

May 1, 1934.

F. HEDLEY ET AL

1,957,209

MAGNETIC STEEL DUST COLLECTOR

Filed June 15, 1932

3 Sheets-Sheet 1

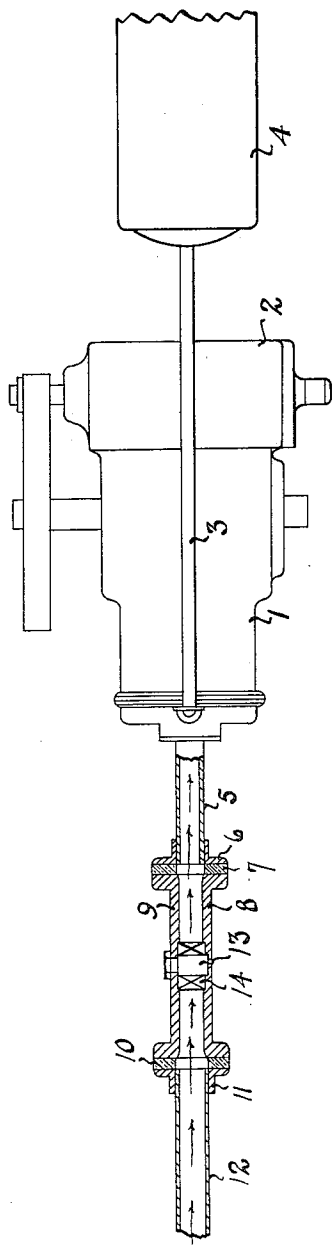


Fig. 1.

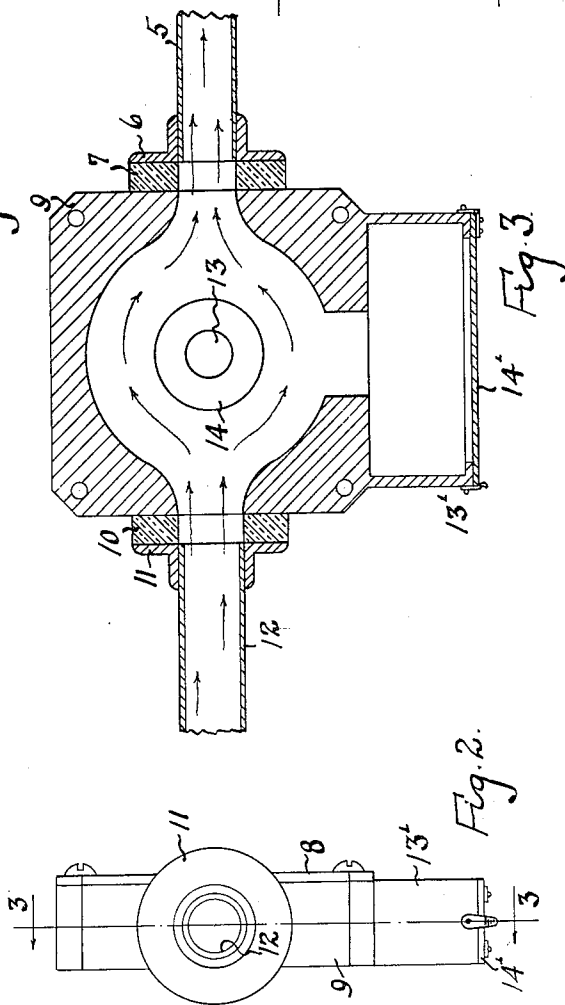


Fig. 2.

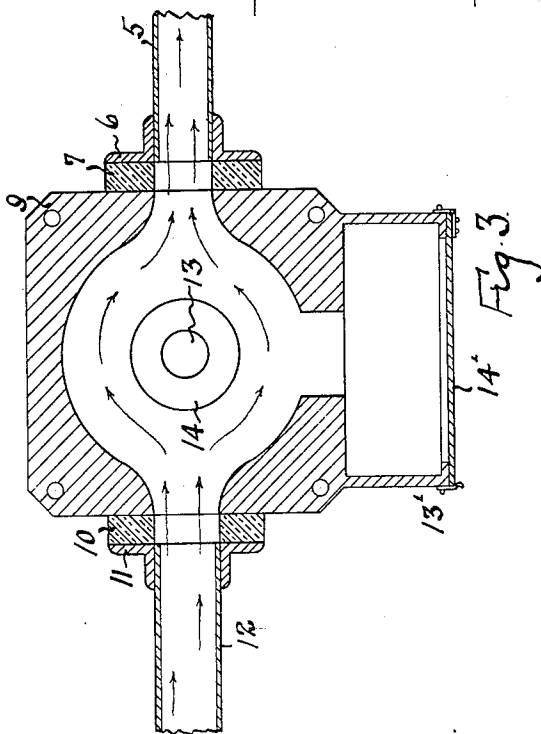


Fig. 3.

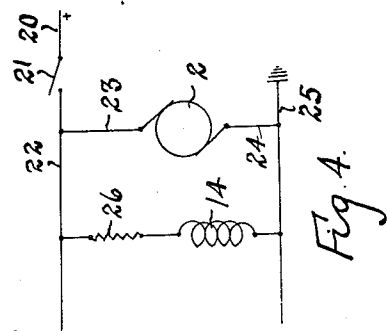


Fig. 4.

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3 Sheets-Sheet 2

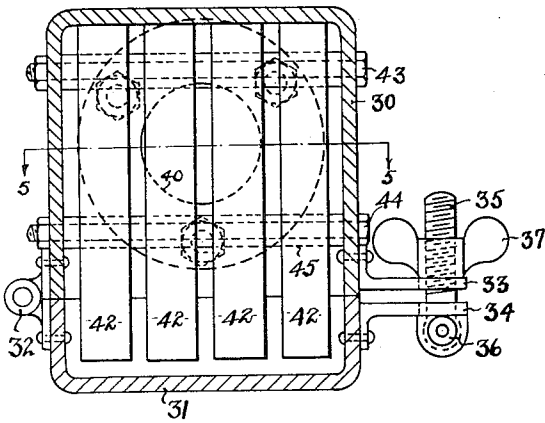


Fig. 6.

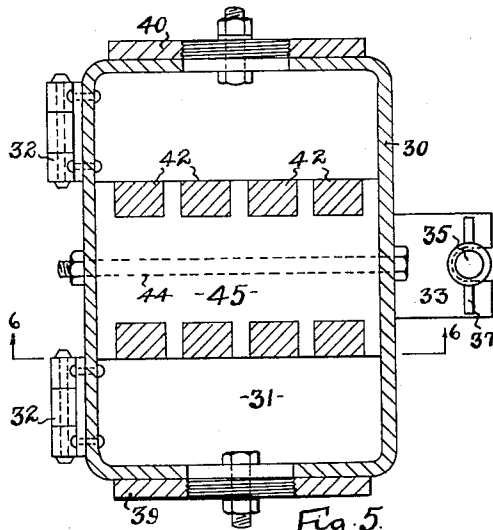


Fig. 5.

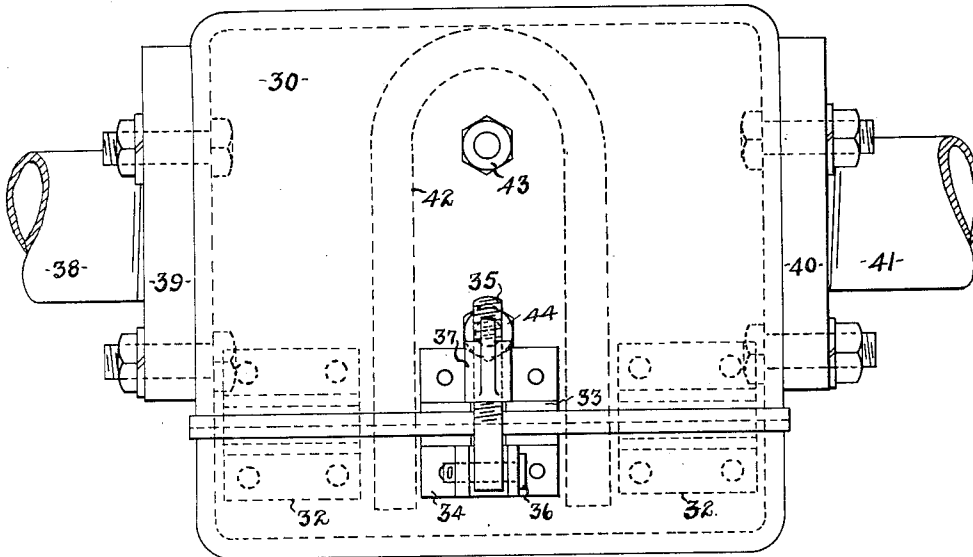


Fig. 7.

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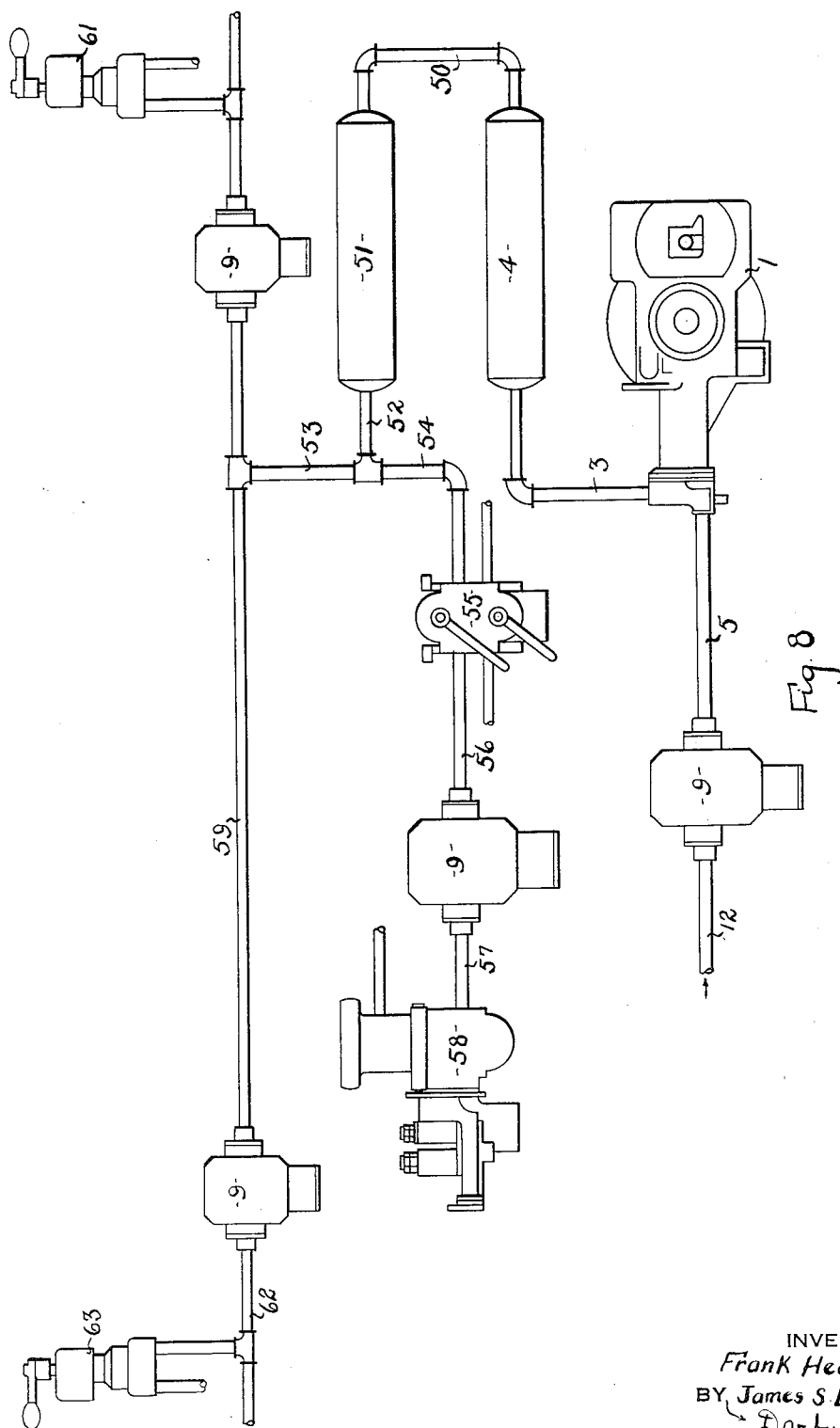
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MAGNETIC STEEL DUST COLLECTOR

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3 Sheets-Sheet 3



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MAGNETIC STEEL DUST COLLECTOR

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Application June 15, 1932, Serial No. 617,355

5 Claims. (Cl. 183-7)

This invention relates to an improvement in a magnetic steel collector for removing magnetic materials in the form of dust, small particles, and small pieces from an air stream.

5 The general object of this invention is to provide an exceedingly simple magnetic device to be interposed in an air line for the purpose of removing from the air flowing through the line any particles of magnetic material.

10 A still further object of this invention is to provide a structure which catches the particles of magnetic material and holds them in a position so that the air as it passes therethrough is subjected to a straining action to remove particles
15 of non-magnetic material which are caught in the maze of magnetic particles held in the magnetic field.

A still further object of the invention involves the combination of such a device with the intake line of a pump or at any other point in the brake system and having its magnetizing winding in circuit with the pump motor so that the winding is only energized when the motor is operating the pump or energized continuously
25 with a circuit independent of the pump circuit.

A still further object of the invention is to provide with such a combination a chamber arranged with respect to the collector so that when it is demagnetized the magnetic particles
30 are permitted to fall freely therein and to be removed from the path of the air flow.

These and many other objects, as will appear from the following disclosure, are successfully secured by means of this invention.

35 This invention resides substantially in the combination, construction, arrangement, and relative location of parts, all as will be described in detail below.

Referring to the drawings—

40 Figure 1 is a top plan view of a motor driven pump and air reservoir in combination with the magnetic dust collector of this invention which is shown in cross-section;

45 Fig. 2 is an end elevational view of the dust collector;

Fig. 3 is a vertical cross-sectional view through the collector on the line 3—3 of Fig. 2;

Fig. 4 is a circuit diagram of the connections
50 for the coil of the collector and the motor;

Fig. 5 is a cross-sectional view on the line 5—5 of Fig. 6 of a modified form of device employing permanent magnets;

Fig. 6 is a cross-sectional view taken on the
55 line 6—6 of Fig. 5;

Fig. 7 is a side elevational view of this form of device; and

Fig. 8 is a diagrammatic illustration of an air piping system including a plurality of air devices, reservoirs, and pumps protected by means of the
60 magnetic dust collector of this invention.

In the operation of transportation vehicles, and particularly in the operation of subway trains through substantially closed tunnels, considerable difficulty is encountered in the air system of such
65 vehicles by reason of the collection of steel dust in the air lines, valves, and other parts of the air system. Large quantities of steel dust and particles are normally produced by the operation of trains, as will be apparent when it is considered
70 that on each train are a number of brake shoes which are continually being ground away to form steel dust and steel particles. Likewise, the frictional contact between the rails and wheels of the trains results in the production of steel dust
75 and particles as the wheels and rails gradually wear away. Thus it will be seen that large quantities of steel dust are produced in the normal operation of trains.

When these trains operate through under-
80 ground passages, as in the case of subway trains, this steel dust is present in considerable quantities with respect to the volume of air present and is in continual motion and in suspension in the air because of the violent disturbance of
85 the air caused by the passage of trains through the underground passageways.

As is of course well known, considerable pneumatic equipment is employed on modern trains which is operated by means of compressed air
90 which is pumped into reservoirs carried on each car of the train. The required pressure is maintained in these reservoirs by means of control devices which automatically set the motor driven pumps in operation when the pressure in the
95 reservoirs falls below a predetermined value. The pumps, of course, take in air from the surrounding atmosphere and deliver it to the reservoirs under the proper pressure. It is at once apparent, therefore, that all the dust and dirt,
100 including the steel dust and particles present, are likewise carried through the pump into the reservoir and then carried from the reservoir, as air is withdrawn, to the air lines, valves, and other equipment connected thereto.

Experience with the operation of subway trains has demonstrated that the pipe lines, valves, and other pneumatic equipment, including the valves of the pumps, are quickly coated with a layer of steel dust, which coating is strongly adherent
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because of the presence of moisture in the atmosphere, as well as atomized oil which is likewise produced by the operation of the train. Quite obviously this hardened layer interferes with the correct operation of the pneumatic apparatus, and particularly interferes with the proper operation of the various valves connected to the air system. It becomes necessary, therefore, to periodically tear down the air equipment and clean out this accumulated layer, which is quite obviously an expensive procedure.

The general object of this invention is to remove all of the steel dust and particles from the air before it enters the intake ports of the pumps and to remove as much as possible other foreign particles of non-magnetic character.

Referring to the drawings, the air pump is shown diagrammatically at 1 driven by means of an electric motor 2. The discharge port of the pump is connected by pipe 3 to the air reservoir 4. To the intake port of the pump is connected a pipe 5 which in turn is attached by means of a flange to a plate 7, which is preferably of an insulating or non-magnetic material. At 12 is an extension of the air intake line which likewise is attached by means of a flange coupling 11 to a similar plate of insulating or non-magnetic material 10. Secured between these plates to form therewith a closed chamber are the plates 8 and 9 of magnetic material which are secured together and to the plates 7 and 10 in any suitable manner. Mounted centrally of the chamber formed by the plates 9 and 10 is an iron core 13 which is surrounded by a solenoid winding 14. When the winding 14 is energized the core 13 of the magnetic plates 9 and 8 are likewise energized, creating a powerful electromagnetic field. When the pump is in operation air is drawn through pipe 12 to the chamber formed by the plates 9 and 10 and pipe 5 into the intake port of the pump. The powerful magnetic field created between the plates 8 and 9, through which the air must pass, acts to collect all particles of magnetic material in the air. The end plates 7 and 10 are preferably of non-magnetic material in order not to provide a short-circuit for the magnetic field between the plates 8 and 9.

Another advantage of the arrangement of this apparatus is that as the iron particles collect on the plates 8 and 9 the slivers of steel and small pieces of steel align themselves with the magnetic field between the plates and hence stand out at right angles to them. The air in passing through the chamber must, therefore, thread its way through the maze of iron and steel particles standing at right angles to the plates. This effectively acts to collect at least the larger particles of non-magnetic material suspended in the air and hence the collected steel particles provide a sort of screening action on the air to retain the non-magnetic particles. It is likewise apparent that it would be desirable to employ some form of well known air strainer between the magnetic collector and the intake port of the pump in order to collect therein any non-magnetic particles which are not retained in the magnetic collector.

In Figs. 2 and 3 there is shown in enlarged form a suitable construction for the magnetic collector. It is substantially like that shown in Fig. 1 but in this case plate 9 is made relatively thick to provide substantially the entire chamber and the plate 8 is provided in the form of a cover to close the circular chamber. While not absolutely necessary, the efficiency of the device is somewhat increased by interposing be-

tween the plate 9 and the plate cover 8 a non-magnetic gasket in order that an air gap be formed in the magnetic circuit.

The plate 9 is shown provided with a depending hollow extension 13' forming with the hinged cover 14' a chamber which is in communication with the circular chamber through which the air passes. With this arrangement when the winding 14 is deenergized the steel dust and particles and any other foreign material, which are collected in the circular chamber, is free to fall under the action of gravity into the chamber 13 where it is collected and from which it may be removed.

A suitable circuit arrangement is shown in Fig. 4 in which the wire 20 is connected to the positive side of the current source from the trolley wire or third rail. At 21 is a switch in this circuit, which in accordance with standard practice, would be pressure operated under the control of the pressure in the reservoir so as to close the circuit when the pressure in the reservoir falls below a predetermined value. This switch connects wire 20 with wire 22, which in turn is connected to ground through wire 23, the motor 2, wire 24, and wire 25. Shunted across the motor is the winding 14 for the electromagnet of the dust collector, which of course is in series with a suitable resistance 26 in order that the voltage impressed thereupon will be of the proper value. Thus, whenever the pump motor is in operation, the winding 14 is energized.

In Figs. 5, 6, and 7 there is shown another form of magnetic dust collector which differs from the form of the other figures in that permanent magnets are employed in the air stream in place of electromagnets. As shown, this form of device comprises a casing 30 provided with a bottom cover 31, which parts are hingedly united by means of the hinges 32. The casing is provided with a lug 33 in juxtaposition to a lug 34 mounted on the bottom cover. Pivotaly mounted at 36 on the lug 34 is a threaded bolt 35 which, in the position shown in Fig. 6, lies within the slotted end of the lug 37. A wing nut 37 serves to hold the bottom cover in place. If desired some form of bead or flange, as shown in Fig. 7, may be provided on the casing to cooperate with the bottom cover to provide an airtight seal when the cover is closed. Secured to each side of the casing are the pipe coupling flanges 39 and 40 which receive the air inlet and air outlet pipes 38 and 41, respectively. Mounted within the casing are a plurality of permanent horseshoe magnets 42 which are supported at their upper end by means of the transverse bolt 43 and are supported at their lower end in spaced relation by means of a plate of non-magnetic material, preferably of insulating material, as shown at 45, which is held in place by means of the bolt 44. As will be apparent, the air enters the casing through pipe 38 and leaves it by pipe 41. In passing through the casing it distributes and flows around the permanent magnets 42 and as a result any magnetic particles in the air are abstracted therefrom and held by the magnets. When it becomes necessary to clean out the device the bottom cover is opened and the lower ends of the magnets, as will be apparent from Figs. 6 and 7, are exposed for cleaning.

The purpose of the diagrammatic illustration in Fig. 8 is to show more clearly the use of the device of this invention in any air piping system for the purpose of protecting the various

devices connected into the system from clogging and jamming with dust and dirt, and particularly with magnetic particles. The circuit is a portion of the air circuit of a transportation vehicle, such as a subway car, showing the various control devices, pumps, and the like preceded with respect to the path of air flow with the device of this invention in order to protect them. As shown in the drawings, the air intake pipe 12 is connected to the inlet of the magnetic dust separator 9 of this invention, the outlet of which is connected by pipe 5 to the intake port of the compressor 1. The discharge port of this compressor is connected by pipe 3 to the air storage reservoir 4. This reservoir in turn is connected in series with a second reservoir 51 having a discharge pipe 52. This discharge pipe is provided with the branch connections 53 and 54. In the branch connection 54 is a double cut-out cock 55 which in turn is connected by pipe 56 to a second magnetic dust collector 9. The discharge port of this collector is connected by pipe 57 to the valve 58. Branch 53 is connected to what is known as a reservoir pipe 59 which in turn is provided with two dust collectors 9. The discharge of the right hand collector is connected by pipe 60 to the brake valve 61, and the left hand dust collector is connected at the discharge port of a pipe 62, which in turn is connected to the brake valve 63. Insofar as the object of this figure is concerned, it is immaterial what the detail constructions of the device are since the purpose of the figure is to illustrate the principle of the insertion of the device of this invention at different points in an air circuit to protect the various devices thereof from jamming and clogging by removing the magnetic particles and such nonmagnetic particles as are trapped in the collectors from the air stream.

It will be apparent to those skilled in the art that the device of this invention will have considerable utility if instead of using an electromagnet a permanent magnet is employed in the dust collector. We do not, therefore, desire to be strictly limited to the form of the invention disclosed in the drawings for purposes of illus-

tration, but rather to the scope of the invention as set forth in the appended claims.

What we seek to secure by United States Letters Patent is:

1. In an apparatus as described, the combination with an air pump, an electric motor for operating the pump, an air reservoir connected to the pump, an air inlet line connected to the intake port of the pump, a magnetizable casing connected to the air inlet line, an electromagnet winding for magnetizing the casing, a circuit for the pump motor, and connections from the circuit to the electromagnet winding whereby when the pump motor is energized the electromagnet winding is energized.

2. A magnetic separator as described comprising a magnetizable casing provided with a chamber therein, a magnet mounted in said chamber for magnetizing the casing, and pipes connected to the casing at opposite sides to provide a continuous air passage in conjunction with the chamber in the casing.

3. A magnetic separator as described comprising a magnetizable casing provided with a chamber therein, an electromagnet mounted in said chamber for magnetizing the casing, and pipes connected to the casing at opposite sides to provide a continuous air passage in conjunction with the chamber in the casing.

4. In a brake piping system for subway cars the combination including an air pump having an intake connection and a discharge connection, a reservoir connected to the discharge connection, a reservoir line, a brake valve in the reservoir line, and a magnetic dust collector in the reservoir line between the reservoir and the brake valve.

5. In a brake piping system for subway cars the combination including an air pump having intake and discharge ports, a reservoir, a connection between the discharge port of the pump and the reservoir, an air supply line connected to the reservoir, a control valve in said line, and a magnetic dust collector in said line between said valve and said reservoir.

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