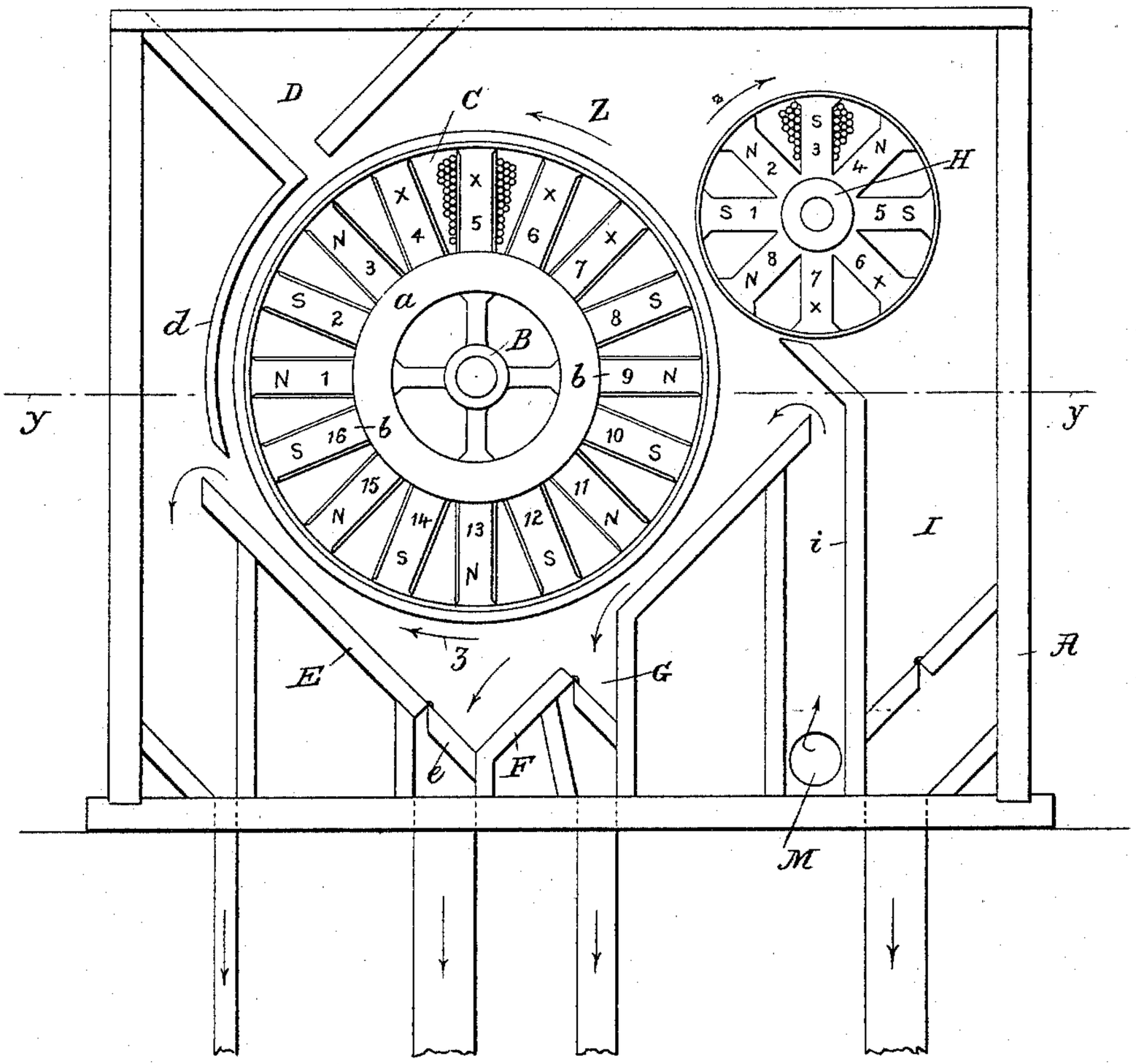
(No Model.) 2 Sheets—Sheet 1.

H. G. FISKE.

MAGNETIC SEPARATOR.

No. 456,507. Patented July 21, 1891.

FIG. 1.



Attest:
Geo. T. Smallwood.
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Inventor:
Henry G. Fiske
by Pollock & Mauro
his attorneys

(No Model.) 2 Sheets—Sheet 2.

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MAGNETIC SEPARATOR.

No. 456,507. Patented July 21, 1891.

FIG. II.

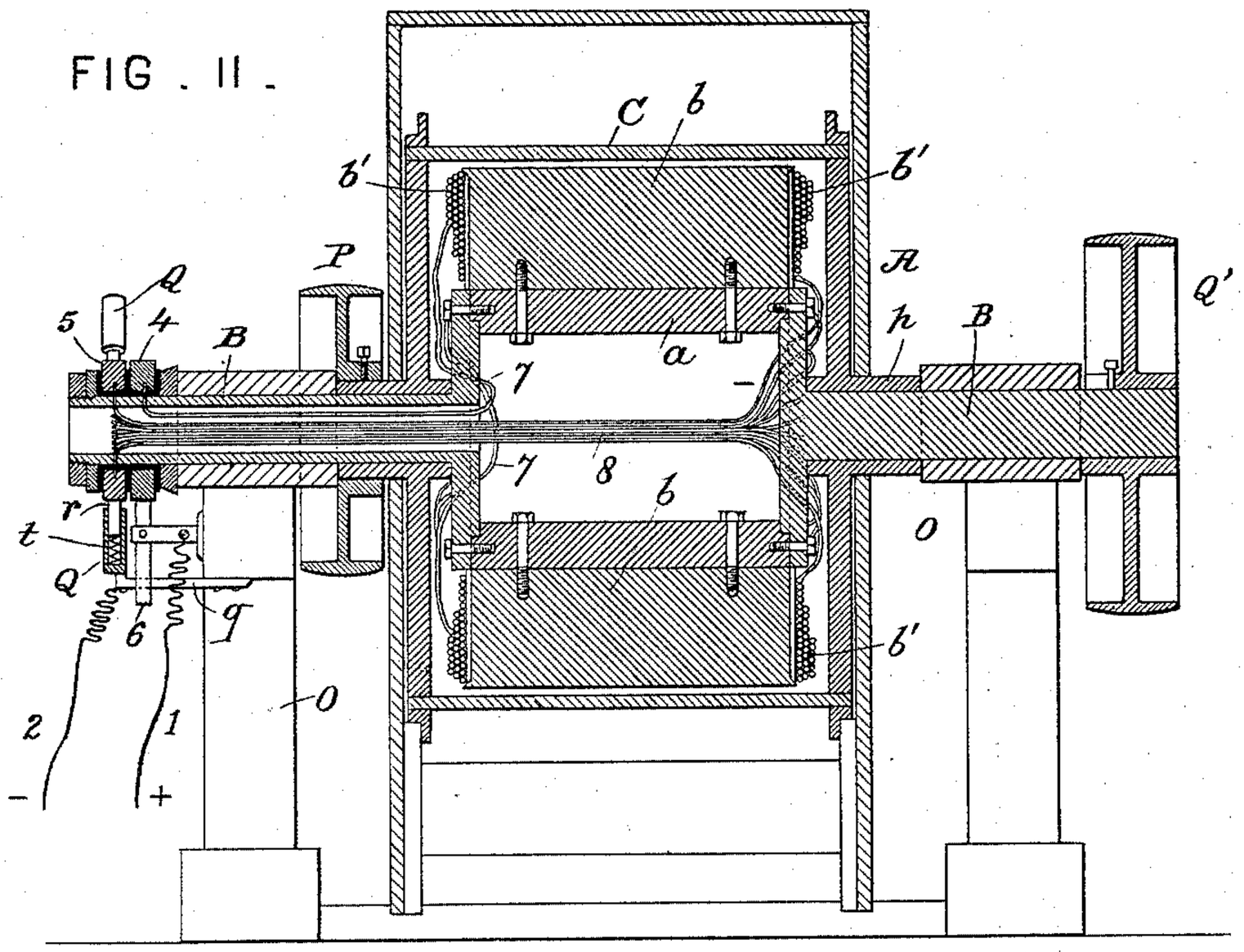


FIG. III.

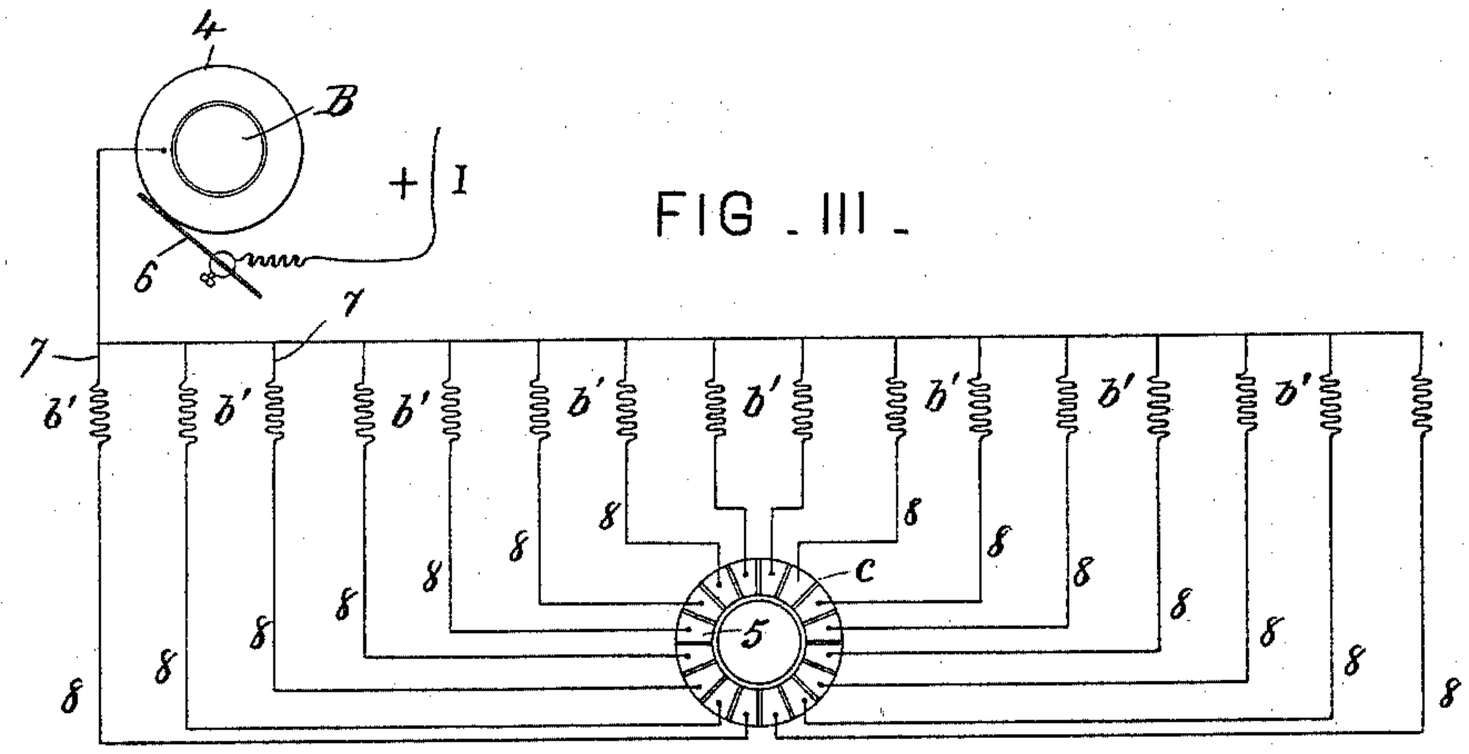
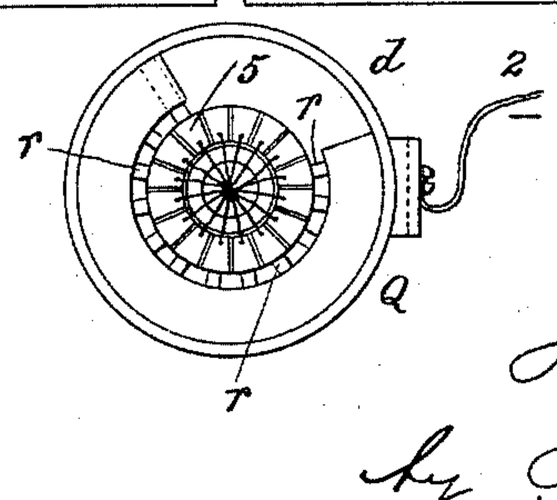


FIG. IV.



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UNITED STATES PATENT OFFICE.

HENRY G. FISKE, OF NEW YORK, N. Y., ASSIGNOR TO JOHN D. CHEEVER, OF SAME PLACE.

MAGNETIC SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 456,507, dated July 21, 1891.

Application filed March 26, 1891. Serial No. 386,528. (No model.)

To all whom it may concern:

Be it known that I, HENRY G. FISKE, a resident of New York city, county and State of New York, have invented a new and useful Improvement in Magnetic Separators, which improvement is fully set forth in the following specification.

The present invention relates to the construction of magnetic separators, and particularly to that type of apparatus in which the field-magnets consist of a number of cores carried by a rotating shaft and projecting radially therefrom. In the use of apparatus of this type the crushed ores (or other materials to be graded) are fed against a screen or shield surrounding the poles of the magnets, and as the latter rotate they carry the magnetic particles to a suitable point where they are picked off or discharged, the non-magnetic particles falling away from the magnets by gravity.

My invention includes certain new improvements and combinations in magnetic separators of this type, as will be particularly pointed out in the following detailed description, reference being made to the drawings, which accompany and form part of this specification.

Figure I is a vertical section of the apparatus transverse to the magnet-shaft. Fig. II is a vertical section lengthwise thereof; Fig. III, a diagram illustrating the arrangement of circuits, and Fig. IV a detail of the brushes and commutator.

A is a water-tight casing which incloses the apparatus on all sides. Supported in suitable bearings in this casing is a shaft B, by which are carried a series of radially-disposed cores *b*, all secured at one end or pole to the ring or hub *a*. As indicated by the letters N S, the coils are so wound that a north pole alternates with a south pole around the entire circumference of the field. Outside the poles and in close proximity thereto, but out of contact therewith, is a tubular shield C, so mounted that it can rotate independently of the field-magnets. This shield should be made of non-magnetic material. Above and to one side of the magnets is the ore-hopper D, to which is attached a downwardly-curved guard *d*, between which and the shield C is sufficient space for the passage of a layer of ore. The non-magnetic particles will begin to fall from the magnetic field at about the end of the guard *d*, and they will collect in a pocket or receptacle formed by the inclined partitions E F. At the lowest part of the pocket a trap *e* is arranged, through which the tailings may be discharged. Beyond this receptacle in the direction of movement of the magnet is the pocket G, in which intermediates will be collected, the concentrates or products of highest grade being carried around to the upper side of the field, from which they are removed in any suitable way.

According to the plan illustrated in the drawings I cut out the coils of the field-magnet successively as they come to the top of the field. The cores marked X are those which are cut out, the neutral part of the field extending, as indicated, to the mouth of the ore-hopper. At the point where the neutral point of the field begins I arrange a rotating picker-magnet H, which collects the magnetic particles from tube C and discharges them into the receptacle I. This latter is separated from the adjacent compartment by a water-tight partition *i*. The coils of magnet H are cut out as they come over the mouth of receptacle I, as indicated by the cores marked X.

M represents an inlet for air or water, the latter being preferred. When water is used, it should rise in the vessel to about the level indicated by dotted line *y*, and a gentle current should be kept flowing in the direction of the arrows *z*—that is, in the opposite direction to the movement of the magnets and shield, which rotate in the direction of the arrow Z. When air is used instead of water, the current should be more energetic.

Figs. II, III, and IV illustrate means which may be added to rotate the shield and magnets independently and to cut out the magnet-coils as they approach the upper part of the field. The magnet-shaft B is journaled in bearings in uprights O, and on one side has a hand-pulley Q'. The other end of the shaft is hollow, and through it pass the conductors leading to the magnet-coils. The drum or shield C has hollow journals *p*, which turn on

shaft B, and one of which carries a band-pulley P. On the magnet-shaft B, near one end, is fixed an insulated copper conducting-ring 4 and commutator 5, whose sections are insulated in the usual way. The main conductor leads to brush 6, which is in contact with ring 4, from which the circuit proceeds by parallel branch wires 7 to the several magnet-coils *b'*. The return-wires 8 lead from the several coils and connect each with one section of the commutator 5.

Q is an annular brush-holder surrounding the commutator 5 and supported by a bar *q* bolted to the frame. It carries a series of radially-arranged pencils or brushes *r*, which are pressed by springs *t* against the commutator-sections 5. The circuit continues through these brushes to the metal-holder Q, with which the return-conductor 2 is permanently connected. It will be seen from Fig. IV that several of the commutator-sections (four, as shown) have no brushes to connect them with the return-conductor. Consequently the coils connected with these sections are, for the time being, disconnected from the circuit.

Any other suitable cut-out mechanism may be substituted for that shown in the drawings.

In operation, the field-magnets and the shield C being rotated in the same direction, but at different speeds, and the ore being fed against the shield, the magnetic particles seek at once to attach themselves to the surface of the shield. As they are caused to move from one pole to another of opposite polarity, they tumble over and thus tend to clear themselves from the non-magnetic matters. This action continues until when the end of guard *d* is reached the tailings are free to disengage themselves and fall by gravity. At this point the gangue encounters the current of water or air, in which the agitation of the mass, due to the continued reversals of polarity to which each particle is exposed, assists in cleansing and separating the magnetic particles from the mixed mass. The different velocities of the magnets and shield can be determined to make these reversals occur with greater or less frequency, as may be found most desirable. When the particles adhering to the shield reach the neutral point of the field, the magnetic portions thereof are attracted to the surface of the picker-magnet H. A further separation takes place at this point, inasmuch as the particles which are largely or wholly non-magnetic have an opportunity to fall back into the receptacle G provided for the intermediate grade or lean ores.

I claim as my invention—

1. The process of separating magnetic particles from associated impurities by feeding the mass through the field of a moving series of magnets at a speed different from that of the magnets and subjecting the mass while traversing said field to continued reversals of polarity, the movement of the mass being in opposition to a current of fluid, substantially as described.

2. The combination of a series of magnets of alternately-opposite polarity arranged radially on a rotatory shaft, a tubular shield rotatable freely around said magnets and independently thereof, a hopper for delivering ore or other material against said shield, and a case or chamber inclosing said magnets and shield and provided with an inlet for admitting air or water on the side opposite to said hopper, so that the current moves in the opposite direction to the feed of the materials under treatment, substantially as described.

3. The combination of a water-tight casing provided with an inlet, a series of magnets of alternately opposite polarity arranged radially on a rotatory shaft within said case, a shield rotatable around said magnets, and a hopper having a discharge-opening, in proximity to said shield, substantially as described.

4. The combination of a series of magnets mounted on a rotatable shaft and forming a cylindrical field presenting alternately opposite poles, a shield rotatable around said magnets, a hopper having a discharge-opening at the upper part of the field, and a rotatable picker-magnet close to the upper part of the field on the side opposite to said hopper, the coils of the several field-magnets between the picker-magnet and discharge-opening being cut out of circuit, so that the field between the two points is neutral, substantially as described.

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

HENRY G. FISKE.

Witnesses:
PHILIP MAURO,
JONA B. CILLEY.