

J. Y. SMITH.
MAGNETIC MACHINE FOR CLEANING AND SEPARATING ORES OF IRON.
No. 104,221.
Patented June 14, 1870.

Fig. 1.

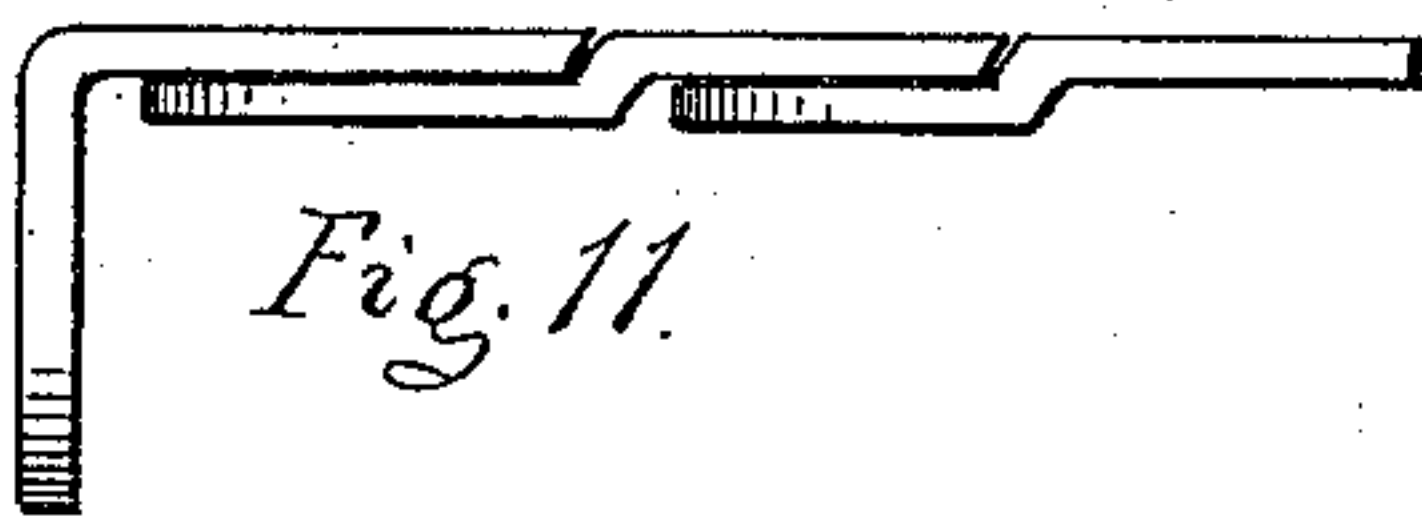
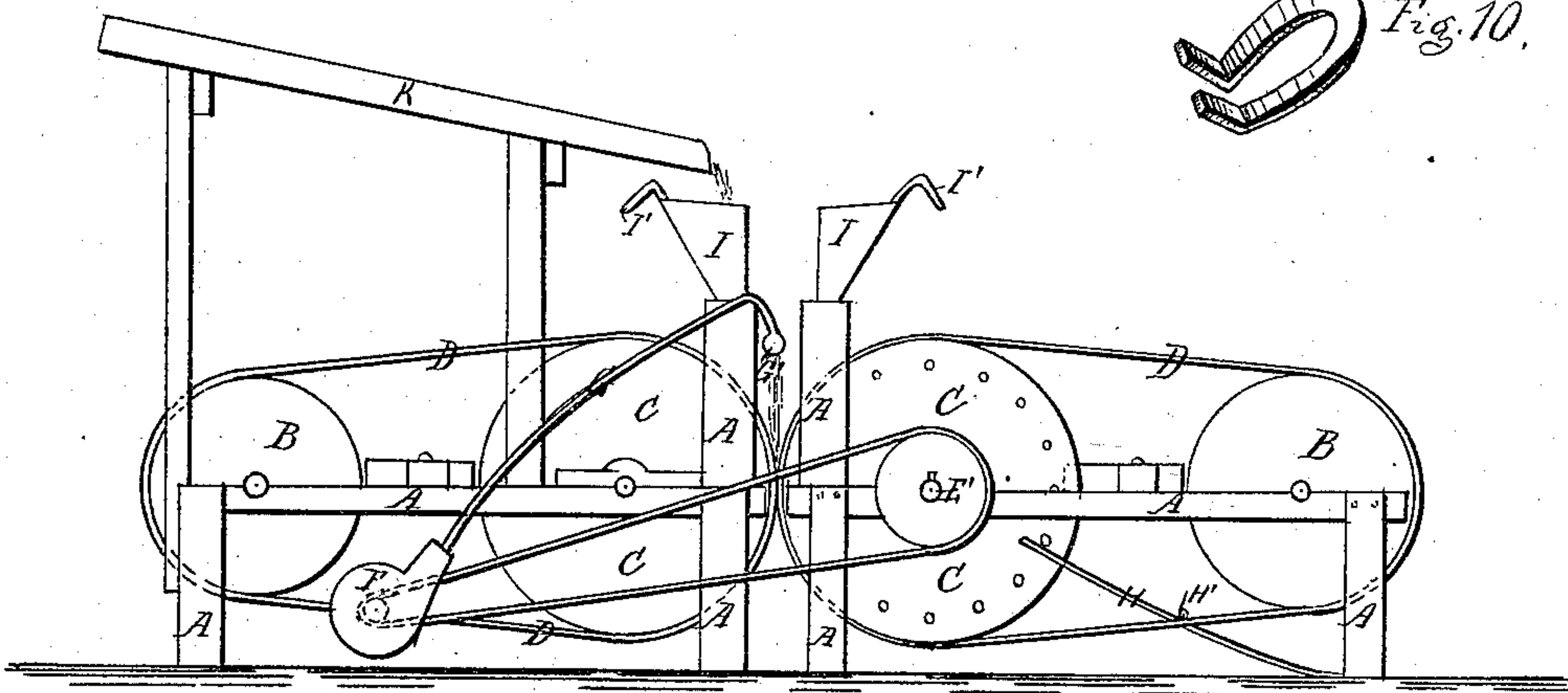


Fig. 2.

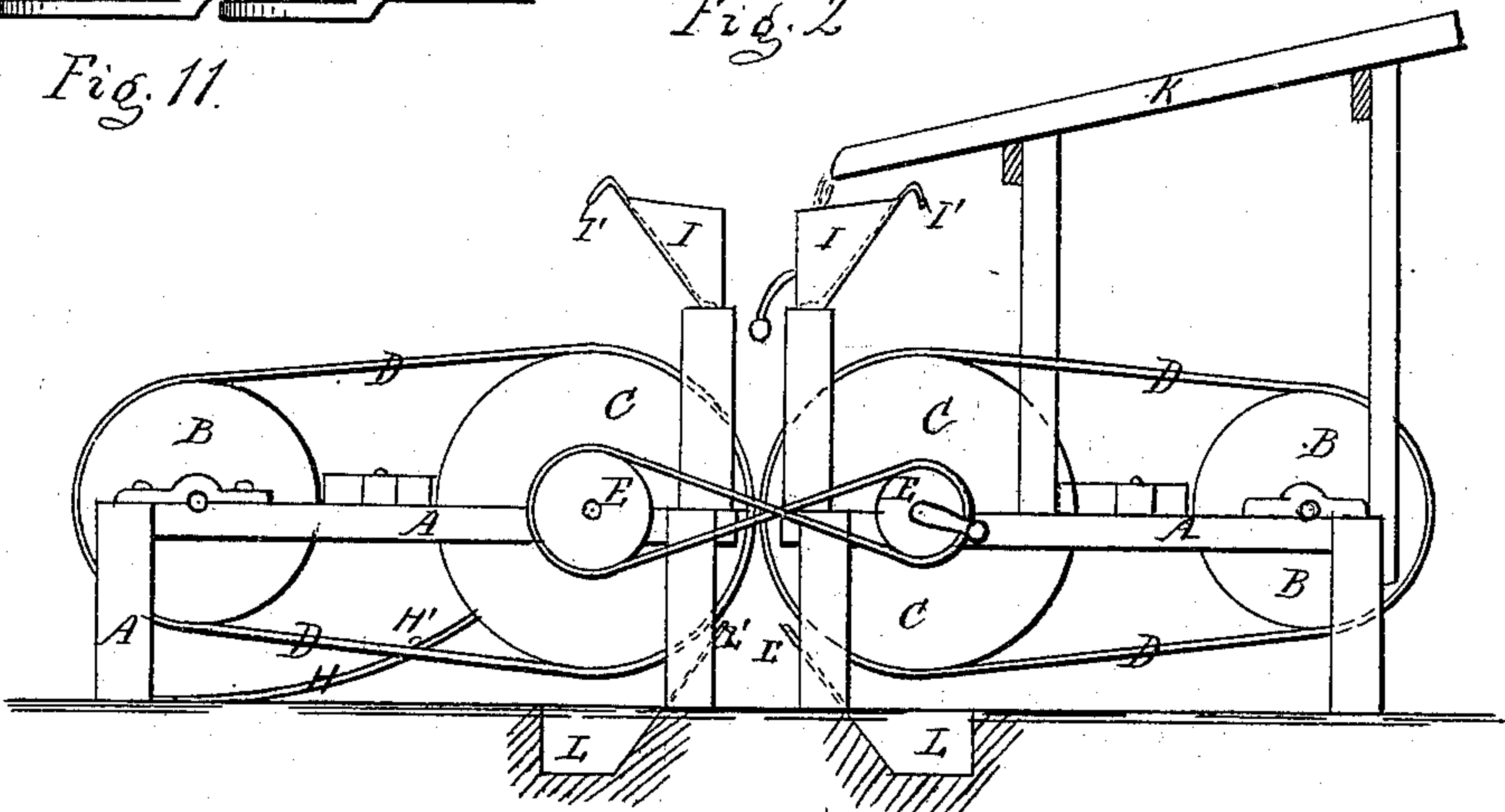


Fig. 3.

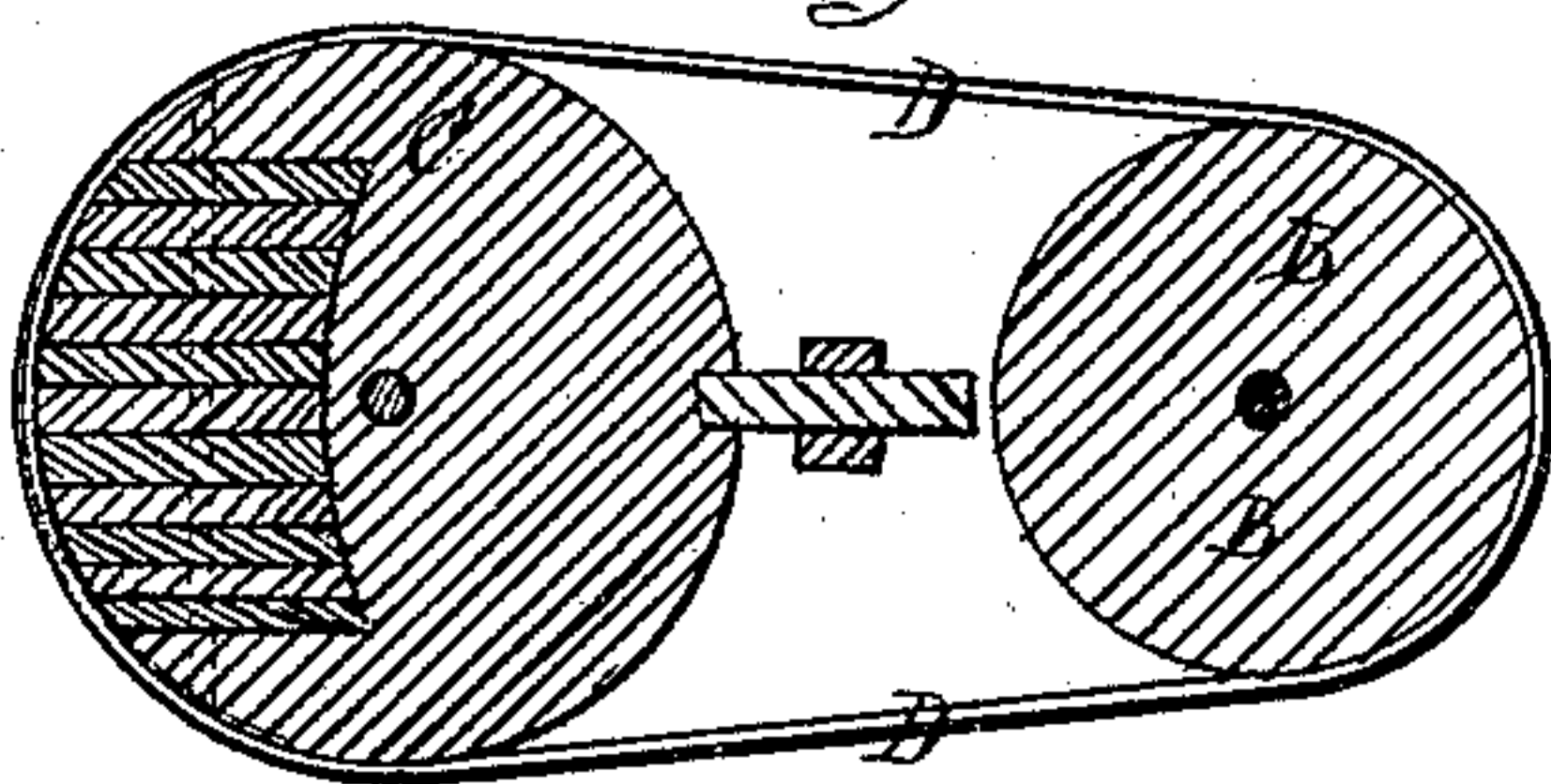


Fig. 4.

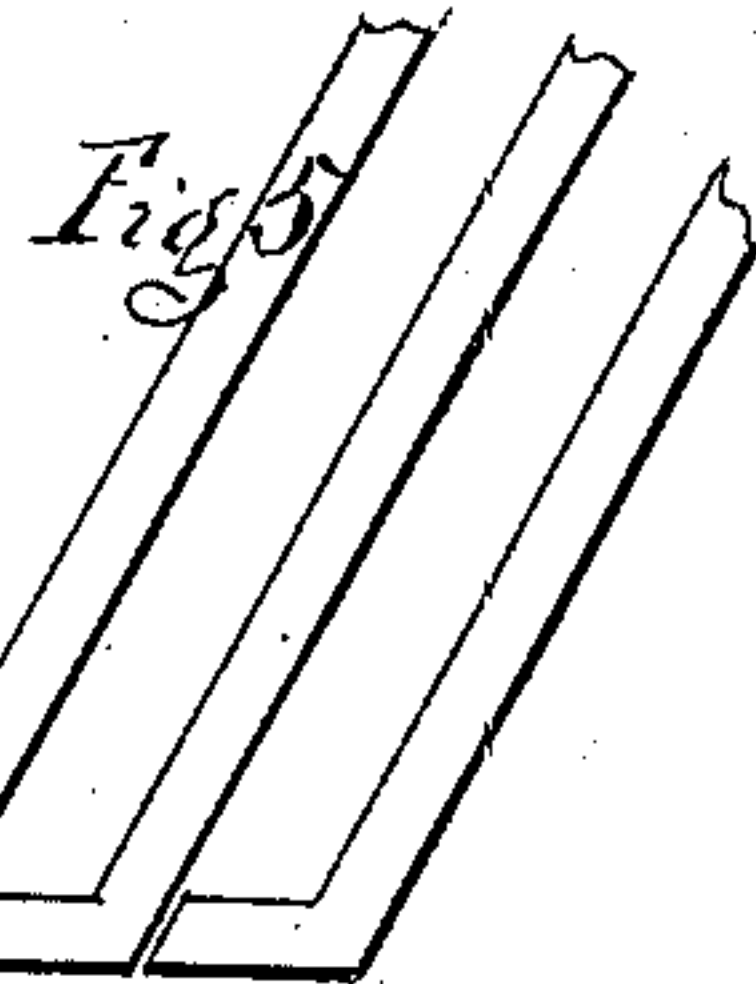
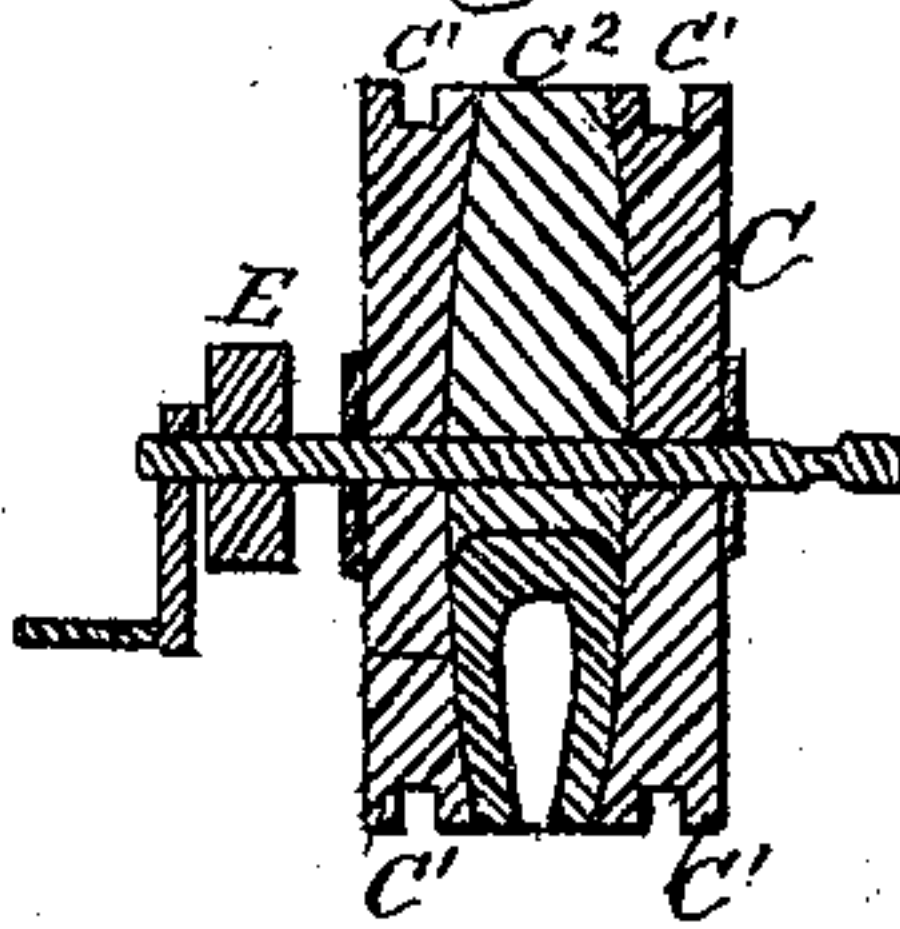
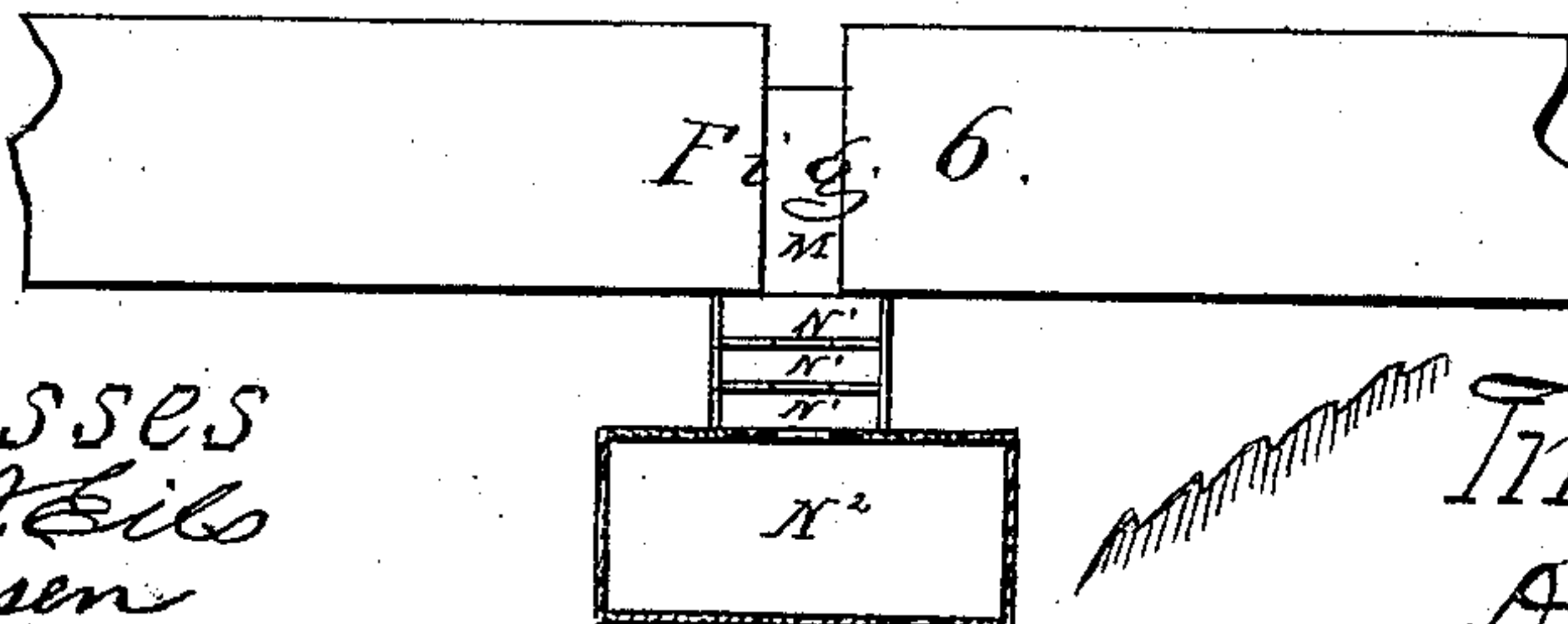


Fig. 6.



Witnesses
O. E. J. Eils
C. F. Clausen

John C. Smith
Inventor
By J. B. Holloway, atty

J. Y. SMITH.
MAGNETIC MACHINE FOR CLEANING AND SEPARATING ORES OF IRON.
No. 104,221. Patented June 14, 1870.

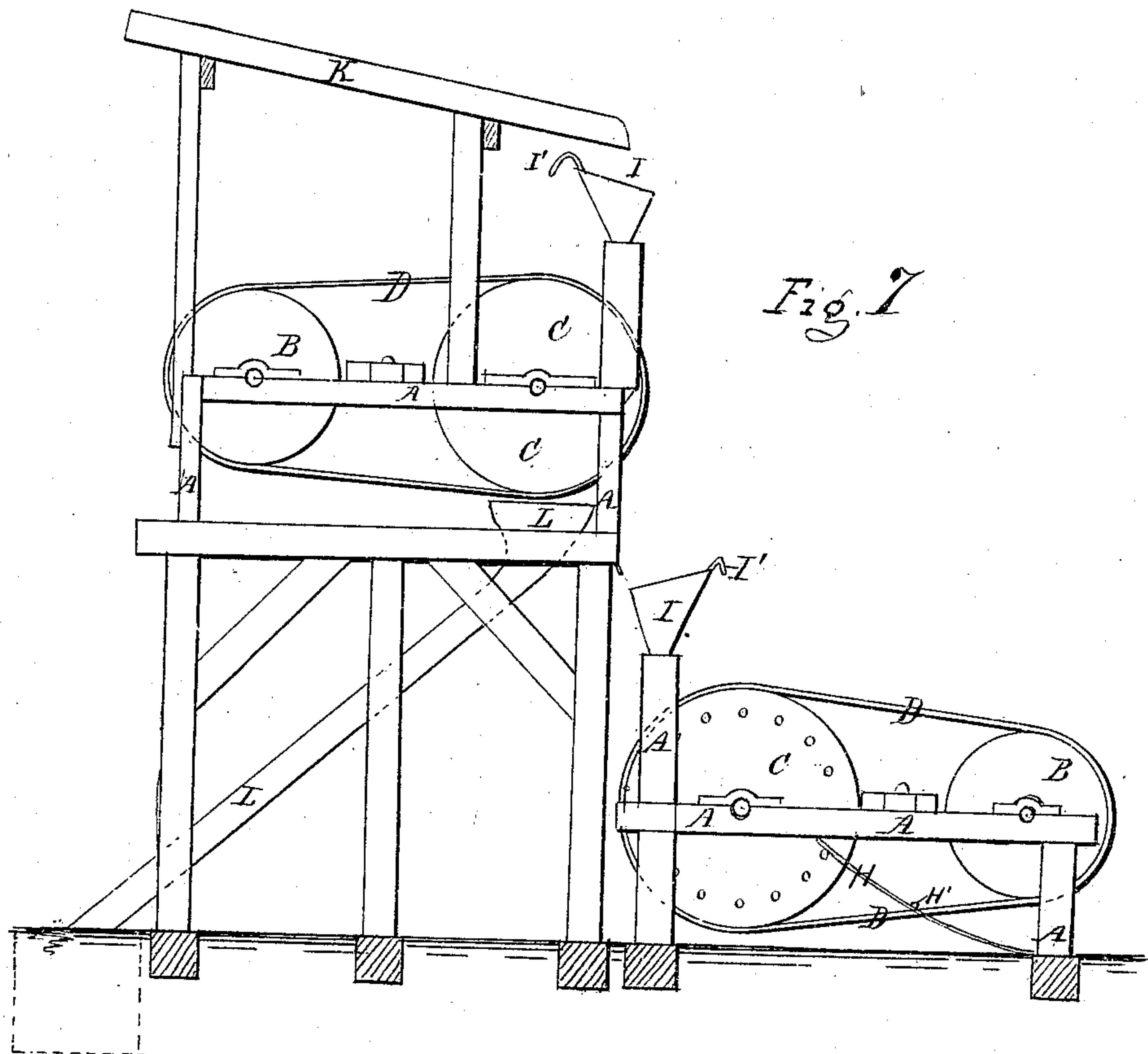


Fig. 7

Fig. 8.

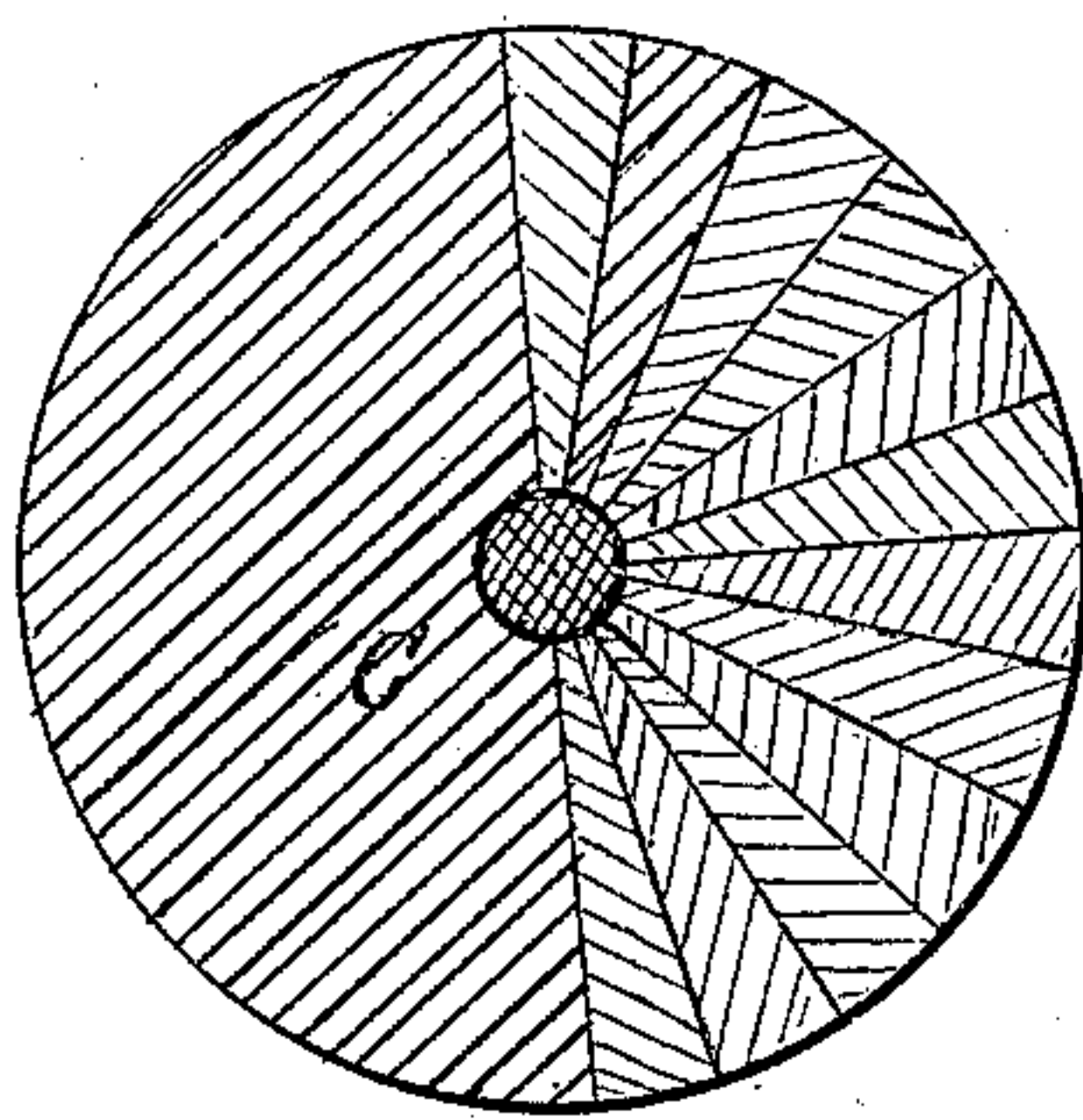
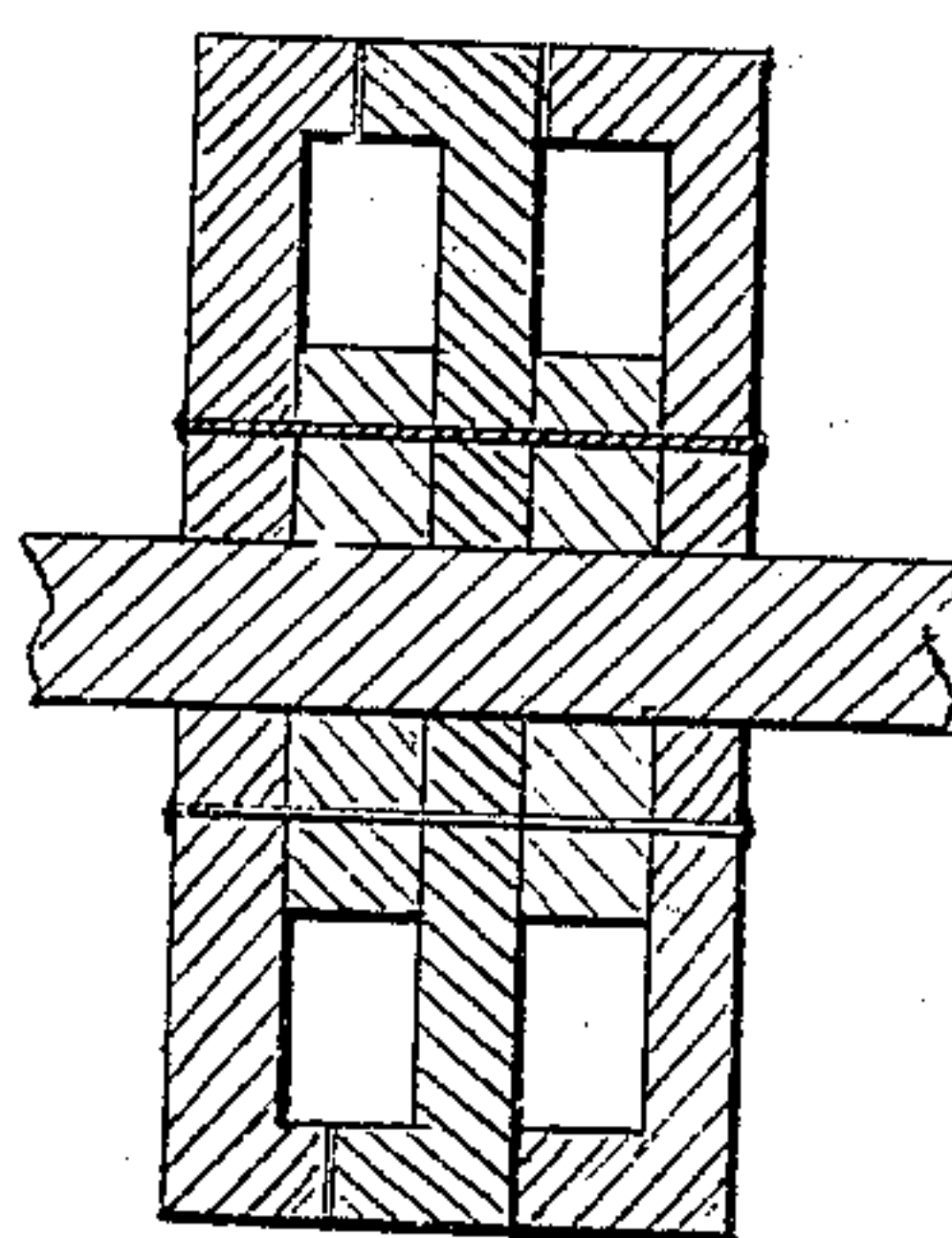


Fig. 9.



Witnesses
A. B. J. Eils
Ch. Clausen.

John Y. Smith
Inventor
D. O. Hollaway
his atty-

United States Patent Office.

JOHN Y. SMITH, OF PITTSBURG, PENNSYLVANIA.

Letters Patent No. 104,221, dated June 14, 1870; antedated June 3, 1870.

IMPROVED MAGNETIC-MACHINE FOR CLEANING AND SEPARATING ORES OF IRON.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that I, JOHN Y. SMITH, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented an Improved Magnetic-Machine for Separating Pulverized or Granulated Magnetic Iron or Ores of Iron from other materials with which they are mingled; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the annexed drawing making part of this specification, in which—

Figure 1 is a side elevation.

Figure 2 is a side elevation, showing the opposite side of the machine.

Figure 3 is a transverse section of the cylinders.

Figure 4 is a cross-section through the axis of the magnetic cylinder.

Figure 5 is a side elevation, showing one mode of arranging the magnets.

Figure 6 is a plan view of the box in which the debris is received.

Figure 7 is an elevation of two machines, arranged to work over the residuum discharged after the first operation.

Figure 8 is a section of a magnet cylinder differently arranged.

Figure 9 is a section of the same, through the length of the axis.

Figure 10 is a perspective view of a bent magnet.

Figure 11 is a side elevation, showing another arrangement of magnets.

The same letters are employed in all the figures to designate identical parts.

My invention relates to an improved machine for separating particles of iron or iron ore, pulverized and magnetic, from other substances, by means of magnets, which attract the particles of magnetized iron, while other substances, mineral or metallic, are separated, not being subject to magnetic attraction; and

My improvements consist in combining, with a series of magnets, an endless apron, upon which the ores are carried across the magnets, and, while the magnetic particles are subject to the force of the magnetic attraction which holds them in place upon the apron, applying streams of water or jets of air or steam to sweep away all non-magnetic particles with which they are combined; and also in peculiarities in the construction, combination, and arrangement of parts of the machine to be hereinafter specifically indicated in the following specification and claims.

This machine may be used for separating the magnetic particles from magnetic sand-ores, or from other ores that contain magnetic iron, either natural, or which have been converted into magnetic iron by processes familiar to iron manufacturers, or in separating iron filings from impurities, or for separating

the magnetic ores of iron from the black gold-bearing sand common in gold-mines.

The following description will enable persons skilled in the art to construct and operate my improved machine.

In the annexed drawing—

A is the frame of the machine, arranged to support the operating parts;

B is a cylinder, turning in bearings upon the frame; and

C is the magnet cylinder, also revolving in bearings on the frame. In this cylinder a series of magnets are arranged, in a manner to be hereinafter fully described.

This cylinder I prefer to construct in three parts, viz: the two disks O^1 C^1 , on which the endless apron D, which passes around the cylinder B, and around these disks is carried, and a central disk, C^2 , in or to which the magnets are attached, so as to project nearly to the under surface of the endless apron D, which, by the revolution of the drum B and disk C^1 , is carried in close proximity to the surfaces of the magnets. The cylinders and endless apron may be revolved by any convenient power.

A crossed belt around the pulleys E E, on the magnet cylinders C C, when the machines are arranged as shown in figs. 1 and 2, will communicate the power from one machine to the other, so as to cause the endless aprons to revolve toward one another above the cylinders.

I also propose to drive the magnet-disk C^2 in the same direction as the disk O^1 , but by a slightly-retarded or increased motion. This may be accomplished by making the shafts of the disks C^1 C^2 tubular, and carrying the shaft of the disk C^2 through them, and making the slight difference in the pulleys or gearing driving each necessary to create the requisite retarded motion in the revolution of one of the cylinders. This difference in speed is valuable for giving greater agitation to the magnetic particles as they pass over the successive magnets placed in series in the disk C^2 .

A pulley, E', on the overhung shaft of the wheel C, in fig. 1, carries a belt for driving a fan, F, which drives a blast of air through the pipe G, and discharges it through a series of holes in the lower surface of the cross-pipe G', which is so placed as to drive the blast against the surfaces of the endless aprons, so that, while the particles of magnetic iron are held to the aprons by the strong attraction of the magnets, the force of the blast will carry down the foreign non-magnetic particles mingled with the iron. Instead of an air-blast, jets of steam or streams of water may be employed for the same purpose. The shaft of the magnet-cylinder may be made hollow,

and a stream of water may be forced outward between the magnets radially, and through the porous apron, to wash away the non-magnetic particles.

A spring, H, may be attached to the frame, extending up so as to bear against a series of pins placed on the outer surface of the disks C', which alternately draw it up and release it, thus causing a cross-arm, H', to strike against the lower part of the belt, and thus whip off particles of iron or ore which may adhere to the fibers of the woven fabric of which the endless apron will be constructed.

I I are hoppers, arranged to discharge the pulverulent material upon the aprons. They may be placed at such point along the upper surface as may be preferred.

Valves, operated by rods I', may be used to regulate the discharge of the ore upon the apron.

Where water is used, it may be introduced with the ore into the hopper, through the trough K, and, washing down over the surface of the endless apron, it will carry away the foreign non-magnetic matters, while the magnetic particles are retained by the force of the magnets, and held until the apron, in its revolution, has carried them beyond the magnet-cylinder, where, there being no longer any attraction to hold them, they will fall, by their own gravity, into the hopper L intended to receive them.

The foreign matters not adhering to the apron will fall directly from the horizontal radius of the wheel vertically, and be received into the hopper M.

As in gold-bearing regions magnetic-iron ore is found in combination with particles of gold, when the separation occurs, the gold will be carried away with the other non-magnetic substances, metallic and mineral, and must then be saved by washing, amalgamating, or by other known process or processes.

I have shown at M' a series of riffles, placed in a trough, such as is commonly used for washing gold-bearing sands. Any cleaning apparatus adapted for the purpose may be used for separating the gold from the non-magnetic particles with which it is mingled.

The magnet-disk is formed by permanent horseshoe magnets, or by electro-magnets, radially arranged, with their points projecting, as shown in fig. 3, or they may be bent, as shown in fig. 10, at the points, and then placed in the cylinder, as shown in figs. 8 and 9, so that the points shall come in contact, whereby one set of magnets will operate as keepers for another, the whole being connected by rods, which hold them in close contiguity with one another; or a series of magnets, bent as shown in fig. 11, and laid one upon the other, so that the sides shall project in one continuous plane, forming the entire width of the magnetized surface over which the apron extends.

Instead of having the magnet-disk C' revolve, it may be stationary, and, instead of being round, it may be flat upon the top, so that the work of separation may be commenced before the apron begins to carry the ore downward, or it may be extended underneath.

The machines may be used singly or in pairs, arranged as shown in figs. 1 and 2; the effect of which will be that the ore subjected to the alternating action of the magnets of the different machines will be more disturbed, so as to open it more fully to the action of the blast of air, or stream or current of water; or one machine may be slightly raised, so that the horizontal diameter of the wheel of one shall be a little above that of the other; or one machine may be elevated above the other, as shown in fig. 7, so that the residuum discharged after one operation shall be subjected to another machine for the removal of any particles of iron that may have passed away from the first machine without being held by its magnets.

I do not claim the use of magnets in a machine for taking up magnetic ores or particles of iron, for such

machines are in use. Nor do I claim, broadly, the combination of such magnets with a revolving apron; for such apron has been used in other machines, in combination with stationary magnets.

But my invention is distinguished from all other machines in the following respects:

That I use an apron, of fibrous material, on which the ores will not slip when beginning to approach, or recede from the magnet, nor yield readily to the force of the blast or current, in combination with a series of magnets moving in the same direction with the apron, but at a different speed.

I have described the movement of the magnets as being slower than that of the apron; but it is obvious that the same result will be effected by having the magnets move faster than the apron, and I therefore claim for either.

In other machines the magnet is placed above the apron, and lifts the ore from the revolving apron, discharging the magnetic particles either by cutting off the current from electro-magnets, or by interposing between the magnet and the particles a woven fabric, which is at intervals separated from the magnet, so as to drop the magnetic particles adhering to such fabric.

My invention differs from these in this, that I use the magnets to retain the magnetic particles on a revolving apron, interposed between the ore, &c., and the magnet, until the magnetic particles are dropped, when carried beyond the influence of the magnets, and also that, while the magnetic particles are held upon the apron, I bring to bear upon the mass jets or currents of air, steam, or water, by which the non-magnetic particles are swept away, the magnetic particles adhering to the revolving apron, and being discharged at a point beyond that at which the non-magnetic particles are delivered; and, also, that, instead of the ordinary horseshoe magnets, I use such magnets, bent near their points, to present their sides or edges for action upon the magnetic particles, by which means I am enabled to reduce the number of magnets by presenting broader surfaces, and can recharge them without removing the magnets; and also that I combine two machines, to operate either simultaneously or successively; and also that I combine with the magnetic machine, when operating upon ores of iron, combined with particles of gold, an apparatus for separating the gold from the other non-magnetic particles discharged by the machine.

Having fully described the construction and operation of my improved machine for separating particles of magnetic iron or ores of iron from other non-magnetic particles, and pointed out wherein it is distinguished from other machines,

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The revolving apron and magnet-cylinder, in combination, but only when so actuated as to revolve in the same direction, at different speeds, substantially as set forth.

2. The combination and arrangement of the magnets and revolving apron, substantially in the manner set forth, so that the revolving apron shall be interposed between the magnets and the pulverized material subjected to the action of the magnets.

3. The magnets and revolving apron, when combined and arranged to discharge first the non-magnetic particles in the pulverulent substance treated, and to retain the magnetic particles against the apron until they have been carried below and beyond the magnets, when they will be delivered separately, substantially in the manner set forth.

4. The combination of the magnets and apron with jets or streams of air, steam, or water, for sweeping away the non-magnetic particles mingled with the magnetic particles, while the latter are held against

the apron by the attraction of the magnets, substantially as set forth.

5. The combination of the apron with magnets, bent or arranged so as to oppose their sides or edges to act upon the magnetic particles, substantially as set forth.

6. The arrangement of two magnetic machines to operate upon the materials passing between them, substantially as shown in figs. 1 and 2.

7. The arrangement of two or more magnetic machines above one another, to act successively upon the materials submitted to their action, substantially as shown and set forth.

8. The combination of a magnetic machine for taking up the particles of magnetic iron, and an apparatus for separating particles of gold mingled with the non-magnetic substances discharged with the residuum, substantially as set forth.

9. The arrangement, in combination with the magnets, of a hopper and a pipe or trough, or pipes or troughs, for discharging the pulverized material, in combination with water from the hopper, for subjection to the action of the magnets, substantially as set forth.

10. The combination, with the magnets and revolving apron, of the whipper H H', substantially as and for the purpose set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN Y. SMITH.

Witnesses:

B. EDW. J. EILS,
R. MASON.