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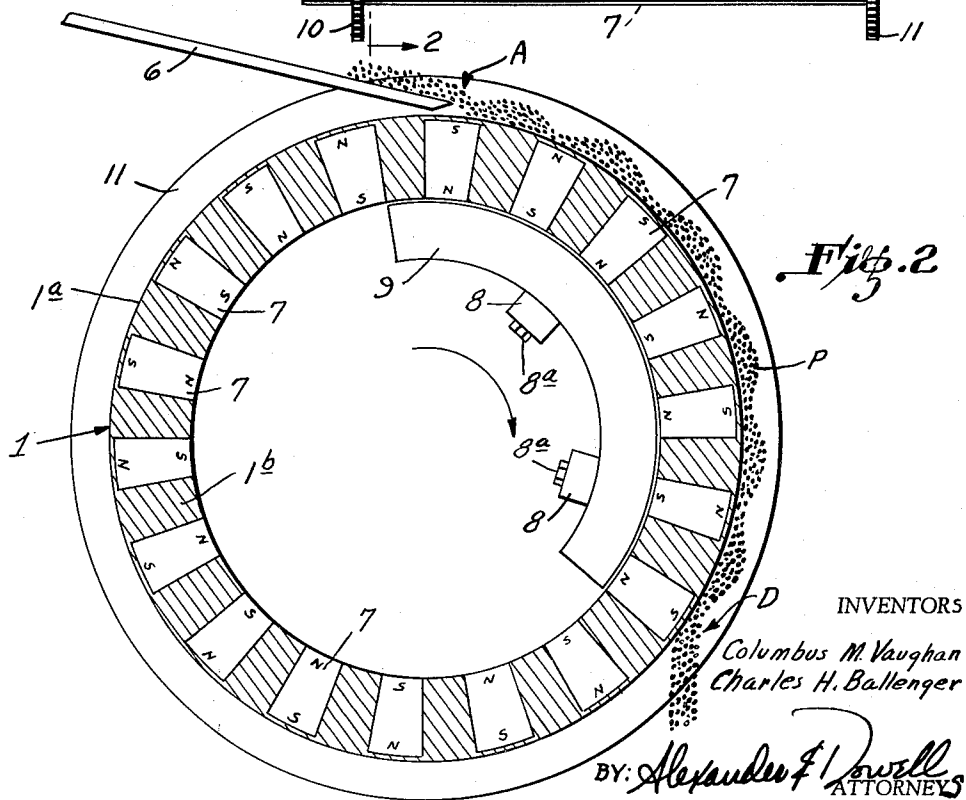
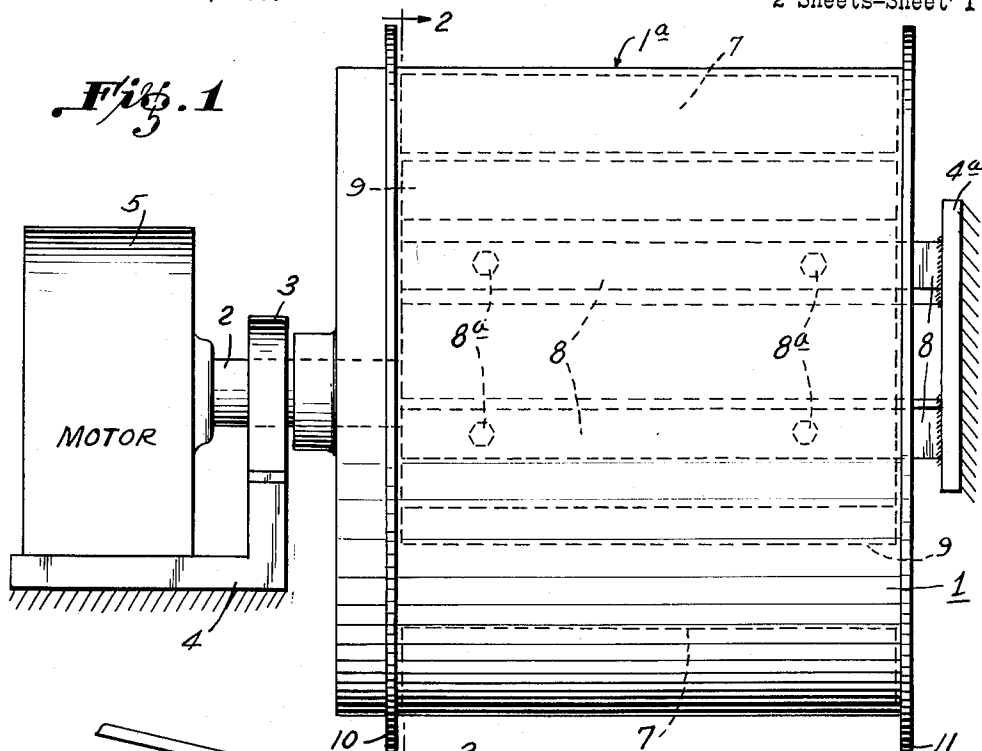
C. M. VAUGHAN ET AL
BLAST CLEANING MACHINES

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2 Sheets-Sheet 1

Fig. 1



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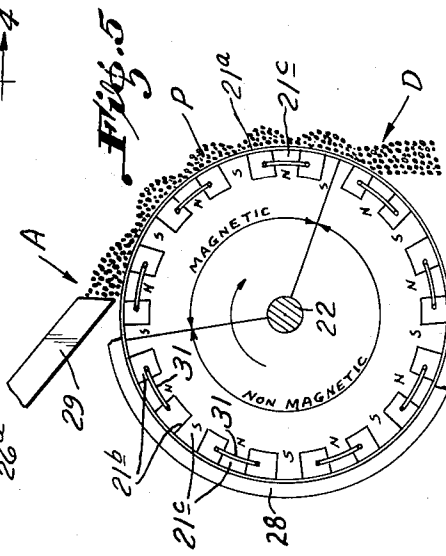
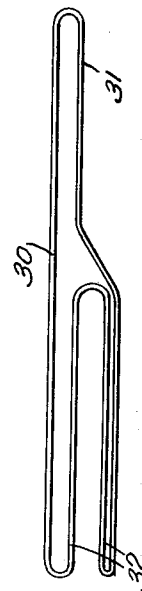
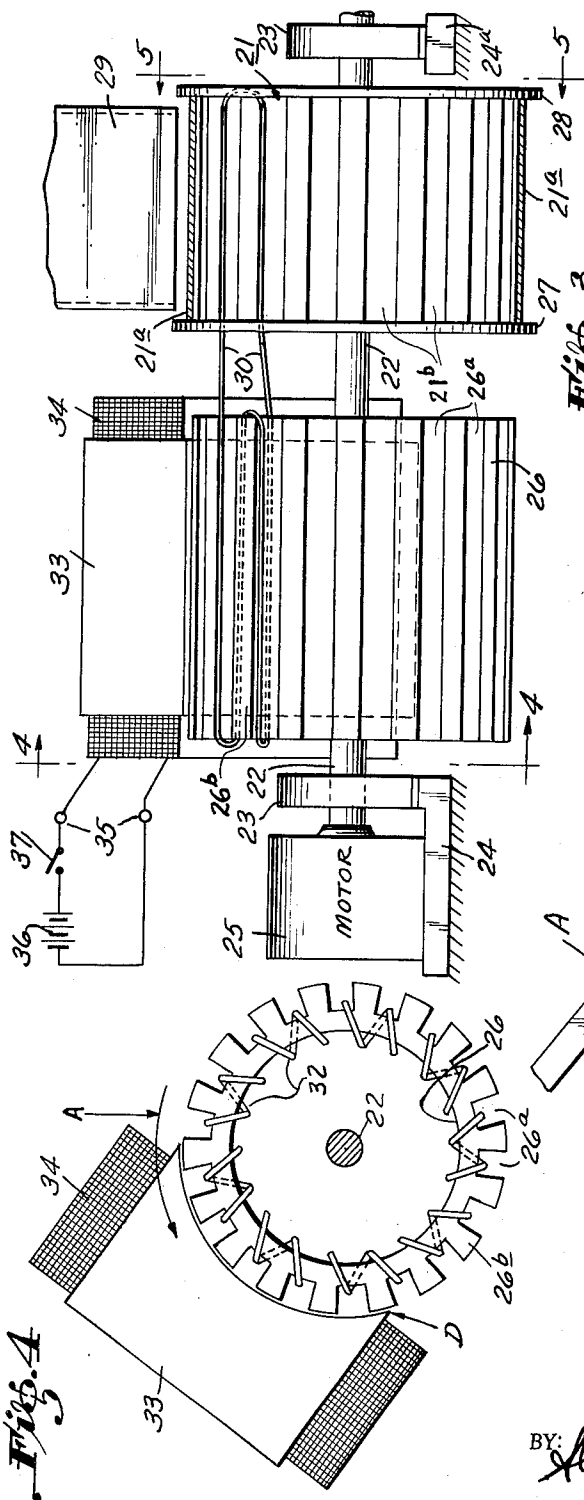


Fig. 4

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BLAST CLEANING MACHINES

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10 Claims. (Cl. 51-9)

This invention relates to abrasion machines and more particularly relates to an improved rotary abrasive-particle accelerating and projecting machine of the type employing magnetic means for holding the particles against the periphery of the rotor while they are being accelerated to a point of discharge whereat the particles are thrown from the rotor against a working surface.

The illustrated embodiment of the machine comprises a drum capable of attracting paramagnetic grit or shot particles, and holding these particles while accelerating the same through part of the peripheral path of the drum. The particles are then thrown therefrom with such a force as to clean, treat or cut metal or other materials. The shot or grit particles are applied to the drum by a conveyor or by a gravity feed chute. In the present machine, the magnetic force is employed to hold the particles against the drum until a satisfactory speed of rotation is reached, whereupon the magnetic force is either shut off entirely or sharply reduced so as to release the grit and throw it from the periphery of the drum. Just inside the outer periphery of the drum there is an annular series of north and south magnetic poles which are created by either permanent magnets or by electromagnets located within the drum under its peripheral surface. This surface may be either smooth or grooved, and the rotor is driven by a suitable prime mover which itself comprises no part of the invention.

It is an important object of this invention to provide a machine having a particle-accelerating rotor of improved design wherein the magnetic particle-attracting means are mounted beneath the cylindrical outer surface of the rotor so that the magnets are enclosed and protected from damage by contact with the particles.

Another important object of this invention is to provide a rotary drum carrying individual magnet means disposed with alternate north and south polarity under the surface of the drum. The inclusion of the magnet means as an annular series within the drum itself permits lengthening of the drum in the direction of its axis so as to provide a larger cylindrical surface for carrying the particles without at the same time weakening the flux density, as would happen if the magnets were mounted on a frame adjacent the drum and were therefore stationary with respect thereto.

Still another object of the invention is to provide improved means for controlling the strength of the flux field near the surface of the drum at various points around the rotary path of the drum, while at the same time eliminating moving contact such as commutator segments or slip rings which have been employed in some of the prior art devices.

Other objects and advantages of the invention will become apparent during the following discussion of the drawings, wherein:

FIG. 1 is an elevation view of an embodiment of an abrading machine according to the present invention showing a rotary drum carrying fixed bar magnets and driven by a motor adjacent a magnetic path completing segment;

FIG. 2 is a section view taken along line 2-2 of FIG. 1;

FIG. 3 is a side elevation of a second embodiment of the machine employing electromagnets according to the present invention;

FIG. 4 is a section view taken along line 4-4 of FIG. 3;

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FIG. 5 is a section view taken along line 5-5 of FIG. 3; and

FIG. 6 is a view of a winding of the type employed in the machine according to the embodiment of FIG. 3.

Referring now to FIGS. 1 and 2, it will be seen that the abrading machine comprises a drum 1 mounted on a shaft 2 supported in a bearing 3 which is in turn supported by a frame 4. The frame also carries a motor 5 which is connected to the shaft 2 to drive the drum 1. The drum comprises an annular structure having a cylindrical surface 1a onto which paramagnetic particles P are applied by a chute 6 which could also comprise a conveyor in a more complicated form of the invention.

Within the drum 1 are a plurality of permanent magnets 7 which extend across the drum 1 beneath the cylindrical surface 1a. The magnets 7 are arranged so that they alternately present north and south poles to the under side of the surface 1a, and the magnets are spaced apart by intervening material 1b, which separates the magnets 7 by uniform spacings. The drum itself may be made out of any suitable material as long as the material is not paramagnetic.

A portion 4a of the frame 4 also supports two mounting rods 8 which extend into the open end of the drum and are bolted by means of bolts 8a to a paramagnetic sector 9. The sector 9 is not itself magnetized, and is preferably made of some easily magnetized material such as soft iron. The sector is disposed so that it lies close to the inner periphery of the drum and in particular close to the inner poles of the magnets 7 as they revolve into close proximity with the sector 9.

As the drum is rotated by the motor 5, the magnets come alternately into close proximity with the sector 9 and then pass away from the sector 9. When the sector is adjacent the inner poles of the magnets 7 it completes magnetic flux paths between adjacent different poles and thereby greatly reduces the air gap between adjacent magnets so as to greatly strengthen the flux appearing between the outer poles of the magnets 7 which lie just under the outer cylindrical surface 1a of the drum. Therefore, when the magnets are adjacent the sector 9, the attraction of the outer poles of the magnets for the paramagnetic particles P is much greater than when the magnets pass away from the sector 9.

As can be seen in FIG. 2, the magnetic particles drop onto the surface of the drum at the lower end of the chute 6, and at this point of application A the magnets coming under the end of the chute 6 also come opposite the sector 9. The sector extends partway around the inner periphery of the drum, but ends opposite a discharge point generally designated by the reference character D where the magnetic particles are discharged more or less tangentially from the drum in the direction of a work surface (not shown). Two annular flanges 10 and 11 are located at opposite ends of the cylindrical surface 9a so as to confine the particles to substantially annular motion and prevent their accidental discharge off of the ends of the drum.

Referring now to the embodiment of the invention shown in FIGS. 3, 4, 5 and 6, it will be seen that this modification includes a rotor 21 mounted on a shaft 22 which is in turn supported in bearings 23 which are mounted on frame members 24 and 24a. The shaft and the drum are rotated by a motor 25, and the shaft also carries a generator armature 26, the armature 26 and the rotor 21 being keyed to the shaft for unitary rotation. The rotor 21 has substantially the same external shape as the rotor 1 shown in the first embodiment, and includes a cylindrical particle-receiving surface 21a located between two flanges 27 and 28 serving to confine the particles in the axial direction to the drum itself. A chute 29 is provided to deposit paramagnetic abrasive particles P

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on the cylindrical surface 21a of the drum 21 in the manner described in connection with the preceding embodiment. The chute 29 may be either of the gravity feed type or may alternatively comprise a power driven conveyor.

The rotor 21 has an annular series of axially disposed slots 21b which form salient poles 21c around the periphery of the rotor which in this case is made of a paramagnetic material. For instance, this rotor could be made of laminations of soft iron covered by an annular sheet 21a which forms the outer particle-receiving surface.

Likewise, the armature 26 is made of paramagnetic material and has a plurality of slots 26a which leave an annular series of poles 26b. The number of poles 26b on the armature 26 is integrally related to the number of poles 21c on the rotor 21, and mutually separate windings 30 interconnect corresponding rotor and armature poles in the manner shown in FIG. 3. A single winding is shown in FIG. 6, and it will be seen that the winding itself is reentrant and is not connected to any other winding. Each winding 30 has at one end windings 31 which lie in the slots 21b of the rotor 21, and each winding has at its other end windings 32 which lie in the slots 26a of the armature 26 and surround the poles 26b. For the sake of generalization, the winding shown in FIG. 6 has a different number of turns on the left side than on the right side, and it is to be understood that the number of turns on the armature may not be precisely equal to the number of turns on the rotor, and that the number of poles on the armature may not be precisely equal to the number of poles on the rotor. The winding shown in FIG. 6 may consist either of a plurality of turns with the ends thereof interconnected, or alternately may be a heavy busbar type winding with the two ends connected together.

At any rate, when the motor 25 rotates the armature 26 and the rotor 21, the windings 32 pass adjacent to the field pole 33 which has a substantially constant flux which is cut by the windings 32. This field pole 33 may also include a winding 34 having its two leads brought out to terminals 35 which are in turn connected to a source of direct current such as a battery 36 through a control switch 37.

The length of the arc from the point of application A to the point of discharge D is determined by the length of the pole 33 in the annular direction. In other words, the annular distance from the point A to the point D in FIG. 5 is determined by the length of the pole 33 in the annular direction, as shown in FIG. 4. As the shaft 22 is rotated by the motor 25, the armature is rotated past the field pole 33, and the particular windings 32 which are temporarily located opposite the field pole 33 cut the flux therefrom and thereby generate current which flows through the entire winding 31 which is carried by the rotor 21. Thus, the winding 31 magnetizes the particular pole 21c of the rotor 21 around which it passes and thereby propagates a magnetic flux which extends outwardly beyond the surface 21a of the drum to which the particles are applied. The current in the winding 30 is sustained until the particular winding passes beyond the field pole 33, whereupon the current decreases substantially to zero and the pole becomes demagnetized, this occurring at the discharge point D. In the drawing, in FIGS. 3, 4 and 5, not every pole is shown as having a winding thereon, for the sake of simplifying the drawing. However, as many poles and as many windings as desired can be employed.

We do not limit our invention to the exact forms shown in the drawings for obviously changes can be made therein within the scope of the following claims.

We claim:

1. A rotary particle projecting machine for accelerating and casting paramagnetic particles against a work surface to be cleaned, said machine being driven by a

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motor and comprising a frame; a shaft journaled on said frame and coupled with the motor; a drum co-axially mounted on the shaft and having a cylindrical outer surface; means at a particle deposit point adjacent the drum for depositing particles on said cylindrical surface; an annular series of separate magnet means attached within the drum and closely underlying said cylindrical surface for establishing particle-attracting flux in the vicinity of said cylindrical surface; and stationary flux-control means fixed to the frame and extending in a sector from the deposit point in the direction of drum rotation to a point of tangential particle discharge, said flux-control means being inductively coupled by magnetic flux to each magnet means while in said sector for increasing the flux density at said drum surface between the magnet means when within said sector as compared with the flux density between the magnet means when outside of said sector.

2. In a machine as set forth in claim 1, said magnet means comprising an annular series of bar magnets attached inside the surface of said drum parallel to its axis and having north and south poles alternately located at the outer peripheral surfaces of the magnets adjacent said cylindrical surface, the bar magnets being mutually circumferentially spaced; and said flux-control means comprising a sector of paramagnetic material fixed to the frame inside said drum and adjacent the inner peripheral surfaces of said bar magnets, said sector completing a flux path through each pair of bar magnets coming into close proximity therewith.

3. In a machine as set forth in claim 1, the axial length of the drum and of the cylindrical surface being at least as great as the radius of the drum; and an annular outwardly extending flange at each end of said cylindrical drum surface for confining the particles thereto.

4. In a machine as set forth in claim 1, said drum having an annular series of paramagnetic poles each disposed longitudinally thereof; an armature on said shaft having poles corresponding with the poles of said drum, mutually separate windings on each drum pole and each encompassing corresponding armature poles, the windings and poles comprising said magnet means; and said flux control means comprising a field pole adjacent said armature and coextensive with said sector, the field pole propagating flux interacting with the armature windings which pass thereadjacent to magnetize the corresponding poles on the drum.

5. In a machine as set forth in claim 4, said field pole having a field winding connected to a source of direct current.

6. A rotary particle projecting machine for accelerating and casting paramagnetic particles against a work surface to be cleaned, said machine being driven by a motor and comprising a frame; a shaft journaled on said frame and coupled with the motor; a drum coaxially mounted on the shaft and having a cylindrical outer surface; means at a particle deposit point adjacent the drum for depositing particles on said cylindrical surface; an annular series of magnet means attached within the drum and closely underlying said cylindrical surface and establishing particle-attracting flux in the vicinity of said cylindrical surface; and stationary magnetic flux-control means extending in a sector from the deposit point in the direction of drum rotation to a point of tangential particle discharge, said control means being magnetically coupled with the magnet means when within said sector to increase the particle attracting flux as compared with the flux of the magnet means when outside of said sector.

7. In a machine as set forth in claim 6, said magnet means comprising an annular series of bar magnets attached inside the surface of said drum parallel to its axis and having north and south poles alternately located at the outer peripheral surfaces of the magnets adjacent said cylindrical surface, the bar magnets being mutually circumferentially spaced; and said flux-control means comprising a sector of paramagnetic material fixed to the

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frame inside said drum and adjacent the inner peripheral surfaces of said bar magnets, said sector completing a flux path through each pair of bar magnets coming into close proximity therewith.

8. In a machine as set forth in claim 6, the axial length of the drum and of the cylindrical surface being at least as great as the radius of the drum; and an annular outwardly extending flange at each end of said cylindrical drum surface for confining the particles thereto.

9. In a machine as set forth in claim 6, said drum having an annular series of paramagnetic poles each disposed longitudinally thereof; an armature on said shaft having poles corresponding with the poles of said drum, mutually separate windings on each drum pole and each encompassing corresponding armature poles, the windings and poles comprising said magnet means; and said flux-

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control means comprising a field pole adjacent said armature poles and coextensive with said sector, the field pole propagating flux interacting with the armature windings which pass thereadjacent to magnetize the corresponding poles on the drum.

10. In a machine as set forth in claim 9, said field pole having a field winding connected to a source of direct current.

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