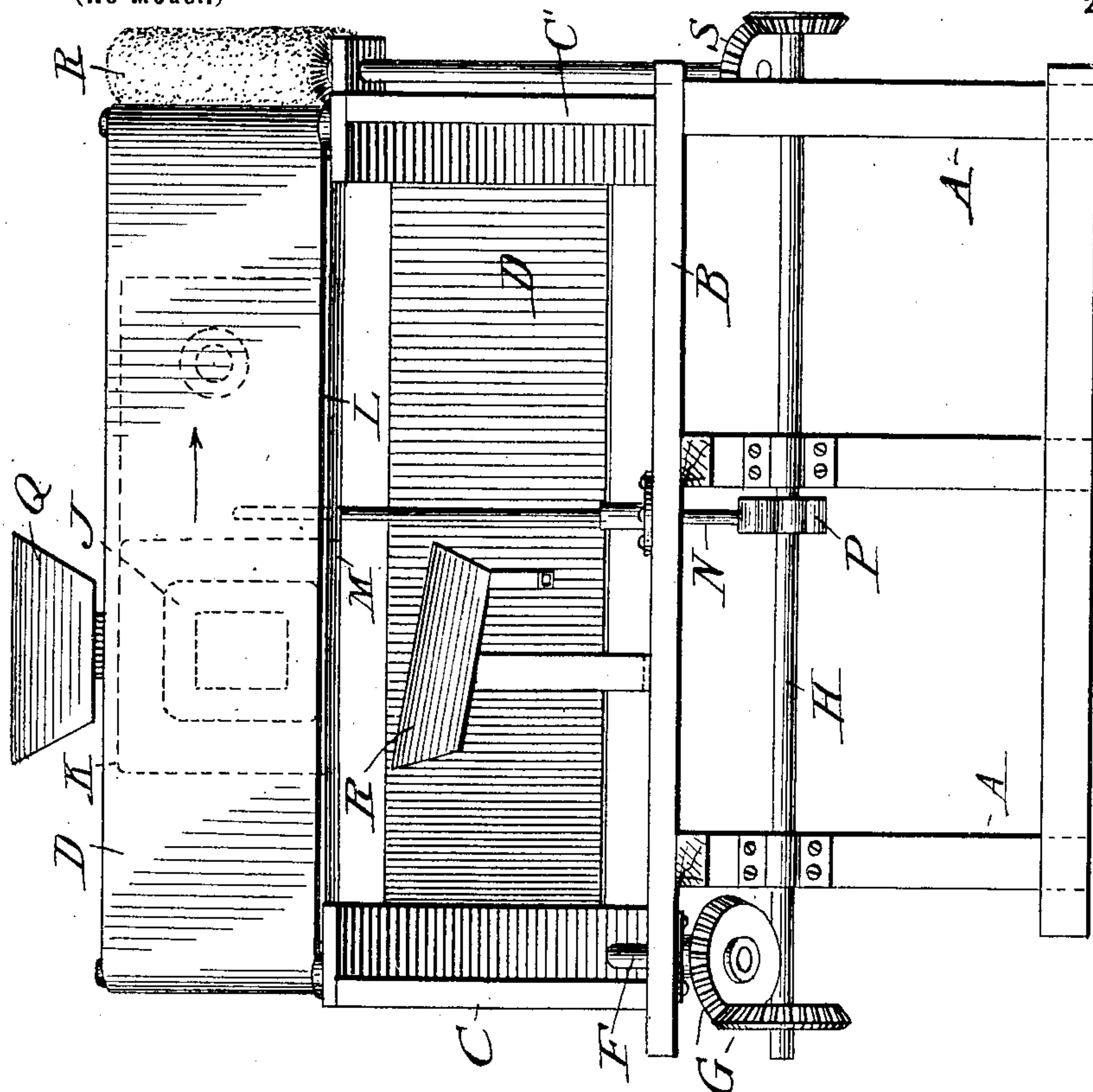


Fig. 2.

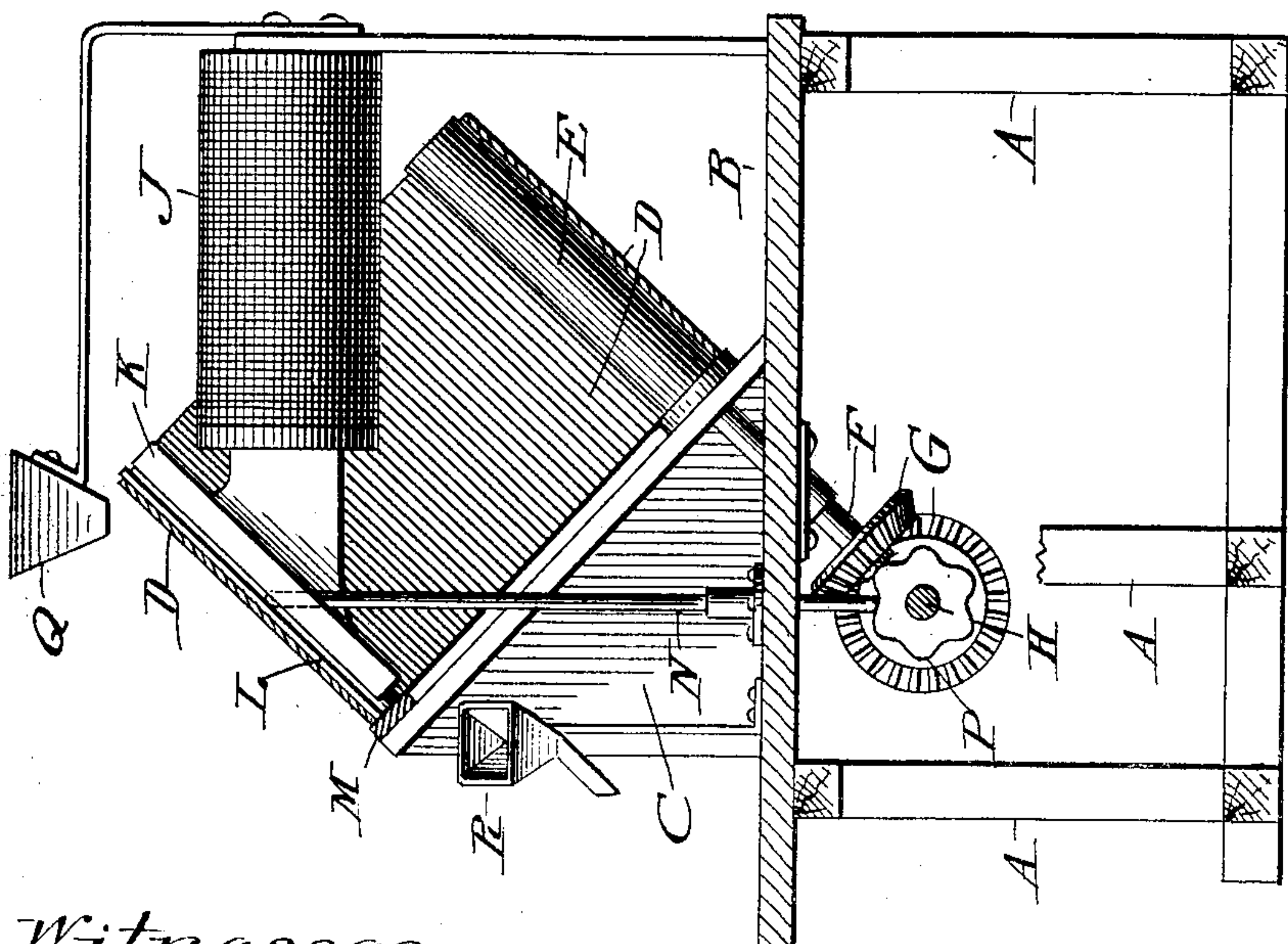


Fig. 1.

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by Lemuel Goldborough,  
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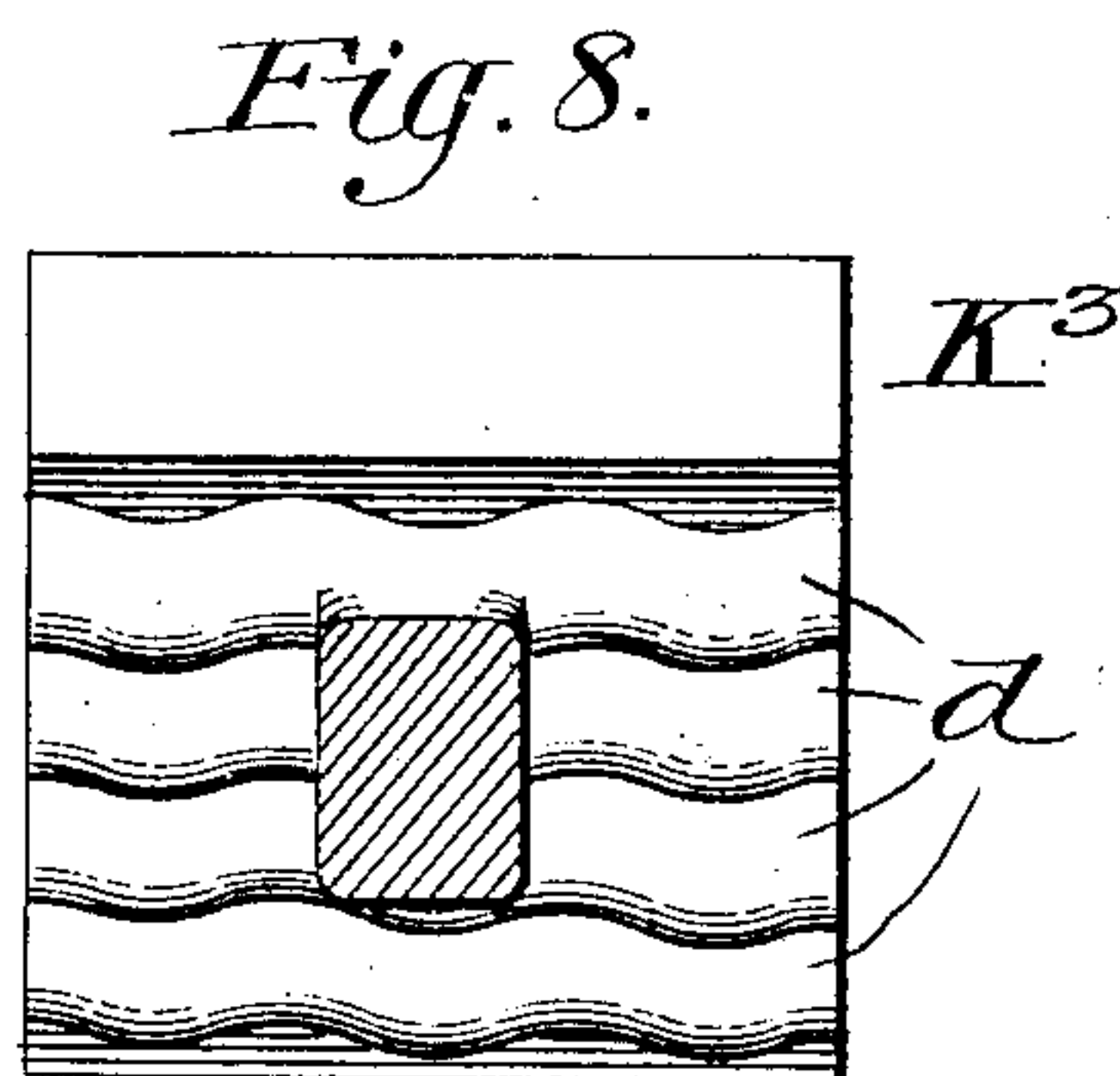
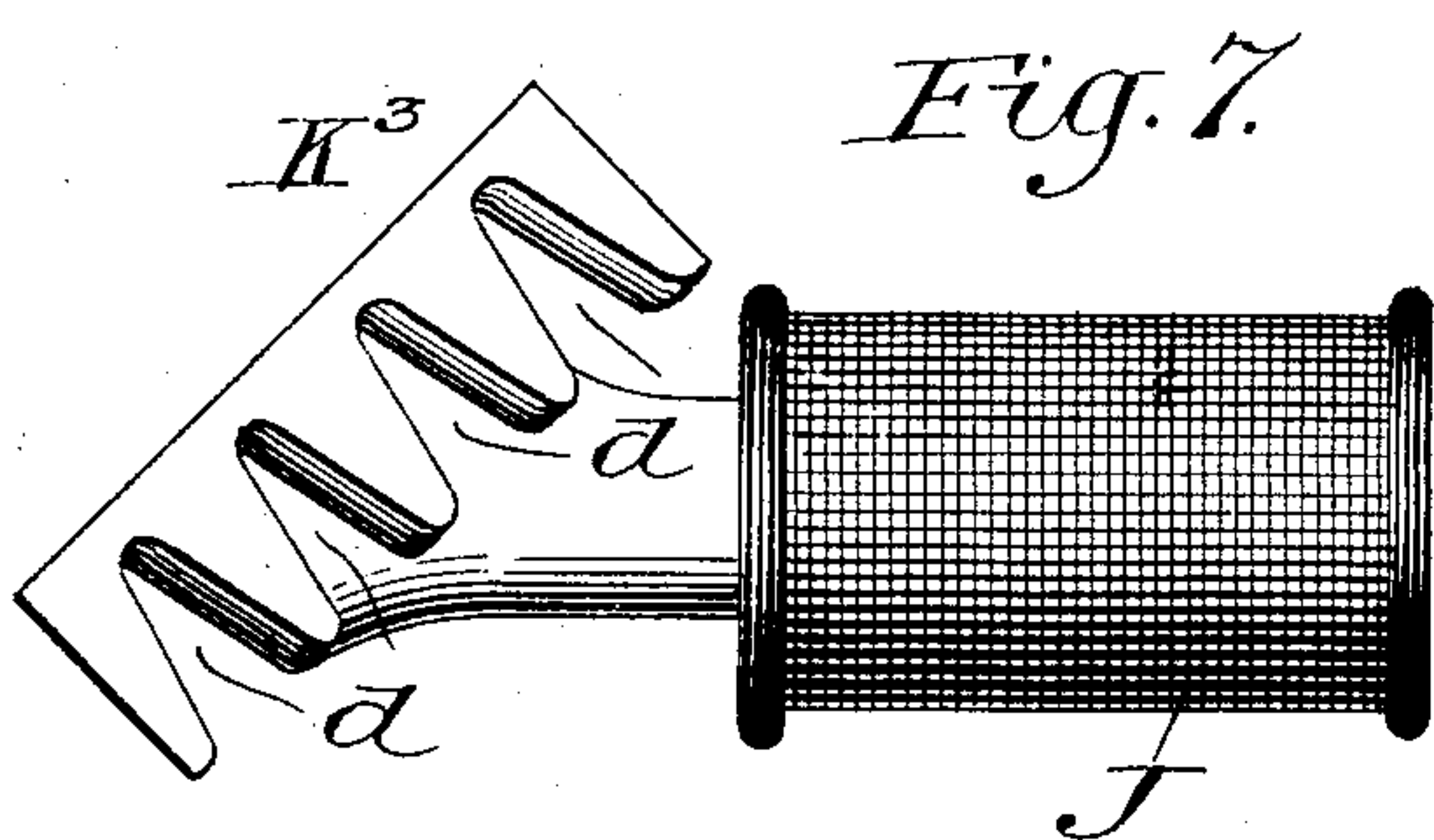
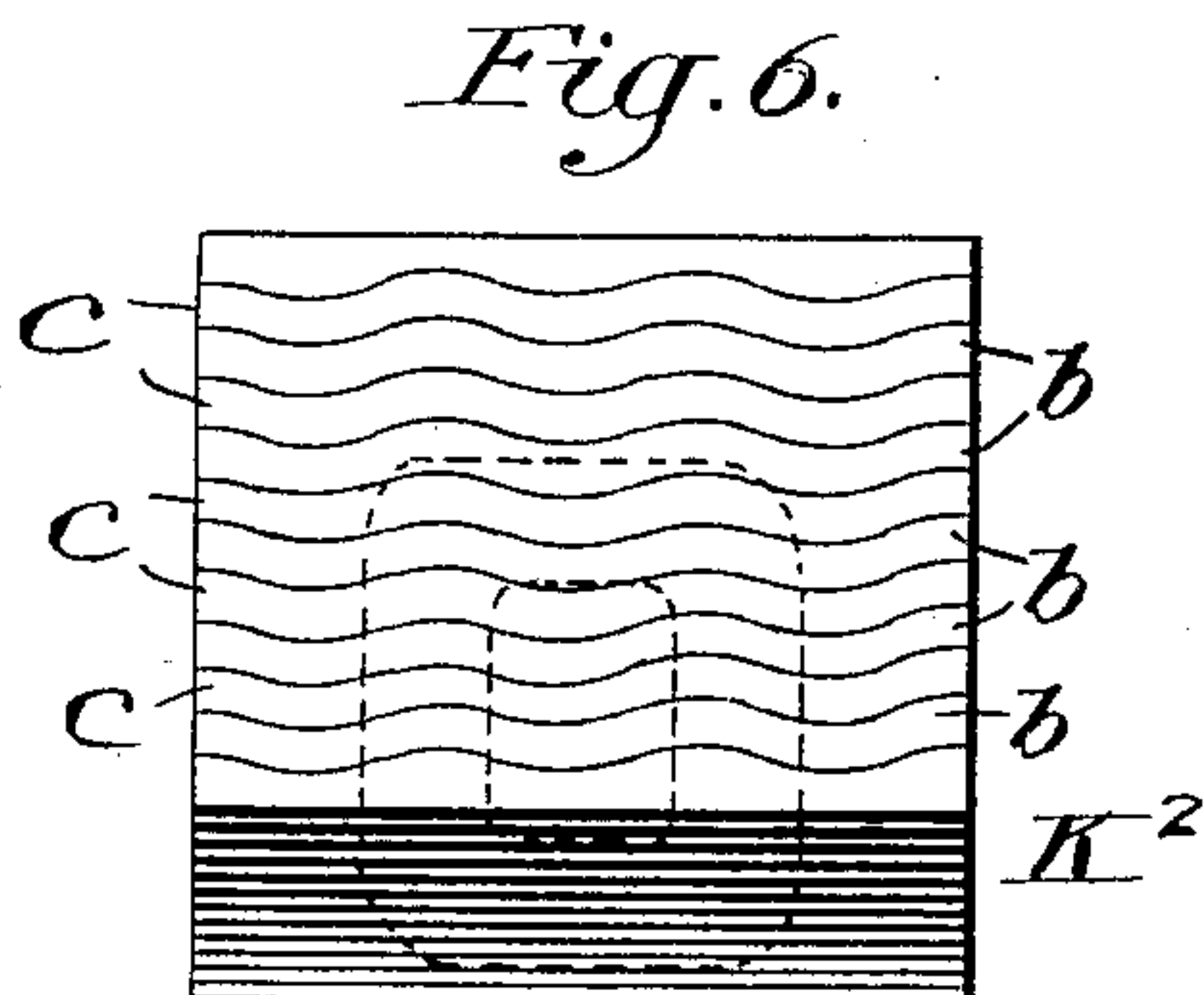
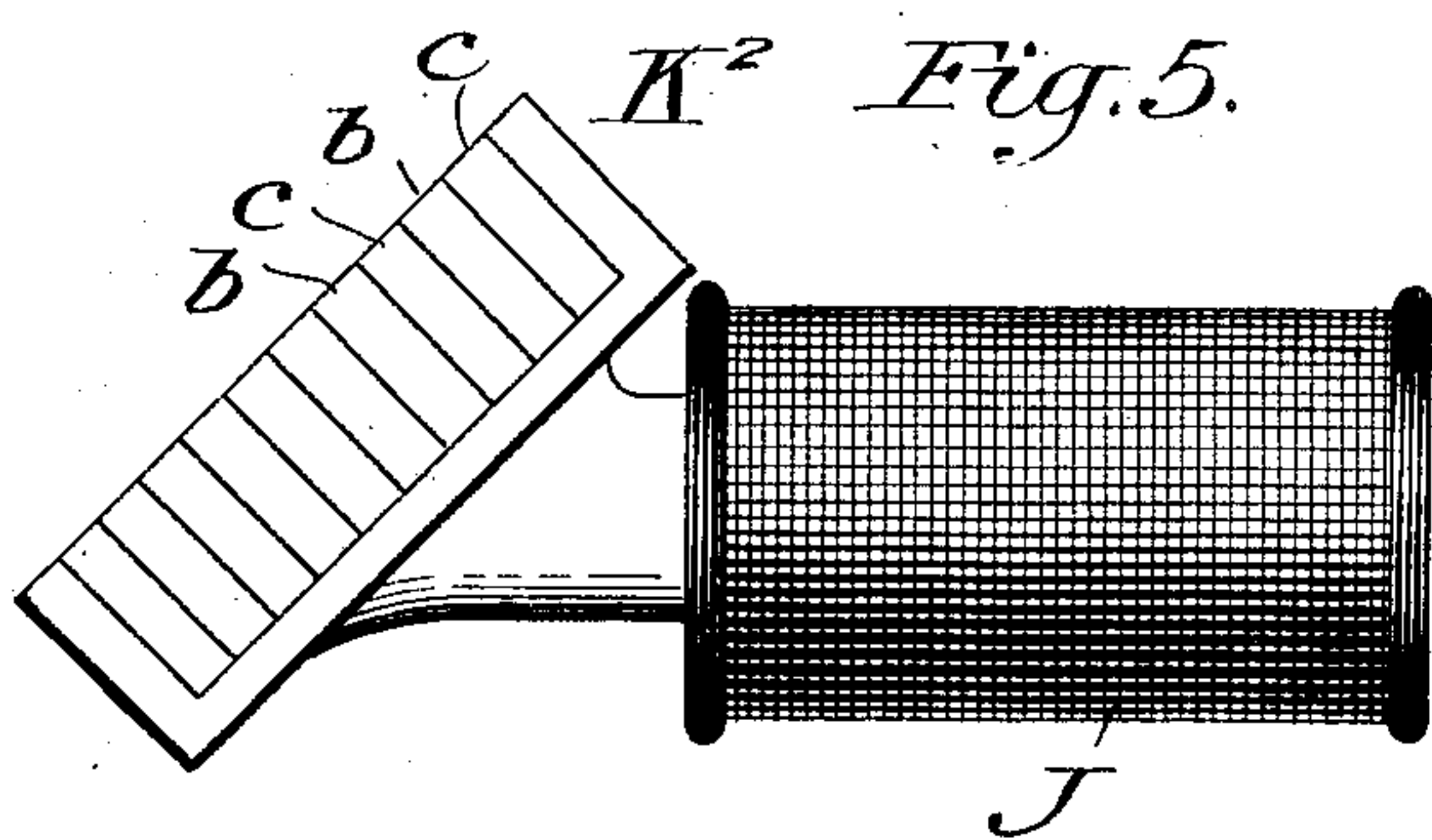
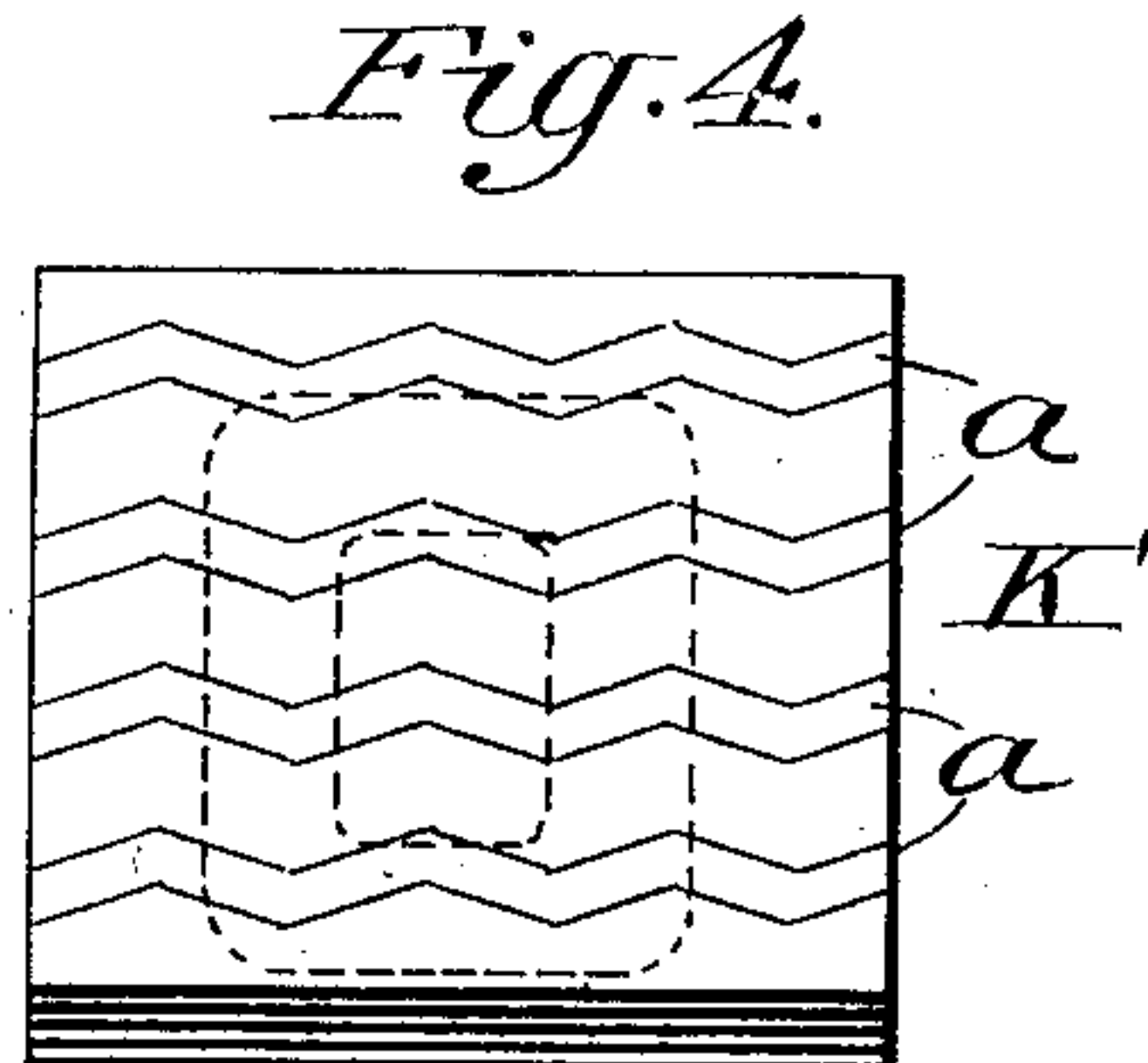
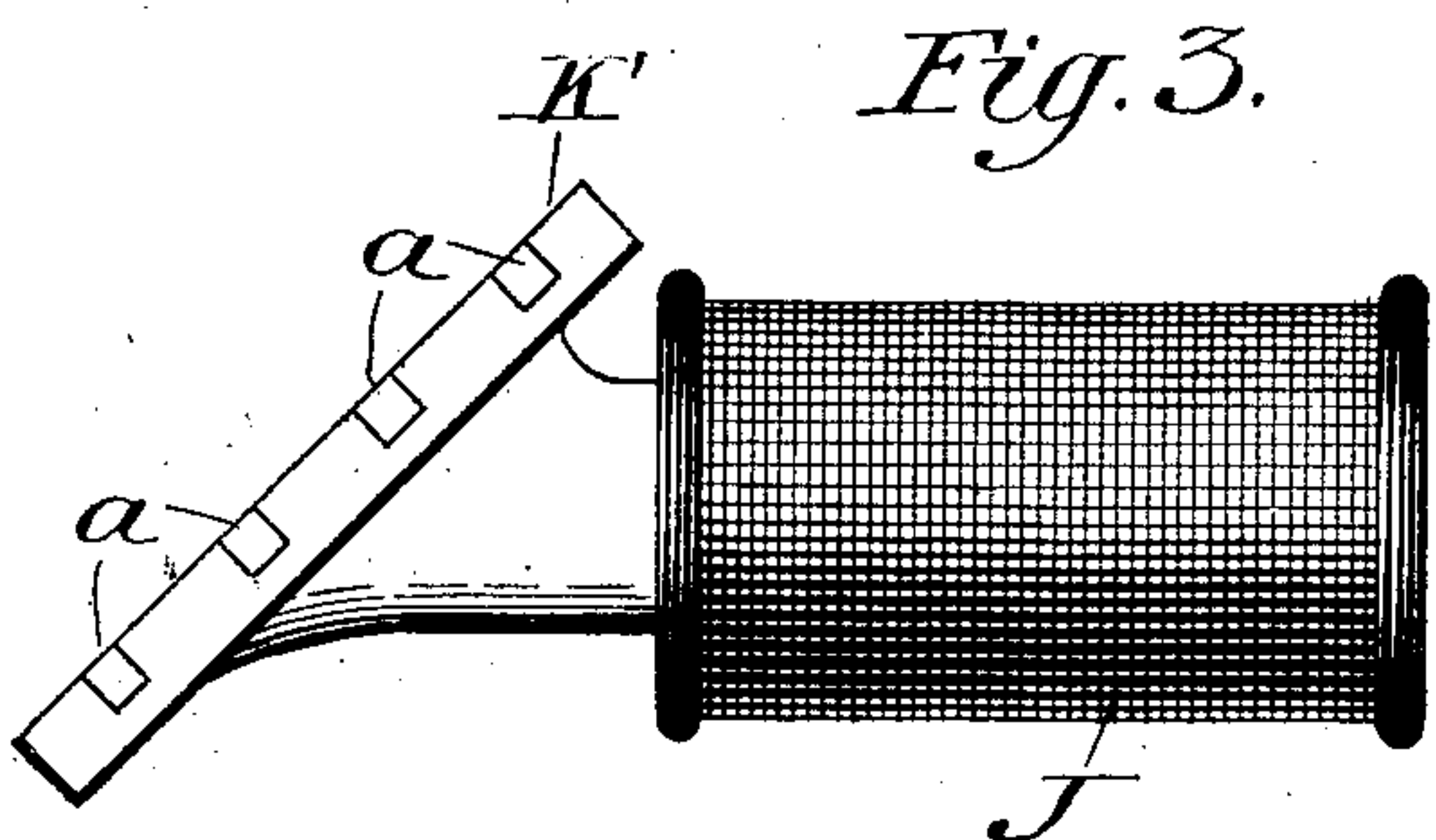
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2 Sheets—Sheet 2.



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# UNITED STATES PATENT OFFICE.

ELMER GATES, OF CHEVY CHASE, MARYLAND, ASSIGNOR TO THEODORE J. MAYER, OF WASHINGTON, DISTRICT OF COLUMBIA.

## APPARATUS FOR SEPARATING GOLD FROM MAGNETIC SANDS.

SPECIFICATION forming part of Letters Patent No. 662,409, dated November 27, 1900.

Application filed March 19, 1900. Serial No. 9,269. (No model.)

*To all whom it may concern:*

Be it known that I, ELMER GATES, a citizen of the United States, residing at Chevy Chase, county of Montgomery, State of Maryland, have invented certain new and useful Improvements in Apparatus for Separating Gold from Magnetic Sands; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

In a companion application of even date herewith, Serial No. 9,268, I have illustrated and described an apparatus for the separation of gold from magnetic sands, said apparatus involving the characteristic feature of arresting the magnetic sand upon an inclined screen of diamagnetic material by means of a magnet energized sufficiently to cause said sand to assume a frond-like structure and imparting a series of rapid but slight vibrations to the inclined surfaces, said vibrations being of such a character as to cause a continuous rearrangement and re-formation of the arrested magnetic sand, thereby liberating the gold particles entangled with it and permitting them to escape down the incline into a receiving-hopper.

The present invention relates to a modified form of apparatus for obtaining the same result.

In the accompanying drawings, Figure 1 represents a vertical sectional view, partly in elevation, of an apparatus embodying my invention. Fig. 2 represents a front elevation thereof. Figs. 3 and 4 represent side and front elevations, respectively, of a modified form of magnetic pole-piece, together with its energizing-coil. Figs. 5 and 6 represent like views of a further modification. Figs. 7 and 8 represent a side elevation and a sectional view, respectively, of a still further modification.

Similar letters of reference indicate similar parts in all the views.

Referring to the drawings, A indicates the standards upon which the general framework of the apparatus is mounted. B represents a horizontal platform or table of said framework, sustaining the triangular supports C C', upon which are mounted the

drums or rollers of an endless apron D, of cotton cloth, oil-cloth, or other suitable fabric. One of such rollers, as E, serves as a driving-roller for the endless apron and is mounted upon a drive-shaft F, driven by miter-gears G from the power-shaft H.

An electromagnet J, suitably energized from any convenient source of electric energy, is provided with a core having a flat pole-piece K inclined, as shown in Fig. 1, and extending in close proximity to the under side of the endless apron D, but separated therefrom, if preferred, by an intervening plate L of brass or wrought-iron. The plate L rests loosely at its lower edge upon a ledge M and is adapted to receive a rapid series of slight vibrations through the instrumentality of a rod N, which is given a vertical reciprocating movement by the cam P on the power-shaft H.

Q represents a feed-hopper for the magnetic sand, and R represents a receiving-hopper for the gold.

R' indicates a brush for removing the impalpable powder which might otherwise adhere to the apron, said brush being driven from the main shaft by the gears S, as shown.

The operation of the apparatus is as follows: The power-shaft being set in motion from any convenient source of power causes a slow travel of the endless diamagnetic apron D and also causes the plate L to slightly rise and fall, thereby imparting to the surface of the endless apron above it a series of rapid but slight vibrations. The magnetic sand containing the particles of gold to be separated is fed continuously from the hopper Q upon the endless apron and is immediately arrested in its descent by the attractive influence of the magnet-pole exercised through the plate L and endless apron. The rapid jiggling motion imparted to the plate L, and consequently to the apron D, I find occasions a continuous rearrangement and re-formation of the frond-like aggregations in which the magnetic sands originally arrange themselves upon the endless apron and that this rearrangement and re-formation is sufficient to permit the particles of gold to escape from their entanglement with the magnetic sand and to fall down the incline into the receiving-hopper R. The magnetic sand, deprived



of its particles of gold, moves laterally out of the magnetic field, which grows weaker and weaker toward the end of the plate L. As soon as it is fully out of the attractive influence of the magnetic field it falls from the incline and may be gathered in any suitable receptacle or place of collection.

In practicing the invention care must be taken to so graduate the attractive power of the magnet that it will not be so excessive as to cause the magnetic sand to build up in amorphous masses nor to prevent the endless apron D from carrying it out of the magnetic field, and the vibrations imparted to the endless apron must not be so abrupt or severe as to detach the magnetic particles from the apron as against the attractive influence of the magnet. It is of course evident that should any magnetic particles be entrained with the gold in its descent into the hopper R the gold may be thereafter disembarrassed of such magnetic particles by passing the contents of the hopper R over another apparatus of the same kind.

It is evident that the plate L may, if desired, be made integral with the magnet-core, in which event the entire core would be jostled or jiggled by the action of the cam, the core having a sufficiently loose fit within the bobbin to permit the slight movement necessary.

On Sheet 2 of the drawings I have illustrated preferred forms of the pole-piece, having as their distinguishing characteristic the fact that they establish wavy or zigzag fields of force across the polar face, with the resultant effect that the material during its travel on the belt is caused to move up and down in a series of wavy oscillations, thereby constantly altering their formation and further disengaging and disentangling the gold particles. In the form shown in Figs. 3 and 4 the pole-piece K' is provided with a series of zigzag grooves, diminishing the intensity of the lines of force opposite said grooves to a degree insufficient to arrest the magnetic sand, but permitting it to be arrested and formed in the frond-like structures desired along the corresponding wavy or zigzag intermediate or proximate portions of the polar face. The grooves referred to may be filled in with brass or other diamagnetic material, if it is desired to give the polar face a smooth surface. In the figures referred to the grooves, with their fillings, are indicated by the letter *a*. In the form shown in Figs. 5 and 6 the same result is obtained by coring out the pole-piece M<sup>2</sup> and filling in the gap with alternate zigzag plates *b* and *c*, one of which is of magnetic and the other of which is of diamagnetic material. In the form shown in Figs. 7 and 8 the same result is obtained by providing the pole-piece K<sup>3</sup> with a number of wavy or zigzag grooves *d* on its rear face. It will of course be understood the several forms of pole-pieces shown on Sheet 2 may be employed in the general structure

either with or without the plate L and whether said plate is integral with them or constitutes a separate element.

Having thus described my invention, what I claim is—

1. Apparatus for separating gold from magnetic sand, comprising a magnet having a pole-piece whose field of force is of a wavy or zigzag contour, means for energizing said magnet just sufficiently to cause the sand to lose its otherwise amorphous arrangement and to assume the arrangement of frond-like structures, an apron extending across the magnetic field and over which the material is fed, and means for causing said apron to travel in a direction transverse to the feed of the material thereon; substantially as set forth.

2. Apparatus for separating gold from magnetic sand, comprising a magnet having a pole-piece provided with wavy or zigzag grooves, means for energizing said magnet just sufficiently to cause the sand to lose its otherwise amorphous arrangement and to assume the arrangement of frond-like structure, an apron extending across the magnetic field, and means for causing said apron to travel across the field in a direction transverse to the feed of the material thereon; substantially as set forth.

3. Apparatus for separating gold from magnetic sand, comprising a magnet having a pole-piece provided with wavy or zigzag grooves containing a filling of diamagnetic material, means for energizing said magnet just sufficiently to cause the sand to lose its otherwise amorphous arrangement and to assume the arrangement of frond-like structure, an apron extending across the magnetic field and over which the material is fed, and means for causing said apron to travel in a direction transverse to the feed of the material thereon; substantially as set forth.

4. Apparatus for separating gold from magnetic sand, comprising a magnet having a pole-piece provided with wavy or zigzag grooves containing a filling of diamagnetic material, means for energizing said magnet just sufficiently to cause the sand to lose its otherwise amorphous arrangement and to assume the arrangement of frond-like structures, an apron extending across the magnetic field and over which the material is fed, and means for causing said apron to travel in a direction transverse to the feed of the material thereon, and means for imparting a succession of slight vibrations to said apron, substantially as set forth.

5. Apparatus for separating gold from magnetic sand, comprising a magnet having a pole-piece provided with wavy or zigzag grooves containing a filling of diamagnetic material, means for energizing said magnet just sufficiently to cause the sand to lose its otherwise amorphous arrangement and to assume the arrangement of frond-like structures, an apron extending across the mag-



netic field and over which the material is fed, and means for causing said apron to travel in a direction transverse to the feed of the material, and means for imparting a succession  
5 of slight vibrations to said apron, said means consisting of a plate underlying the apron and a rod and cam for jiggling the plate, substantially as set forth.

6. Apparatus for separating gold from magnetic sand, comprising a magnet having a pole-piece provided with wavy or zigzag grooves containing a filling of diamagnetic material, means for energizing said magnet just sufficiently to cause the sand to lose its  
10 otherwise amorphous arrangement and to assume the arrangement of frond-like struc-

tures, an apron extending across the magnetic field and over which the material is fed, and means for causing said apron to travel in a direction transverse to the feed of the material thereon, and means for imparting a succession of slight vibrations to said apron, said means consisting of a plate of magnetic material interposed between the pole of the magnet and the apron, and a jiggling device  
20 for said plate, substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

ELMER GATES.

Witnesses:

JOHN C. PENNIE,  
A. E. GRANT.