R. I. WRIGHT & H. E. FROST.

MAGNETIC SEPARATOR.

APPLICATION FILED MAY 10, 1907.

901,765. Patented Oct. 20, 1908.

Fig. 1.

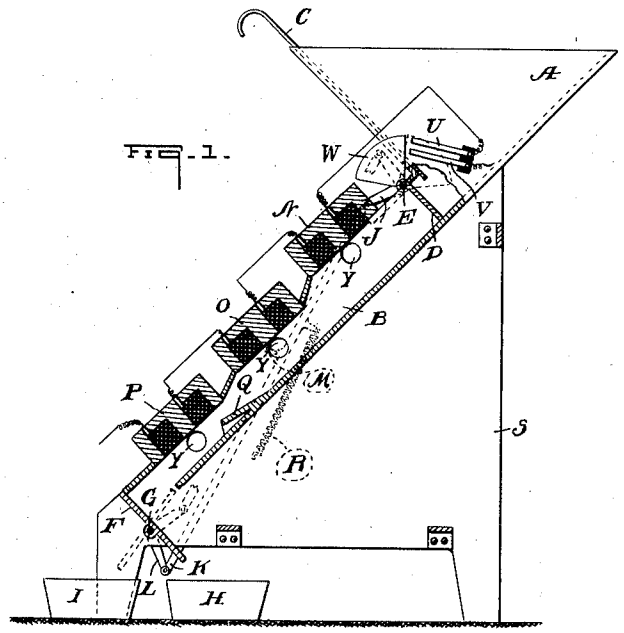


Fig. 2.

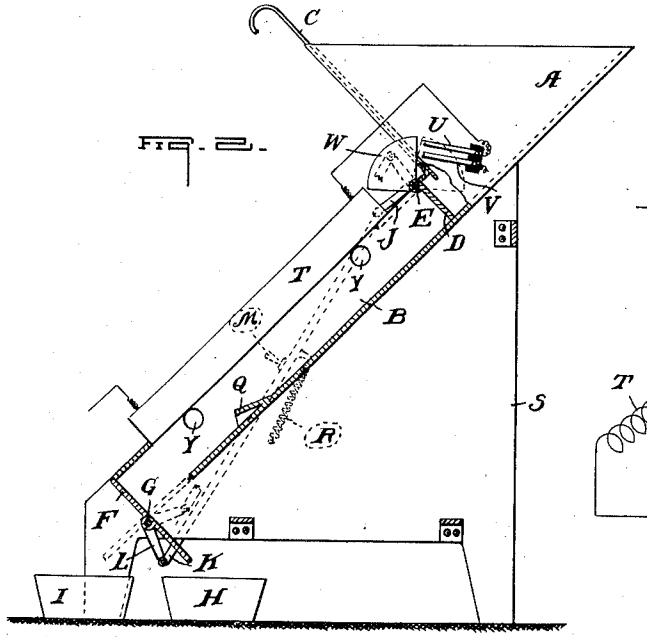
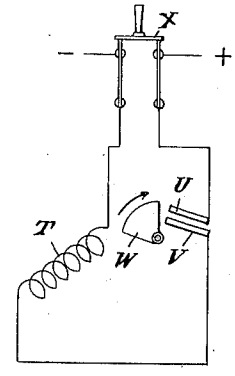


Fig. 3.



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UNITED STATES PATENT OFFICE.

REUBEN I. WRIGHT AND HOMER E. FROST, OF CLEVELAND, OHIO, ASSIGNORS TO THE ELECTRIC CONTROLLER & SUPPLY COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF OHIO.

MAGNETIC SEPARATOR.

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To all whom it may concern:

Be it known that we, REUBEN I. WRIGHT and HOMER E. FROST, citizens of the United States, both residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented or discovered new and useful Improvements in Magnetic Separators, of which the following is a specification.

Heretofore, many magnetic separators have contained mechanically driven feed-rolls, mechanically driven magnets, or traveling belts. Such magnetic separators have had complicated constructions and required both mechanical and electrical power for their operation.

The magnetic separator described below depends upon gravity alone for the passage of material through it. It was especially designed to separate magnetic material from any mixture containing non-magnetic and magnetic material, such as iron and brass borings or turnings, magnetic ore and crushed stone, or non-magnetic ore, or the like.

Referring to the drawings, Figure 1 is a longitudinal central section of our invention: Fig. 2, a similar section of a second form thereof, the magnet being shown in side elevation; and Fig. 3, a diagram of the electric circuit, adapted to either Fig. 1 or Fig. 2.

On the drawings, A represents a hopper, and B, a chute leading obliquely downwardly from the lower end of the hopper. C is a sliding valve or gate which may be pushed down to cut off the flow of material in the hopper into the chute, or to regulate the flow thereof.

D is an oscillatory valve of magnetic material secured to the rock-shaft E, which is located at such a distance above the floor of the chute that the valve when occupying the position shown in full lines will prevent any material above it from passing the same.

F is a shunting valve secured intermediate of its ends to a rock-shaft G which is a short distance below the lower end of the chute. The shaft G is so disposed and the valve F so proportioned that, when it occupies the position shown in full lines it will stand across the chute and divert into the receptacle H, the material passing down the chute, but that, when it occupies the position shown in dotted lines, it will form a straight continuation of the chute and conduct into the receptacle I the material passing down the chute.

The rock-shaft E is provided with an arm J which is connected by the link K to the arm L, secured to the rock-shaft G. The arms are arranged at right angles to each other so that both valves will have the positions shown in full lines or both will have the positions shown in dotted lines.

The link K has the handle M by which it may be actuated to throw the valves D and F, but other means may be provided for actuating the valves.

In Fig. 1, we have shown three magnets N, O, P arranged above the chute, the magnet N being near the upper end, the magnet P being near the lower end, and the magnet O being between the other two magnets. Preferably the magnet N will be farthest from the floor of the chute, and the magnet P, the nearest.

Toward the lower end of the chute, we preferably place a baffle Q, which rises from the floor of the chute and gradually ascends for a short distance toward the magnet P.

The magnet N and the valve D are so arranged that, when the latter occupies its open position, it will be in contact with the magnet, and be held in such position as long as the magnet is energized. The spring R has one end secured to the link K and the other to the frame S to close the valve D and shift the valve F when the magnet releases the valve D.

In Fig. 2, we have shown a single long magnet T in place of the three magnets in Fig. 1.

On the outside of the hopper A, we secure two insulated contact fingers U and V which are so disposed as to be bridged by the brush or movable contact W secured to the rock shaft E. The sector or contact W and the contacts U and V are so arranged that when the valve D is closed the latter two contacts are not bridged by the contact W. The movement required to bring the sector W into contact with the fingers U and V is so small that the valve D is barely opened at the moment when the electric circuit is closed by the sector.

X shows on Fig. 3 a knife switch for connecting the circuit of the separator to the positive and negative mains.

In Fig. 1 we have shown the magnets connected in series but they may be otherwise connected, and in Fig. 2, we have shown the magnet and the chute parallel but the upper end of the magnet may be farther from the floor of the chute than its lower end.

The switch X being closed and the hopper in Fig. 1 containing a mixture of magnetic and non-magnetic materials, the operator moves the handle M upwardly. After a slight movement of the handle the sector W bridges the fingers U and V, whereupon the magnets N, O, P become energized. At the moment of closing the circuit of the magnets, the shut-off valve D has not opened appreciably, or at least not enough to allow any of the contents of the hopper to escape from the chute before the magnets are energized. The handle is moved so as to bring the valves D and F into their dotted positions, in which they are held by the attraction of the magnet N on the valve D, as already described. As the mixture runs down the chute, the strongly magnetic material is attracted to the magnets in the upper end of the chute. The baffle causes the stream of material to jump up against or toward the magnet P, so that any magnetic material not attracted to the two upper magnets is retained by the magnet P. The non-magnetic material passes down the chute and is deflected by the valve F into the receptacle I. Now, if the handle M is pushed down by the operator or if the current fails, the valves will assume their full-line positions, whereupon the flow of material from the hopper will be stopped and the magnetic material, which has been released from the magnets owing to their deënergization, will run down the chute and be conducted by the deflecting valve F into the receptacle H.

More than one baffle may be used, if desired, the number being determined by the character of the material to be acted on. In general, the less the amount of magnetic material and the less the magnetic permeability thereof, the greater the number of baffles required. As more baffles are used, the material will be brought more strongly under the influence of magnets. If the material carries a large proportion of magnetic material of a high degree of permeability, it is better to use fewer baffles and place them near the lower end of the chute in order that the magnetic material may spread itself over the faces of the magnet more uniformly and not choke the upper end of the chute.

The frequency of dumping or the number of times it is necessary to cause the valves to assume the position shown by heavy lines is determined by the amount of magnetic material on the face of the magnet and the consequent choking of the passage between the face of the magnet and the bottom of the chute. This amount of choking can be determined by the operator by means of the sight holes Y in the side of the chute or elsewhere.

It is evident that the choking may be decreased by placing the magnet and chute so that they will not be parallel to each other, in other words, the space between the magnet and chute at the upper end may be greater than the opening at the lower end, thus securing a more uniform distribution of magnetic material on the face of the magnet and preventing choking. We have accomplished this as shown on Fig. 1 by making the magnet of two or more separate parts and placing the upper ones farther away from the chute.

The operation with respect to Fig. 2 is substantially the same as for Fig. 1; the opposite poles of the magnet T act similarly to the magnets N and P in Fig. 1.

We regard the three magnets N, O, P as a magnet and the word magnet in the claims is to be understood to include a sectional magnetic device.

We claim—

1. In a magnetic separator, a chute, a cut-off valve therefor, an electro-magnet over the chute, a witch in the circuit of the magnet, and mechanically connected to the valve operating mechanism, and switch contacts arranged for closing the switch prior to the opening of the valve.

2. In a magnetic separator, a chute, a cut-off valve to alternately permit and prevent the flow of material into the chute, an electro-magnet over the chute, a switch in the circuit of the magnet, the movable member of the switch being connected to move with the valve and switch contacts arranged to close the magnet circuit prior to the opening of the valve.

3. In a magnetic separator, a chute, a pivoted cut-out valve arranged at the feeding-in end thereof, said valve containing magnetic material, and a magnet over the chute below the valve, said valve being arranged, when opened, to be held open by the attraction of said magnet on said magnetic material.

4. In a magnetic separator, a chute having a fixed floor, a magnet over the same for attracting magnetic material passing down the chute, and a pivoted cut-off valve arranged to control the inlet to the chute and having a magnetic portion thereof movable into the field of the magnet so as to be retained in open position thereby.

5. In a magnetic separator, a chute, a magnet over the chute, a cut-off valve for the chute arranged when open to be retained open by the magnet, a switch in the circuit of the magnet, and mechanical means connecting the switch and the valve for closing the switch prior to the opening of the valve.

6. In a magnetic separator, a fixed chute having therein a fixed floor, fixed electro-magnets over the chute, a cut-off valve to control the admission of material into the chute, a switch, and mechanical connections between the valve and the switch to cause the switch to open after the valve closes.

7. In a magnetic separator, an inclined

chute, a longitudinal series of magnets having their polar faces over said chute, and a deflector in the floor of said chute opposite the lowermost magnet only and adapted to deflect the material to be treated against the polar faces of said lowermost magnet.

8. In a magnetic separator, an inclined chute, means over the chute for creating a magnetic field in an extended longitudinal portion of the chute, and a deflector in the floor of the chute opposite the lower portion only of said magnetic field said deflector being adapted to deflect the material to be treated against that portion of the polar face opposite the deflector.

Signed at Cleveland, Ohio, this 30th day of April A. D., 1907.

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Witnesses:
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