No. 687,053. Patented Nov. 19, 1901.

R. McKNIGHT.

MAGNETIC SEPARATOR.

(Application filed Feb. 4, 1901.)

(No Model.) 2 Sheets—Sheet 1.

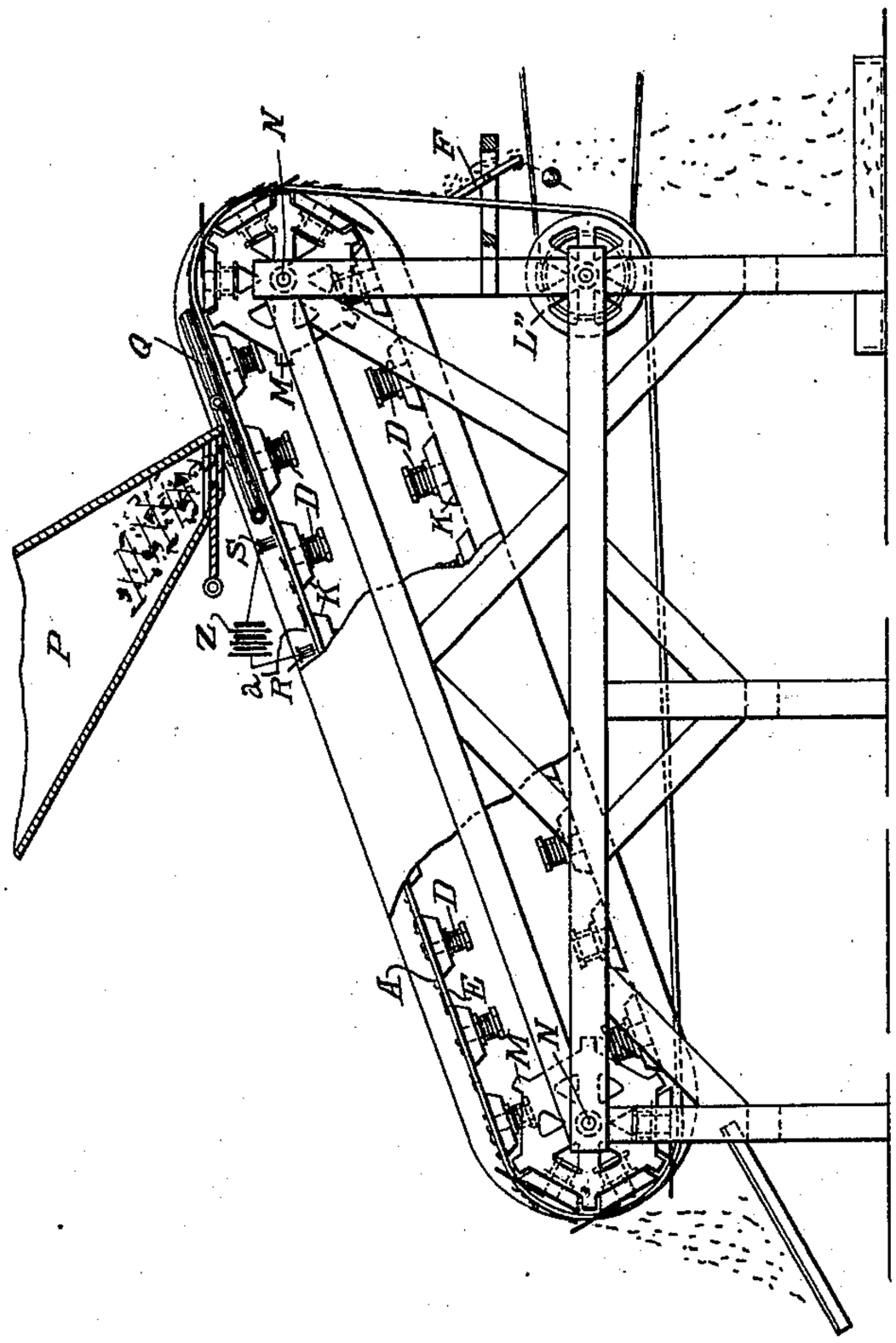

Fig. 1

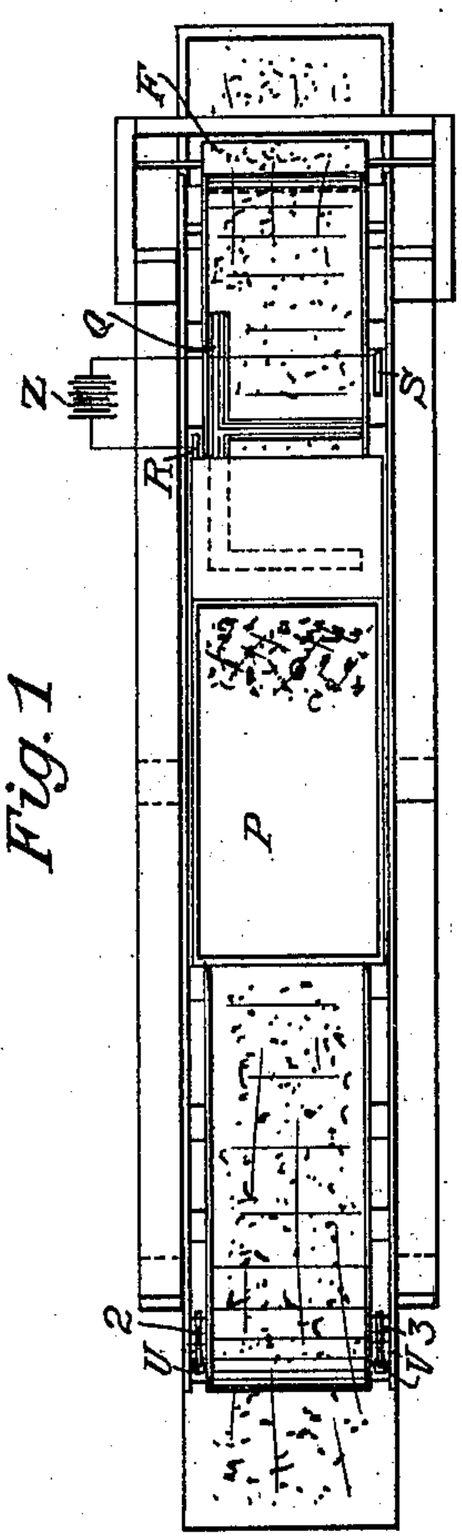

Fig. 2

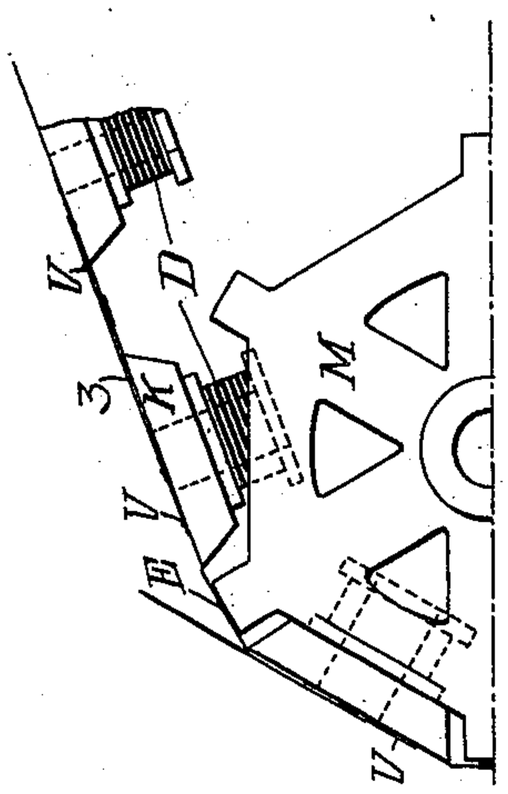

Fig. 3

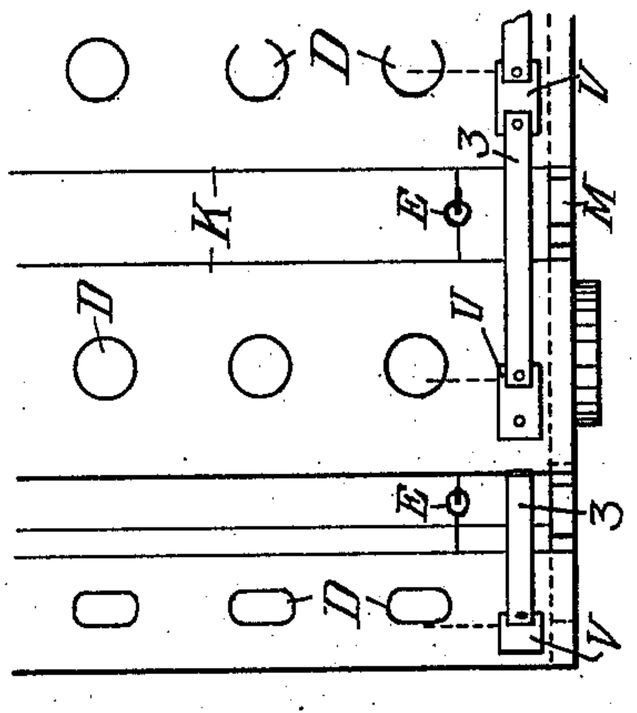

Fig. 4

WITNESSES
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M. Willes

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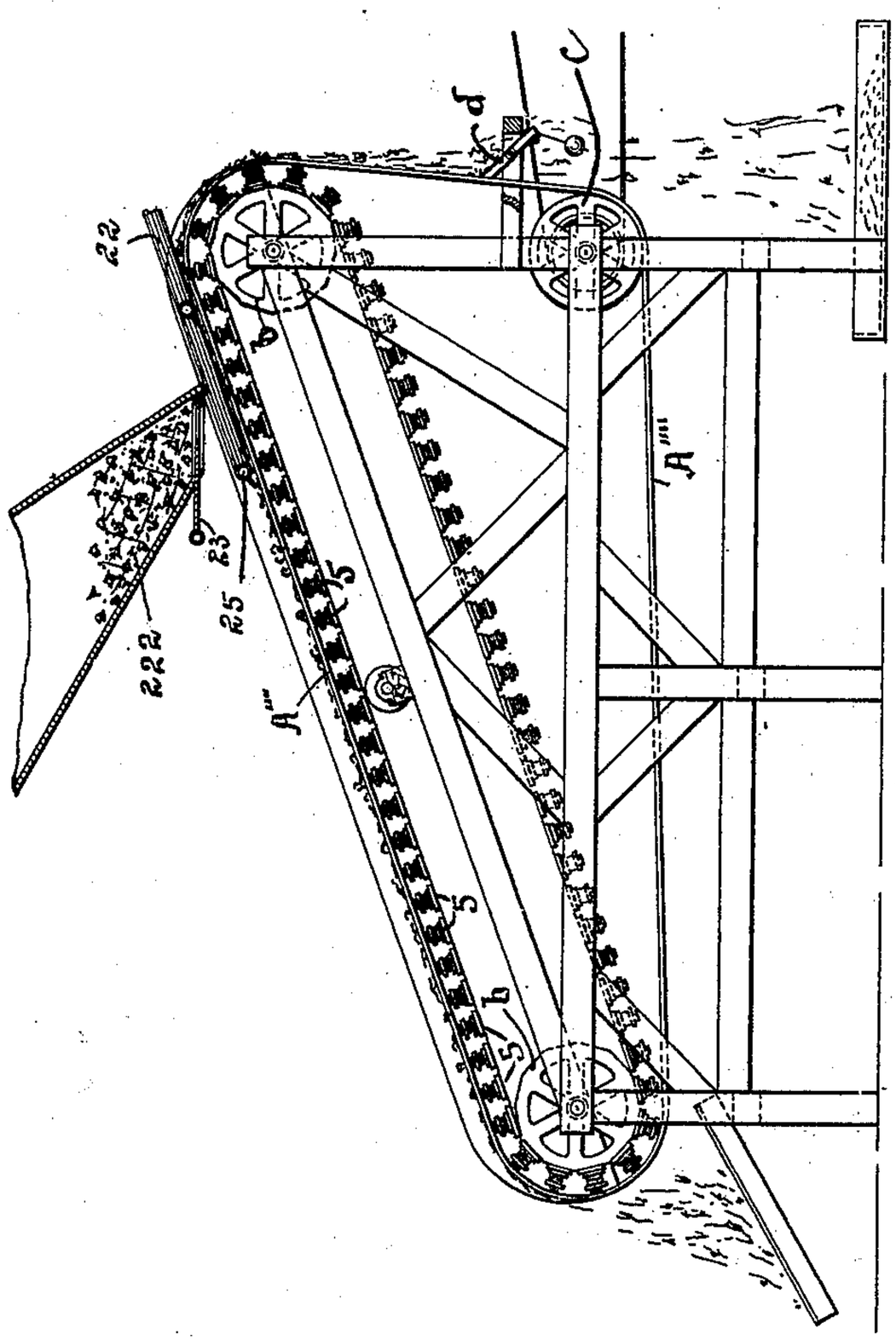

Fig. 5

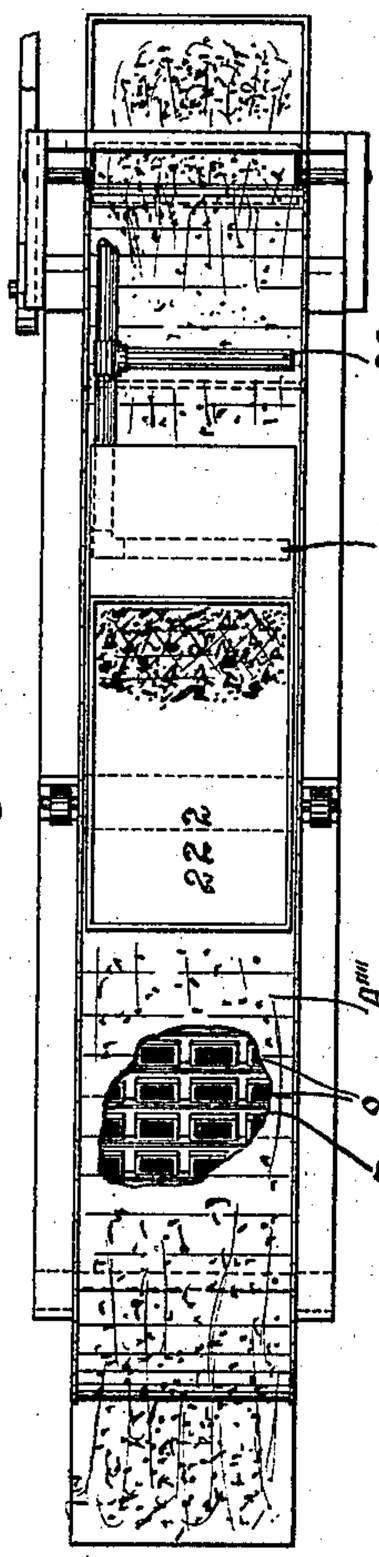

Fig. 6

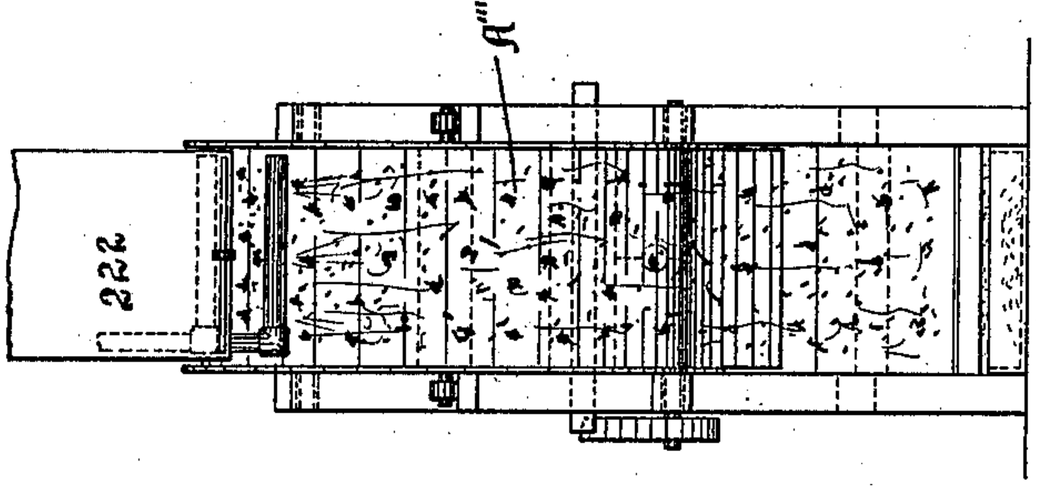

Fig. 7

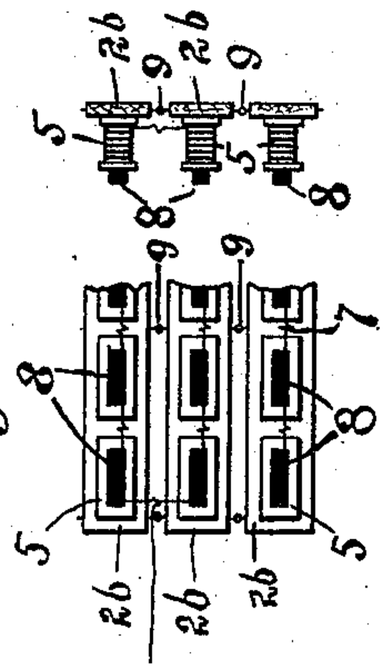

Fig. 8

Fig. 9

WITNESSES
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UNITED STATES PATENT OFFICE.

ROBERT McKNIGHT, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO METALLIC CONDENSE COMPANY, A CORPORATION OF DELAWARE.

MAGNETIC SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 687,053, dated November 19, 1901.

Application filed February 4, 1901. Serial No. 45,924. (No model.)

To all whom it may concern:

Be it known that I, ROBERT MCKNIGHT, a citizen of the United States, and a resident of the city and county of Philadelphia and State of Pennsylvania, have invented a new and useful Improvement in Magnetic Separators, of which the following is a full, clear, and sufficient specification, reference being had to the drawings annexed.

Magnetic separators in which the ore flows down an incline of considerable extent over a belt which passes in front of a number of stationary magnets are subject to the objection, among others, that the particles of ore that cling to the belt and are carried upward by it move through varying fields of force, and, if the belt is composed of a sheet of magnetic material or contains large sections of magnetic material, changes of polarity in this material will disturb the attraction of the magnetic particles to the belt and tend to dislodge them from it. Besides this objection there is the very serious one that where the belt is metallic the difficulty of moving it in front of the magnet and even the difficulty of moving a canvas belt covered with magnetic particles in front of a magnet is considerable. My invented device, by making the belt or apron on which the ore flows and on which the magnetic particles are collected move together, obviates all these and many other objections that will appear clearly to a skilled mechanic from the following portion of my specification.

Figure 1 is a side elevation of my invented device, portions of the casing being broken away. Fig. 2 is a plan view of the same. Fig. 3 is a detail of the mechanism for turning the magnet-carrying belt. Fig. 4 is a plan view of Fig. 3. Fig. 5 is a side elevation of a modification of which Fig. 6 is a plan view. Fig. 7 is a view of the right-hand end of the parts shown in Fig. 5, and Fig. 8 is an enlarged view in elevation of the magnets, and Fig. 9 a side view of the parts shown in Fig. 8.

The traveling belt or apron A is arranged with the long inclined portion *a*, where the belt is made to travel upward. Behind this inclined portion of the belt are placed the upwardly-traveling magnets D D D D. These magnets can be arranged in any desired manner, and, as stated above, they can present different polarities toward the belt A, if desired. This arrangement is practical in the case of the magnets traveling with the belt, because the magnetic particle, having once attached itself to the belt, would not be disturbed by a coming in front of a magnet of a different polarity.

The magnets D D D D can be arranged in various manners, and various means can be used for making them travel as desired. I have found the one I will now describe very convenient and practical. I mount a row of magnets D D D upon a slat running crosswise of the traveling belt A and form a series of these slats into a belt by means of the flexible connections E E between the slats K K K. The slats K K and the magnets D D, forming the magnet-carrying belt, are supported by the sprocket-wheels M M, which are mounted upon the shafts N N, and when the magnets D D are electromagnets they can be arranged so that the energizing-currents will pass through them only when opposite the inclined upwardly-moving portion of the belt A. A convenient way of doing this is as follows: The magnets have the wires of their coils electrically connected with a pair of terminals U V, secured to the slat K, and are provided with the contact-pieces 2 and 3, respectively. These contact-pieces rest upon the terminals of the slat next to the one to which they are attached when the slats lie extended in a straight line and separate from them when the slats pass around the sprockets and break the circuit. The brush R, in connection with one pole of a source of electrical energy Z, and the brush S, in connection with the other pole, connect electrically with the terminals U and V, respectively. The apron A after it has passed beyond the highest point of its incline moves away from the magnetic belt. This can be accomplished by passing it over the roller L″, which is set at a distance from the belt A, carrying the magnets, and consequently causes the belt A to travel away from the magnets after both of these belts have moved to the highest point of their travel. If this belt A is of a material that will be magnetized by the magnets, such as sheet-iron, a brush, as F, is pro-

vided to remove the particles from it. If it it is composed of canvas or other non-magnetic material, this may not be needed. A hopper P is placed above the belt near the top of the incline, and a water or air jet may also be provided, if needful. I have designated a pipe that may be used to carry the water or air by Q on Fig. 1 of the drawings. After the ore has been placed upon the belt it will roll down the incline *a*, and the magnetic or magnetizable materials will be collected upon the same and held to it and be moved upward upon it. As the belt and the magnets move upward together, there will be no change of strength of field or of polarity, and the particles will be less likely to be dislodged than by the operation of any other kind of belt. After the belt has reached its highest point the two belts will separate and the magnetic or magnetized particles will drop off of it or be removed by the brush F.

In the modification shown in Figs. 5, 6, 7, and 8 the magnets 5 5 5 5, the cores 8 8 8 of which may be permanent, are arranged upon the slats 26 26, which are connected together by the flexible connections 9 9 9 and electrically connected together, in case they are wound with wire, by the electrical connections 27. The belt A'''' is run over these magnets and around the pulleys *b*, *b*, and *c*, and the brush *d* is used to scrape off the material clinging to the belt A'''', if necessary. Above the belt A'''' is the hopper 222, provided with the gate 23. The magnet-belt is supported by the pulleys *b b*. 22 and 25 are pipes for the water and air jets. The operation of this form of my invented device is obvious from an inspection of its drawings after the description given of the preferred form.

Having now described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The combination with an upwardly-traveling belt having a straight inclined surface of considerable extent, of a series of magnets situated behind said inclined portion of said belt and traveling upward with the same, and means for feeding the material to be separated near the top of the inclined surface, and mechanism for separating said belt from said magnets after the belt has attained the top of the incline, substantially as described.

2. The combination with an upwardly-traveling belt, having a straight inclined surface of considerable extent, of a series of magnets situated behind said inclined portion of said belt, and having poles of different polarity presented toward said belt and traveling upward with the said belt, and means for feeding the material to be separated near the top of the inclined surface, and mechanism for separating said belt from the magnets after the belt has attained the top of the incline; substantially as described.

3. The combination with an upwardly-traveling belt having a straight inclined surface of considerable extent, of a series of magnets situated behind said inclined portion of said belt and traveling upward with the same and means for feeding the material to be separated near the top of the inclined surface, and a pulley around which the said belt passes placed at a distance from said magnets, substantially as described.

4. The combination with an upwardly-traveling belt having a straight inclined surface of considerable extent, of a magnet-carrying belt lying within the circuit of the said traveling belt, mechanism for making the two belts move simultaneously upward substantially parallel to each other, and means for feeding the material to be separated near the top of the inclined surface, and mechanism for separating the two belts from each other after they had reached their highest point of travel; substantially as described.

5. The combination with an upwardly-traveling belt, of a series of magnets, placed upon slats running crosswise of said belt, connections between said slats forming them into a magnet-carrying belt and mechanism for separating said belts after they have reached the top of the incline substantially as described.

6. The combination with an upwardly-moving belt of a series of slats, each bearing electromagnets, electrically connected to terminals upon said magnets and slats and a series of contact-pieces extending from one of the slats to the other and contacting with the slat next to the one to which they are secured when the slats lie in a substantially straight line with each other and breaking contact when the slats lie out of straight line with each other; substantially as described.

In witness whereof I have hereunto set my hand this 31st day of January, 1901.

ROBERT McKNIGHT.

Witnesses:
M. W. COLLET,
M. WILKS.