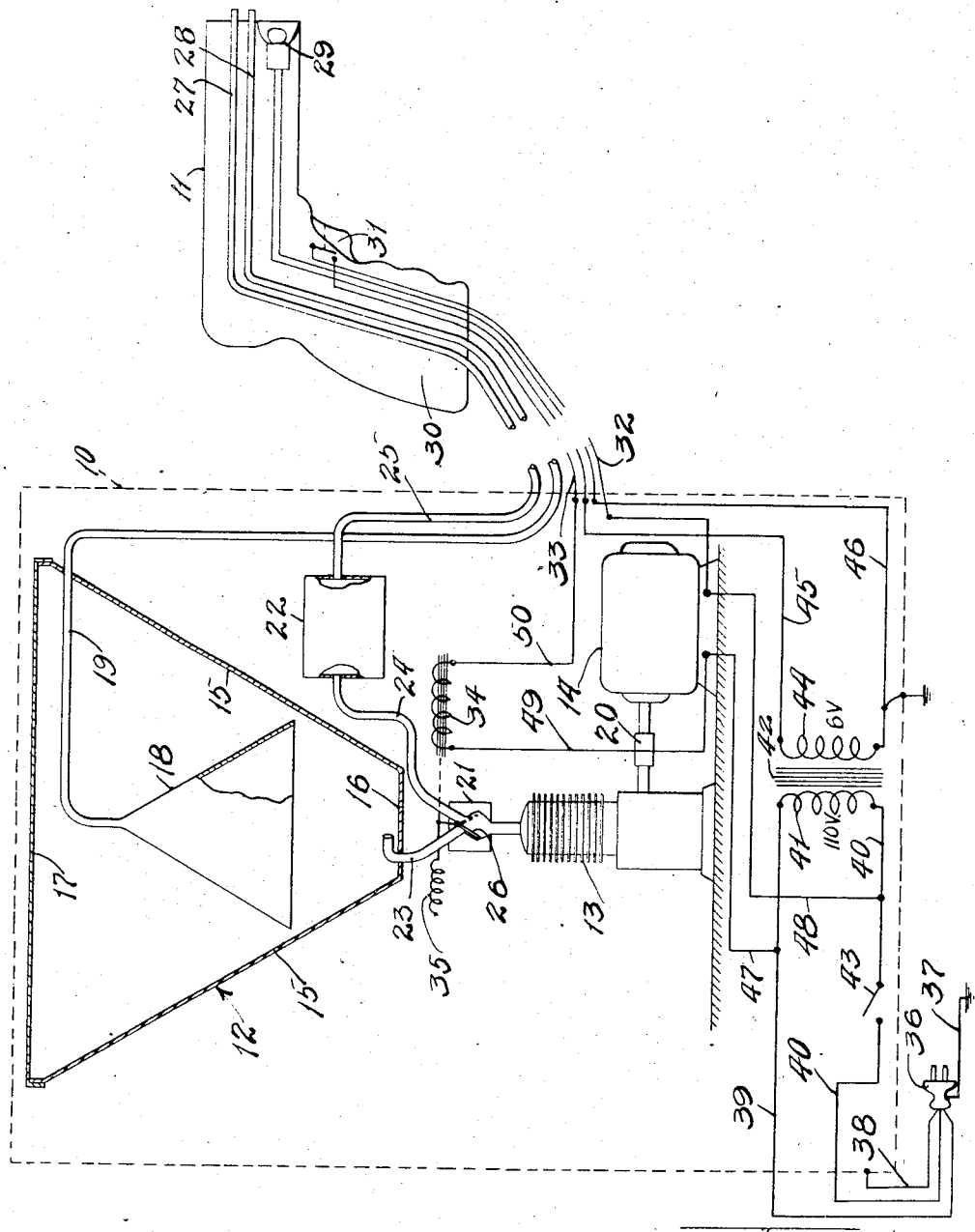
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MAGNETIC INSPECTION APPARATUS

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Inventor
Lee de Forest.

By. Attys.

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MAGNETIC INSPECTION APPARATUS

Taber de Forest, Chicago, Ill., assignor to Magnaflux Corporation, Chicago, Ill., a corporation of Delaware

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This invention relates to a means for magnetic inspection and more particularly to a novel means for applying paramagnetic powder to a magnetized article.

It is well known now that if a steel part or other magnetizable object is magnetized and paramagnetic powder is then applied on the surface of the magnetized object, the powder will congregate or become more dense over a surface or over a subsurface defect, than over portions of the object which have no appreciable flaws or defects. This, of course, provides a simple and convenient method for non-destructive testing of magnetizable metal objects for flaws and defects.

The paramagnetic powder may be applied to the magnetized object in a dry state or the paramagnetic powder may be carried in suspension in liquid, such as a light oil, and either sprayed over the object or applied to the object in the form of a bath.

The above invention relates to a novel means for applying paramagnetic powder to a magnetized object in a dry state. More particularly, it is an object of the present invention to provide a novel means for delivering and applying the powder at very low velocity.

It is a further object of the present invention to provide a novel means for applying paramagnetic powder to a magnetized object in which the powder is borne in a light cloud at low velocity and in which a gaseous fluid, such as air, acts as a suspensoid.

Another and further object of the present invention is to provide a novel means of first applying dry paramagnetic powder to a magnetized object and thereafter applying a light blast of gaseous fluid, such as air, to blow away the excess powder.

Another and still further object of the present invention is to provide a novel powder blower unit including a powder gun having an air nozzle, an air and powder nozzle, and a light therein for illuminating the work.

Still another and further object of the present invention is to provide a novel powder blower unit having novel means therein for effecting a fine suspenson of paramagnetic powder in a low velocity stream of air.

The novel features which I believe to be characteristic of my invention are set forth in particularity in the appended claims. My invention itself, however, both as to its organization, manner of construction and method of operation, together with further objects and advantages thereof, may best be understood by reference to

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the following description, taken in connection with the accompanying drawing, in which the single figure thereof illustrates diagrammatically a powder blower unit which is an embodiment of the present invention.

The powder blower unit as illustrated in the drawing includes a powder blower 10 and a powder gun 11. The powder blower 10, in general, comprises a closed hopper 12 which is initially filled with paramagnetic powder, an air compressor 13 and a motor 14.

The hopper 12 is preferably V-shaped in cross section including downwardly and inwardly converging side walls 15 a bottom wall 16 and a top cover member 17.

Disposed within the hopper 12 is a hood 18, the lower mouth of the hood being of such dimensions as to extend over almost but not quite to the side walls 15 of the hopper 12. The hood 18 is preferably of conical shape and is connected at its upper end to a conduit or hose 19.

A compressor 13 is mounted below the hopper 12 and is driven by the motor 14 through a suitable coupling 20. The compressor 13 is connected through a two-way valve 21 to the hopper 12 and to an air tank 22. More specifically, the two-way valve 21 is connected to a conduit 23 which enters the hopper 12 through the base wall 16. The valve 21 is also connected to a conduit 24 to the air tank 22, which in turn is connected to a conduit or hose 25 which extends out to the powder gun 11. The valve 21 has a valving member 26 which is arranged to be moved between the full line position, as shown in the drawing, and the dotted line position, as shown in the drawing. When in the full line position, as shown in the drawing, the member 26 has closed the conduit 23 and thus air under pressure is fed only to the air tank 22 and to the hose 25. When the valve member 26 is moved to the dotted line position, as shown in the drawing, the conduit 24 is closed and the conduit 23 is open. Air under pressure is then fed to the hopper 12. This air under pressure forces some of the paramagnetic powder up into the hood 18 and thence into the hose 19. The pressure is so adjusted that the resulting air stream is of relatively low velocity. The arrangement of the hood 18 and the hopper in conjunction with the conduit 23 causes a fine cloud of paramagnetic powder to be formed in the air stream which moves through the hose 19 and emerges from the powder gun 11.

The powder gun 11 has a pair of conduits 27 and 28 passing therethrough to which the hoses 25 and 19, respectively, are connected. The pow-

der gun 11 also has a light 29 mounted in the forward end thereof immediately below the conduit 27 and 28. The powder gun 11 has a handle portion 30 which provides a convenient grip, and is also provided with a trigger switch 31 which, when depressed, connects a conductor 32 to a conductor 33 which are in a valve operating control circuit presently to be described.

The valve member 26 of the valve 21 is arranged to be operated by a solenoid 34. A biasing spring 35 is connected to the valve member 26 in such a manner that the valve member 26 is normally held in its full line position, as shown in the drawing. The valve member 26 is arranged to be moved to its dotted line position when the solenoid 34 is energized against the action of the biasing spring 35. (It is, of course, to be understood that the representations in the drawing of the biasing spring 35 and the solenoid 34 are merely diagrammatic.)

The unit is arranged to be electrically connected to a suitable source of alternating current through a plug 36. The plug 36 also preferably has a ground connection 37 which enables the powder blower casing to be grounded by a conductor 38. The plug 36 is attached to conductors 39 and 40 which are connected to the primary winding 41 of a transformer 42 through a switch 43. The secondary 44 of the transformer 42 is connected through a pair of conductors 45 and 46 to the lamp 29. The transformer 42 is preferably a step-down transformer to enable the lamp 29 to be energized by a six volt supply. It will be understood that whenever the switch 43 is closed the lamp 29 is lit. The motor 14 is connected in parallel with the primary 41 of the transformer 42 through conductors 47 and 48, and hence is connected directly to the power source when the switch 43 is closed. The control circuit of the valve 21 is connected in parallel with the motor 14 through a conductor 49 on one side and through conductors 50, 33, trigger switch 31 and conductor 32 on the other side.

To operate the powder blower unit the plug 36 is plugged into a suitable source of alternating current power such, for example, as a source 110 volt, 60 cycle, single phase alternating current. The switch 43 is then closed. The motor 14 and the light 29 are both energized when the switch 43 is closed. Energization of the motor 14 causes operation of the compressor and since the biasing spring 35 is holding the valve member 26 in the position as shown by the full line in the drawing, air under pressure is fed through conduit 24, air tank 22, conduit 25, and conduit 27 of the powder gun 11. A stream of air thus emerges from the muzzle of the gun 11.

Assuming that it is now desired to deposit a coating of paramagnetic particles on a magnetized object to be tested, the trigger switch 31 is depressed to cause energization of the solenoid 34. The valve member 26 thereupon moves over to the dotted line position as shown in the drawing, which causes air under pressure to pass into the hopper 12. This air under pressure emerging from the conduit 23 in the lower portion of the hopper 12 forces some of the paramagnetic particles in the hopper 12 up into the hood 18. The paramagnetic particles thus forced up into the hood 18 are carried in the form of a fine cloud in the air stream which is flowing out through the hose 19 and then through the conduit 27 of the powder gun 11. It will be noted that due to the fact that the hopper is entirely closed and sealed that a stream of air will result in the hose 19 due to the fact that air under pressure is being fed into the hopper through the conduit 23 from the compressor 13. The air which acts as a suspensoid for the fine paramagnetic particles is then directed over the magnetized object to be tested by directing the muzzle of the powder gun 11 at the portion of the magnetized object to which the powder is to be applied. Due to the fact that the light 29 is carried in the muzzle of the powder gun 11, it will readily be apparent that the portion of the object to which the powder is being supplied is illuminated during this operation.

After the paramagnetic powder has been deposited on the magnetized object the trigger switch is released to open the energizing circuit of the solenoid 34. A stream of air now emerges from the muzzle of the powder gun 11 in the place of a stream of air having paramagnetic powder suspended therein. This is directed over the portion of the magnetized object to which the powder has been applied. This blows off all of the paramagnetic particles previously deposited on the object with the exception of those particles which have congregated over defects or flaws in the magnetized article. The particles over the defect or flaw are retained on the object due to the fact that there is an increase in flux density at this point.

From the foregoing description it will be apparent that a very simple and efficient method and means is provided by the present invention for applying paramagnetic powder in a dry state to a magnetized object which is to be tested for flaws or defects and which readily and conveniently removes excess powder or powder which is not concentrated over defects on the magnetized object. It will further be observed that a novel method and means is provided for causing a fine suspension of paramagnetic particles in an air stream in which the air forms a suspensoid for the particles.

While I have shown a particular embodiment of my invention, it will, of course, be understood that I do not wish to be limited thereto, since many modifications may be made, and I, therefore, contemplate by the appended claims to cover all such modifications as fall within the true spirit and scope of my invention.

I claim as my invention:

1. Apparatus for testing a magnetized object for flaws and other defects comprising a closed hopper having paramagnetic powder therein, a hood in said hopper diverging downwardly a conduit communicating with the upper part of said hood and extending out of said hopper, an air compressor, a powder gun, said powder gun having a pair of conduits therein and extending out through the muzzle of said gun, one of said conduits in said gun being connected to the conduit in communication with the hood and the other of said conduits in said gun being connected to said air compressor, said air compressor also having a discharge conduit extending into the lower part of said hopper, and valve means in the discharge of said air compressor for selectively directing air to said hopper or directly to said gun.

2. Apparatus for testing a magnetized object for flaws and other defects comprising a closed hopper having paramagnetic powder therein, a powder gun having a pair of muzzles, a compressor, means for selectively connecting the discharge side of said compressor to one of said muzzles and to said hopper, and conduit means extending between said hopper and the other of said muzzles.

3. Apparatus for testing magnetized objects for flaws and other defects comprising a closed hopper having paramagnetic powder therein, a powder gun having a pair of muzzles and a trigger operated switch, a compressor, conduit means connecting the discharge side of said compressor to said hopper and to one of said muzzles, a two-way valve in said conduit means for selectively controlling the passage of air from said compressor to said hopper and to said one of said muzzles, selectively operable means including said trigger switch for controlling the operation of said two-way valve, and conduit means extending between said hopper and the other of said muzzles.

4. In apparatus for testing magnetized objects for flaws and other defects including means for selectively supplying one of two streams of air, one of the streams having paramagnetic powder in suspension, the subcombination comprising a powder gun having a muzzle with a pair of air ducts therein, one of said ducts being arranged to receive one of said streams of air and the other of said ducts being arranged to receive the other of said streams of air, and means on said gun for selectively controlling the flow of said streams through said ducts.

TABER DE FOREST.

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