Jan. 6, 1925.

1,522,343

C. THOM

MAGNETIC SEPARATOR

Filed May 2, 1923

2 Sheets-Sheet 1

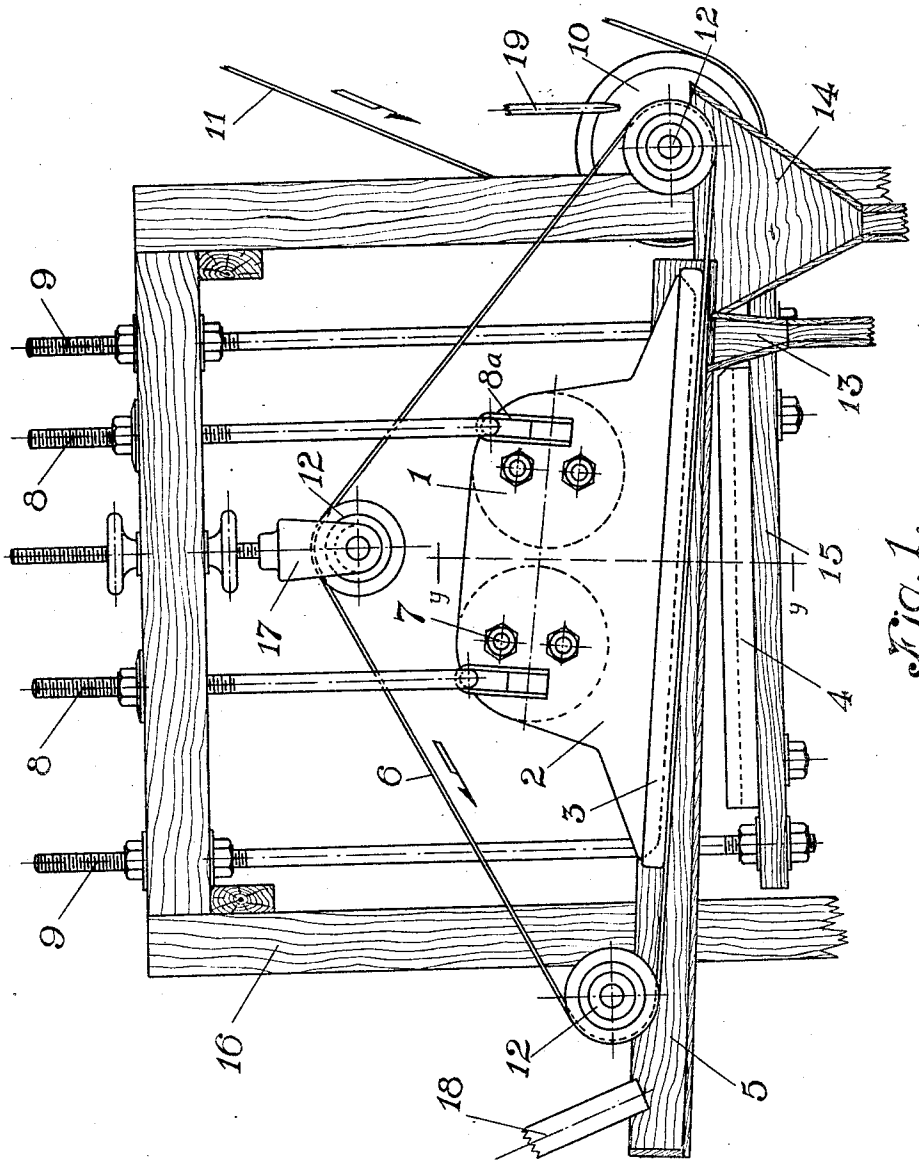

Fig. 1.

Clarence Thom
INVENTOR

WITNESS:
Jos. a. Brown
Julia O'Rourke

BY Munn & Co.
ATTORNEY

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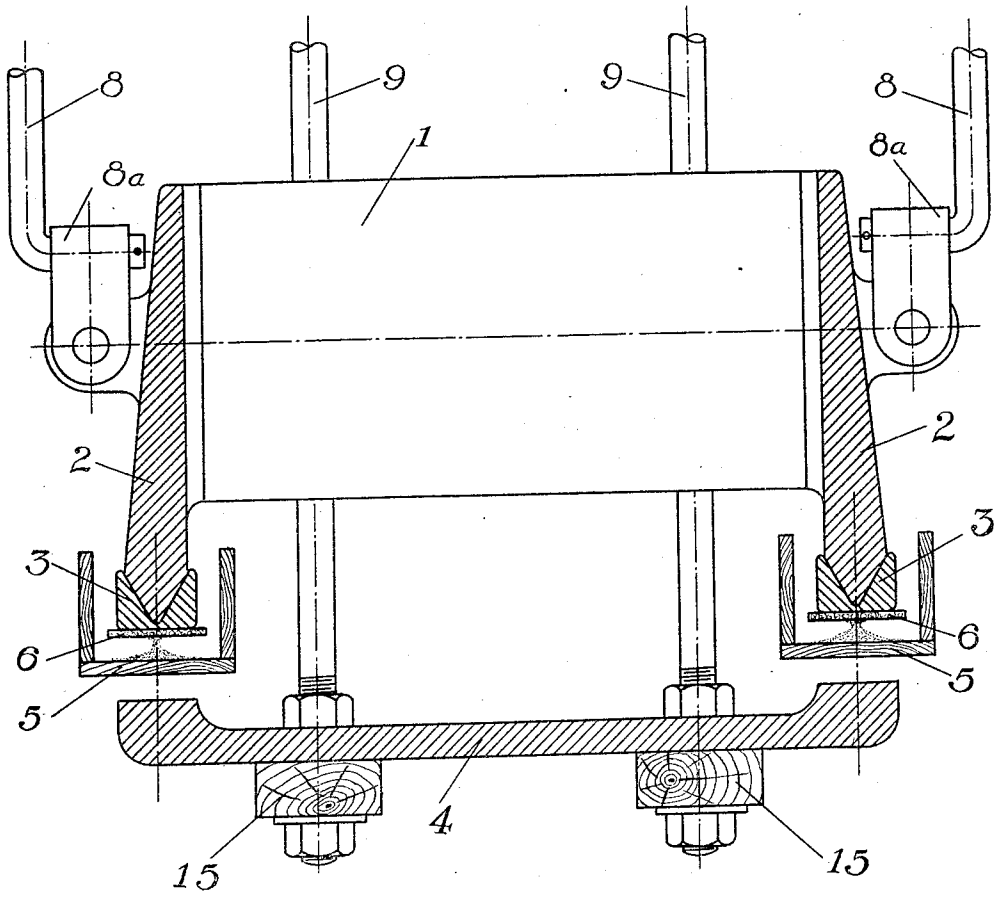

Fig. 2.

Clarence Thom
INVENTOR

WITNESS:
Jos. A. Brown
Julia O'Rourke

BY Munn & Co.
ATTORNEY

Patented Jan. 6, 1925. 1,522,343

UNITED STATES PATENT OFFICE.

CLARENCE THOM, OF WALLACE, IDAHO.

MAGNETIC SEPARATOR.

Application filed May 2, 1923. Serial No. 636,232.

To all whom it may concern:

Be it known that I, CLARENCE THOM, a citizen of the United States, residing at Wallace, in the county of Shoshone, State of Idaho, have invented certain new and useful Improvements in Magnetic Separators, of which the following is a specification.

My invention relates to improvements in machines and devices for the separation of magnetic substances from non-magnetic substances by the application of magnetic force.

The primary object of my invention, is to carry the material while immersed, or partially immersed in water, longitudinally through an extended and continuous magnetic field of gradually increasing strength, with the greatest intensity at any given point at the center of the flow, by which arrangement, the material is subjected to the influence of the magnetic force for an extended period of time, and the magnetic material is first partially segregated from the non-magnetic before it is finally lifted or removed from the flow, thus affecting a cleaner and more perfect separation.

Another object, is to carry the material through an extended and continuous magnetic field of gradually increasing strength, by which arrangement the more magnetically susceptible pieces or particles are first lifted and removed from the mixture, and the less susceptible are later removed as they severally reach the point where the magnetic attraction is sufficient to remove them.

Another object, is to achieve the separation while the material is immersed, or partially immersed in water, thus eliminating the necessity of drying the feed and avoiding all dust, and obtaining the advantage of the action of the water in the process of segregation and separation.

Another object, is the application of the same principle to the separation of dry material by carrying it longitudinally through an extended and continuous magnetic field of gradually increasing strength. This object is accomplished by a few simple mechanical substitutions, as more fully appears from the detailed description that follows.

I attain these objects by the mechanism illustrated in the accompanying drawings, in which Fig. 1 is a vertical sideview of the entire machine, both sides being identical in construction and operation. Fig. 2, is a vertical section of the machine on line *yy* of Fig. 1.

Similar numerals refer to similar parts throughout the several views.

Referring more particularly to the drawings, the machine is composed of a double coil electromagnet 1, which is hung from the frame 16, by adjustable supporting rods 8, and clevises 8^a. The electromagnet is equipped with special pole pieces 2, attached by means of bolts 7. The pole pieces 2, extend downward sufficiently to permit them to be suspended between the sides of the launders 5, hereafter described. The underside or bottom of each pole piece 2, tapers to a double beveled edge to concentrate the flow of magnetic flux along the center line. A special cross bar plate 4, is supported on beams 15, which are hung from the frame 16, by adjustable rods 9. The cross bar 4, extends from one pole piece to the other, but with a space intervening between its raised ends and each pole piece 2. The cross bar 4, is, in reality, a secondary magnet, forming a path for the flow of magnetic flux from one pole to the other of the electromagnet.

Carrying belts 6, are arranged to travel over three small pulleys 12, longitudinally and in contact with the underside of each pole piece 2, and through the intervening space between pole pieces 2 and cross bar 4. The magnetic material is attracted to these belts and carried to the bin or receptacle 14, where it is discharged. This method of securing the application of the magnetic force and disposing of the magnetic material is not new, and is not a part of the invention.

The cross bar 4, is adjusted by means of supporting rods 9, to a horizontal position with its raised ends directly under the pole pieces 2. The magnet and pole pieces 2, are adjusted by means of the supporting rods 8, and clevises 8^a, to a position so that the space between the pole pieces 2, and cross bar 4, is greater at the end where the material enters the magnetic field than at the other end. Since the strength of the magnetic field varies inversely with the depth of this space, the condition is here achieved that the magnetic field increases in strength as this space decreases in depth.

Troughs or launders 5, are interposed lon-

gitudinally through the spaces between the pole pieces 2, and the raised ends of the cross bar 4, sufficiently elevated above the horizontal at the inlet 18, to permit the material in water to flow through the magnetic field from the point of weakest magnetic strength toward the point of greatest magnetic strength. The launders 5, are so placed that the center line is directly between the center line of the beveled edge of the pole pieces 2, and the raised ends of the cross bar 4. Hence, the point of greatest magnetic intensity at any given point along the course of flow, will pass through the center of the launders 5. The launders 5, are so placed that the neutral point at which the polarity changes, will fall below the bottom of them.

The ore, or other material to be separated, and water, are admitted into the launders 5, through the inlets 18, and are allowed to flow along and through the launders the extended length of the pole pieces, entering the magnetic field at the point of weakest magnetic strength. As the magnetic material enters the magnetic field, and before it reaches a point where the attraction is sufficient to lift it from the flow, it is gradually attracted toward the center of the launder, that being the point of greatest intensity at any given point along the flow. The non-magnetic material, being unaffected by the magnetic force, flows, or is washed along the launders in its natural course until discharged into pocket 13. Thus when the magnetic material reaches a point where the magnetic strength is sufficient to lift it from the flow, it is very largely segregated from the non-magnetic material, and when lifted, but little, if any, non-magnetic material is lifted with it.

Permitting the material to flow as above described, through the extended length of the magnetic field of gradually increasing strength, also results in the particles or pieces of more magnetically susceptible material being drawn or lifted from the flow before the less susceptible are removed, thus affording greater freedom in the action of the magnetic force and the water in segregating the remaining material.

The magnetic material, after being attracted to the belts 6, is carried to and discharged into bin or compartment 14. This is achieved by permitting the pole pieces 2, to extend beyond the end of the cross bar 4, thus releasing the material from the belts when it reaches a point beyond the influence of the magnetic attraction. Water jets 19, play upon the belts 6, to insure a complete discharge of the material. The non-magnetic material and water are discharged by gravity from the launders 5, into pockets 13.

By the simple substitution of a belt or other carrying device in place of the launders described in the drawings, the principle of subjecting the mixture to magnetic force for an extended time while passing through an extended and continuous magnetic field of gradually increasing strength, can be applied to dry material or feed, with somewhat similar results.

The other numerals in the drawings refer as follows: 10 is the drive pulley for furnishing motive power to the carrier belt 6. 11 is the drive belt for same. 17 is a tightener mechanism with which to adjust the carrier belts 6. 3 represents the brass wearing surface attached to the pole pieces 2, to afford a contact surface for the carrier belts 6.

It is understood that the invention is not limited to the precise construction set forth, but that it includes within its purview whatever changes fairly come either within the terms or the spirit of the appended claims.

I claim:

1. The process of separating magnetic from non-magnetic materials which comprises feeding a stream of such magnetic and non-magnetic materials along a definite path, subjecting such stream of material to the action of a continuous magnetic field of gradually increasing strength and at the same time causing the greatest intensity of the magnetic flux to be directed towards the middle portion of the stream, whereby the metallic particles of the stream are attracted towards the center and a partial separation of the magnetic materials from the non-magnetic materials is effected before the final lifting from the mass.

2. The process of separating magnetic from non-magnetic materials which comprises feeding a stream of such magnetic and non-magnetic materials along a definite path, subjecting such stream of material to the action of a continuous magnetic field of gradually increasing strength and at the same time causing the greatest intensity of the magnetic flux to be directed towards the middle portion of the stream, whereby the metallic particles of the stream are attracted towards the center and a partial separation of the magnetic materials from the non-magnetic materials is effected before the final lifting from the mass, withdrawing the non-magnetic materials at a point along the path and then discharging the magnetic materials at a point beyond the discharge of the non-magnetic materials.

3. The process of separating magnetic from non-magnetic materials which comprises feeding a stream of such magnetic and non-magnetic materials along a definite path, subjecting such stream of material to the action of a continuous magnetic field of gradually increasing strength and at the same time causing the greatest intensity of

the magnetic flux to be directed towards the middle portion of the stream, whereby the metallic particles of the stream are attracted towards the center and a partial separation of the magnetic materials from the non-magnetic materials is effected before the final lifting from the mass, and discharging the magnetic materials at a point slightly beyond the point of greatest intensity of the magnetic flux.

4. A magnetic separator comprising upper and lower poles, a travelling member moving through the field gap for carrying magnetic materials, means for tilting one of the poles longitudinally and at an angle to the plane of the other pole whereby the strength of the field is progressively increased from one end to the other end of the field, one of the poles being V-shaped in cross sectional area for causing the greatest intensity of the magnetic flux to be directed towards the longitudinal center of the travelling member.

5. A magnetic separator comprising upper and lower poles, a travelling member moving through the field gap for carrying magnetic materials, means for tilting one of the poles longitudinally and at an angle to the plane of the other pole whereby the strength of the field is progressively increased from one end to the other end of the field, one of the poles being V-shaped in cross sectional area for causing the greatest intensity of the magnetic flux to be directed towards the longitudinal center of the travelling member, a shoe having a longitudinal V-shaped groove connected to the pole of V-shaped cross sectional area, and adapted to afford a contact surface for the travelling member.

CLARENCE THOM.