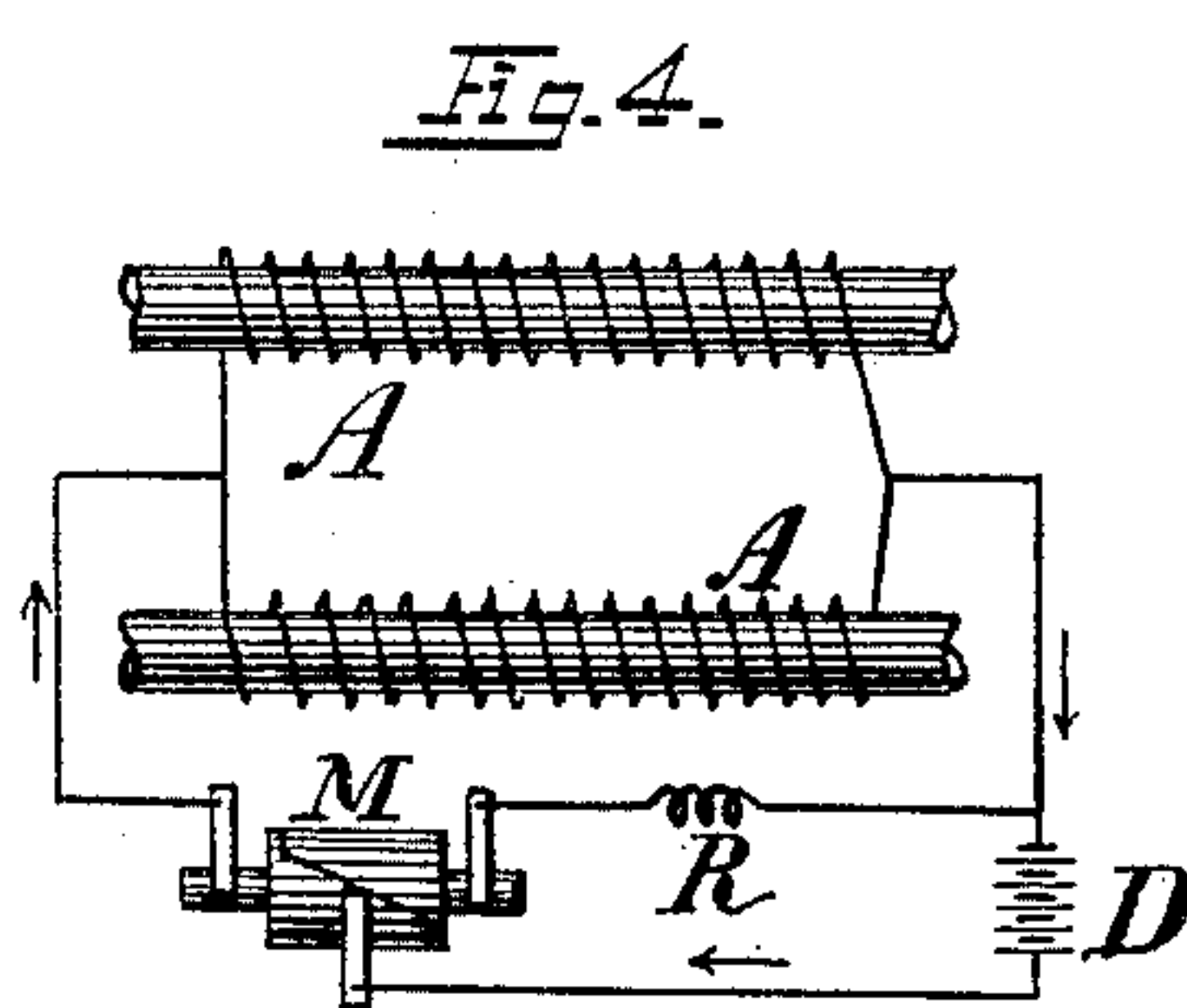
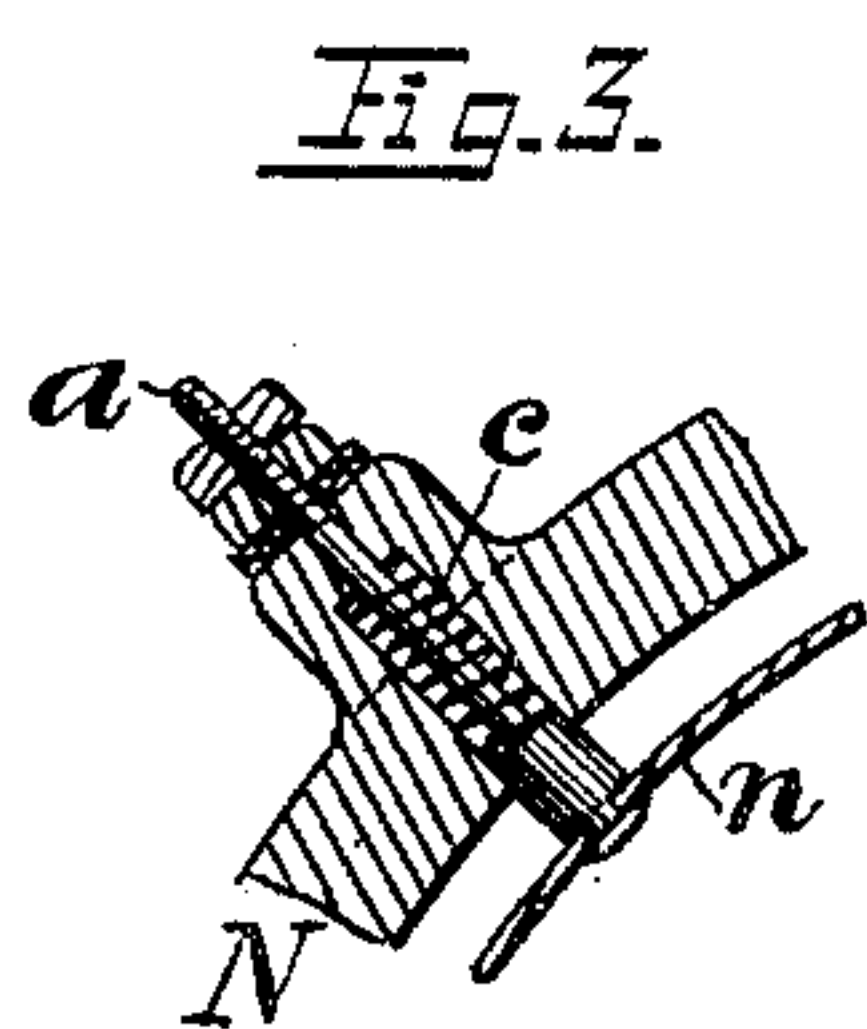
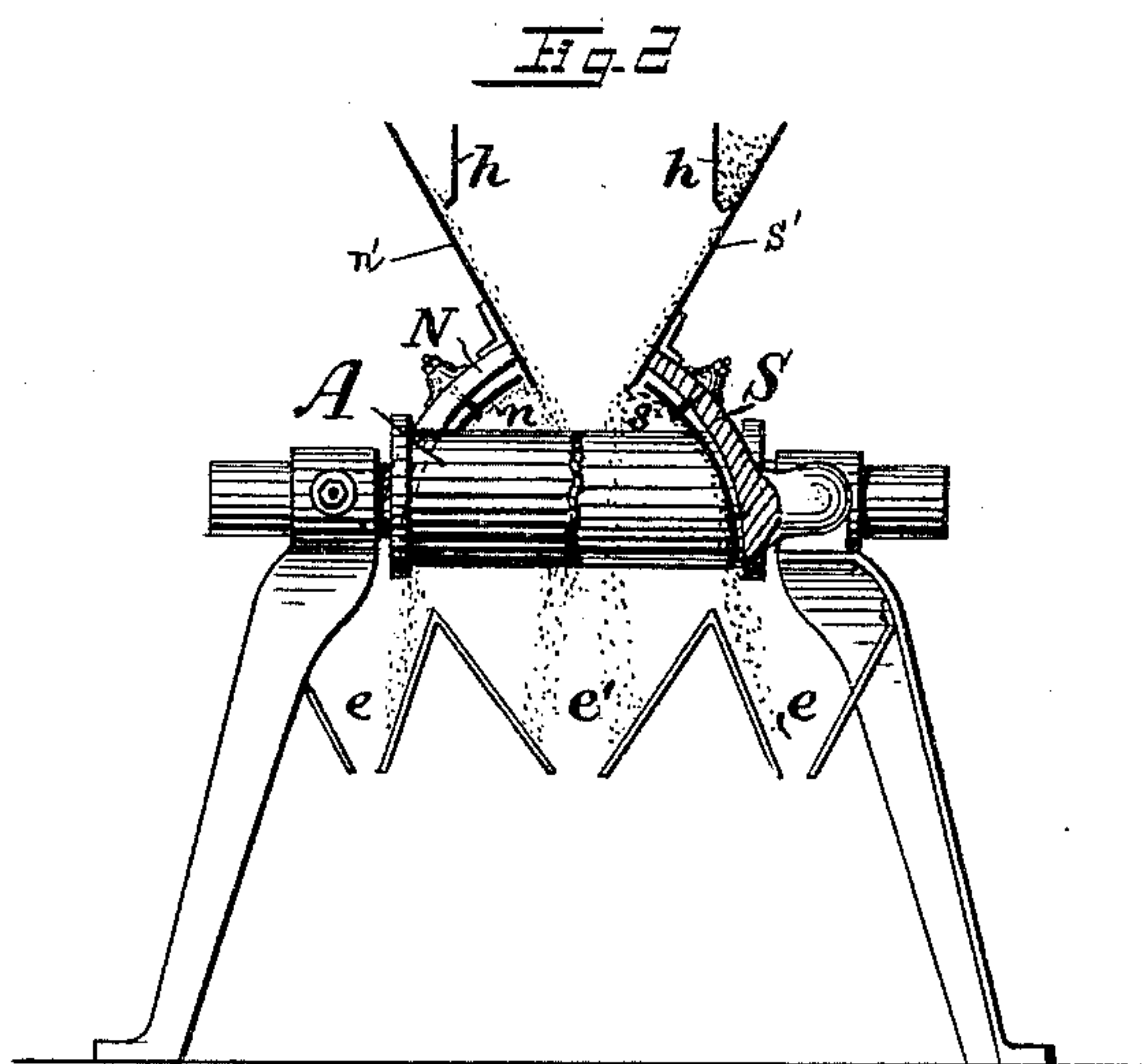
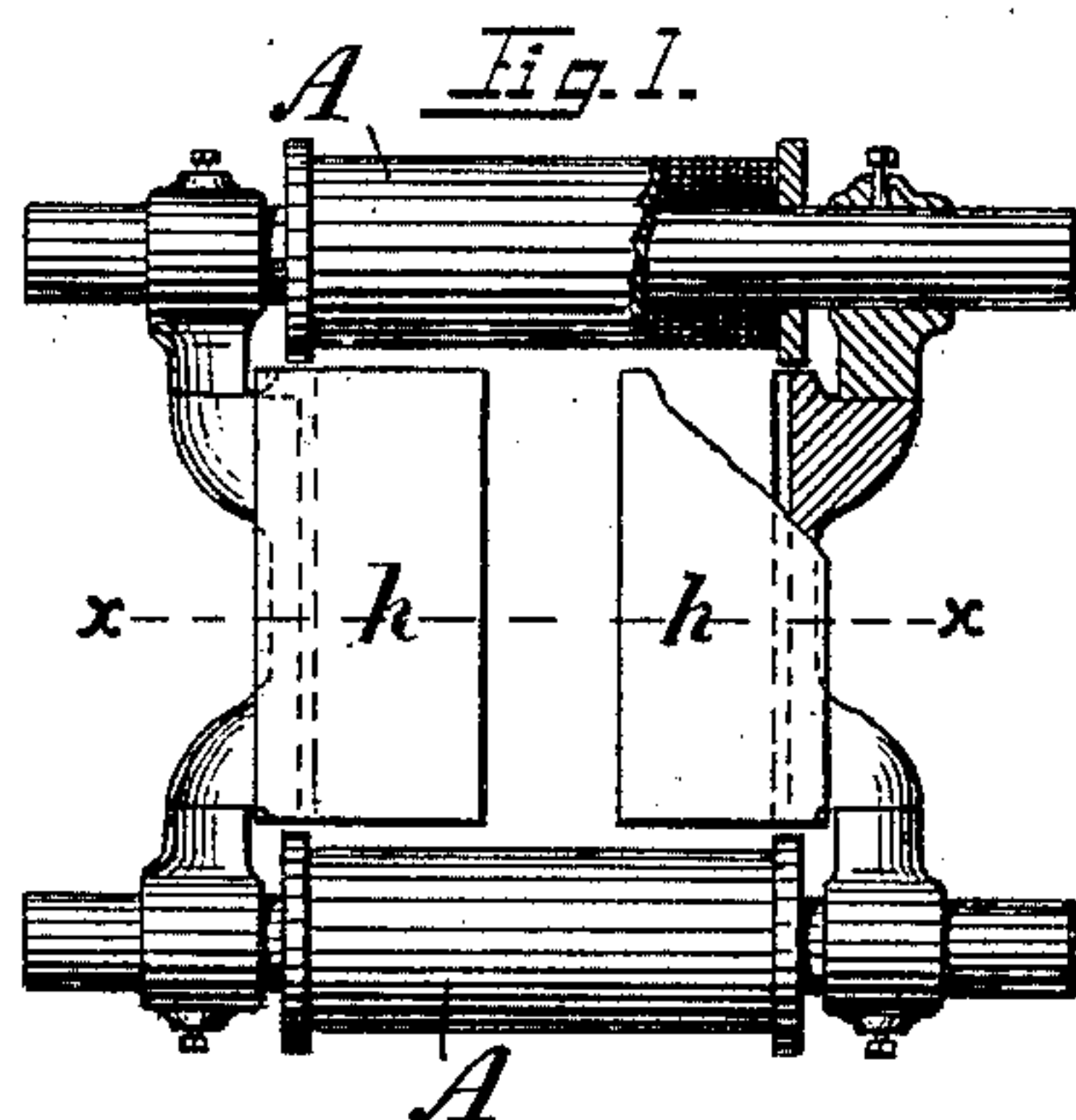


(No Model.)

R. R. MOFFATT & S. CHICHESTER.
ELECTRO MAGNETIC SEPARATOR.

No. 462,322.

Patented Nov. 3, 1891.



Witnesses:
L. N. Legendre
E. H. Lloyd

Inventors
R. R. Moffatt
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UNITED STATES PATENT OFFICE.

RICHARD R. MOFFATT, OF NEW YORK, AND SYLVESTER CHICHESTER, OF
BROOKLYN, NEW YORK.

ELECTRO-MAGNETIC SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 462,322, dated November 3, 1891.

Application filed February 2, 1891. Serial No. 379,874. (No model.)

To all whom it may concern:

Be it known that we, RICHARD R. MOFFATT, a citizen of the United States, residing in the city, county, and State of New York, and SYLVESTER CHICHESTER, a citizen of the United States, residing in the city of Brooklyn, county of Kings, and State of New York, have invented a new and useful Improvement in Electro-Magnetic Separators, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

The invention relates to apparatus for separating magnetic and non-magnetic matters from each other when they are mingled in a free state, such as finely-pulverized magnetic iron ore associated with impurities.

The invention consists in a novel method of feeding the particles through the magnetic field and means for producing a vibratory agitation of the same, for the purpose of effectually separating the magnetic particles from the non-magnetic.

In carrying out our invention we illustrate the improvements applied to a new type of separator, which forms the subject-matter of another application made jointly by us and filed January 20, 1891, Serial No. 378,407.

In the accompanying drawings, Figure 1 is a plan, partly in section, of a separating apparatus embodying our invention. Fig. 2 is a side view of the same, one half being shown in elevation and the other half in section taken on line *xx* Fig. 1. Fig. 3 is an enlarged detail, and Fig. 4 is a diagram, illustrating the elements for operating the invention.

Similar letters of reference in the several figures indicate like or corresponding parts.

In the drawings, *A A* are the helix-coils of the field-magnets. These are connected in such a manner that an electric current active therein will produce consequent poles of opposite nature in the pole-pieces *N S*. The pole-pieces are connected to the projecting parts of the magnet-cores in a manner to permit a movement of the same thereon for the purpose of increasing or decreasing the space or opening between them. They are provided with inclined field-faces, as shown.

n and *s* are plates, preferably made of thin soft sheet-iron. These plates are mounted in

front of the pole-pieces, as shown in Fig. 3, so as to be capable of a slight movement toward and from the pole-pieces. To this end the plates are secured to non-magnetic pistons or pins *a*, that extend through and beyond the pole-pieces, being capable of a free easy movement therein. Collars are secured to the pistons *a*, and guide-frames are secured to the pole-pieces. A retractile spring *c* is so arranged on the piston as to cause the plates to be forced away from the pole-pieces. By this arrangement the plates have no magnetic contact with the pole-pieces and will therefore become completely demagnetized when the magnet is non-active, even when the pole-pieces are composed of cast-iron, which naturally retains residual magnetism.

n' and *s'* are inclined plates made, preferably, of soft sheet-iron. These plates preferably have magnetic contact with the pole-pieces, as shown, and extend in a receding upward direction from the field, terminating in the hoppers *h*, as shown in Fig. 2. The magnet is supported on legs or in other suitable manner, and the apparatus is preferably inclosed and provided with means for producing air-currents, that move in the direction of the falling non-magnetic particles. Suitable receptacles *e e* and *e'* are provided, into which the assorted particles pass.

M is a rotating circuit-changing (or breaking) device, such as is well known in the arts. This is arranged in the main circuit, as shown in Fig. 4. By this means the electric current is switched into the magnet-circuit and the shunt or by-pass circuit alternately, which operation produces intermittent or pulsatory magnetic effect in the field, and thereby a vibrating movement of the plates *n s*.

If desired, other means may be employed for producing a magnetizing and demagnetizing effect. The hoppers *h* are preferably made of soft sheet-iron and located at a point where the magnetic particles therein will be effected by sufficient magnetic lines of force to prevent their passing from the feed-opening when the magnets are energized, but will feed therefrom by gravity when the magnetic current is broken or interrupted, thus regulating the flow of material from the hopper to the field.

If desired, the plates *n s* may be made from non-magnetic material and their movement caused by mechanical means actuated or controlled in part by magnetic force.

5 In the operation of our invention the circuit is closed with a suitable electric source—such as a dynamo *D*—and the circuit-changer *M* is rotated with a proper speed. The material to be treated (in a pulverized condition)
10 is conveyed in a regulated manner by suitable means (not shown) to the hoppers *h*, from which they pass by gravitation to the inclined plates *n' s'* when the magnets are non-active; but when the magnets are active the mag-
15 netic particles in the material will become magnetized by induction and adhere to each other and also to the hopper by attractive force, which will prevent their downward movement. The circuit-changer *M*, in rotat-
20 ing, switches the current through the circuit that includes the magnet helix-coils *A* and the shunt or by-pass circuit that includes the resistance *R* in an alternating manner, thus producing an intermittent or pulsating field and
25 an intermittent or pulsating feed movement of the particles from the hoppers and through the field. The inclines *n s* being of magnetic material causes the movement of the magnetic particles thereon to be intermittent. When they
30 reach the inverse inclined plates *n s*, the magnetic particles move away from the inverse inclined plates in a downward direction by their gravity when the magnet is non-active. Then the magnet is again energized and will draw
35 them by attractive force to the surface of the inclined plates *n s*, their movement then being in a direction parallel with the lines of force, which causes them to come into contact with the inclined plates at points below their last
40 contacts therewith, this operation, being continuous, producing a feed movement of the magnetic particles (through the field) in a lateral direction, thus causing them to pass into the receivers *e e*.

45 In the operation of the apparatus the intermittent magnetic force and the action of the retractile springs *c* produces a vibrating movement of the magnetic plate *n s*, the ef-

fect of which is to cause all magnetic parti- 50
cles to be thrown off and away from the face of the inclined plates *n s*, (when demagnet- 55
ized,) which operation frees the plates from contact with even the finest magnetic dust, so that the action of gravity moves them in
a downward direction away from the incline-
plates, thus effectually separating all the free
impurities from the magnetic particles, the
operation being continuous. The magnetic
particles finally reach the lower part of the
inclines (where the attractive force is weak) 60
and fall into receivers *e e*.

Having thus fully described the nature, construction, and the operation of our inven- 65
tion, what we claim as new, and desire to secure by Letters Patent, is—

1. In an electro-magnetic separator, means for producing an intermittent or pulsating magnetic field, combined with a face-plate arranged to be vibrated by the intermittent magnetic force, substantially as and for the 70
purpose specified.

2. In an electro-magnetic separator, the combination of a magnet, means for produc-
ing pulsations of magnetic force in the field, a movable inclined face-plate located in the 75
field arranged to be vibrated by the pulsating magnetic force, and a retractile spring, substantially as and for the purpose specified.

3. In an electro-magnetic separator, the method of agitating magnetic particles by 80
subjecting them to the action of a pulsating magnetic field, and a vibrating plate, substantially as and for the purpose specified.

4. In an electro-magnetic separator, the magnet-plates, the hopper *h*, located above 85
said plates and combined with means for producing intermittent magnetic action therein, so as to cause an intermittent feed movement of the magnetic particles therefrom, substantially as specified.

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