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A. ANDERSON
MAGNETIC SEPARATOR

2,717,080

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2 Sheets-Sheet 1

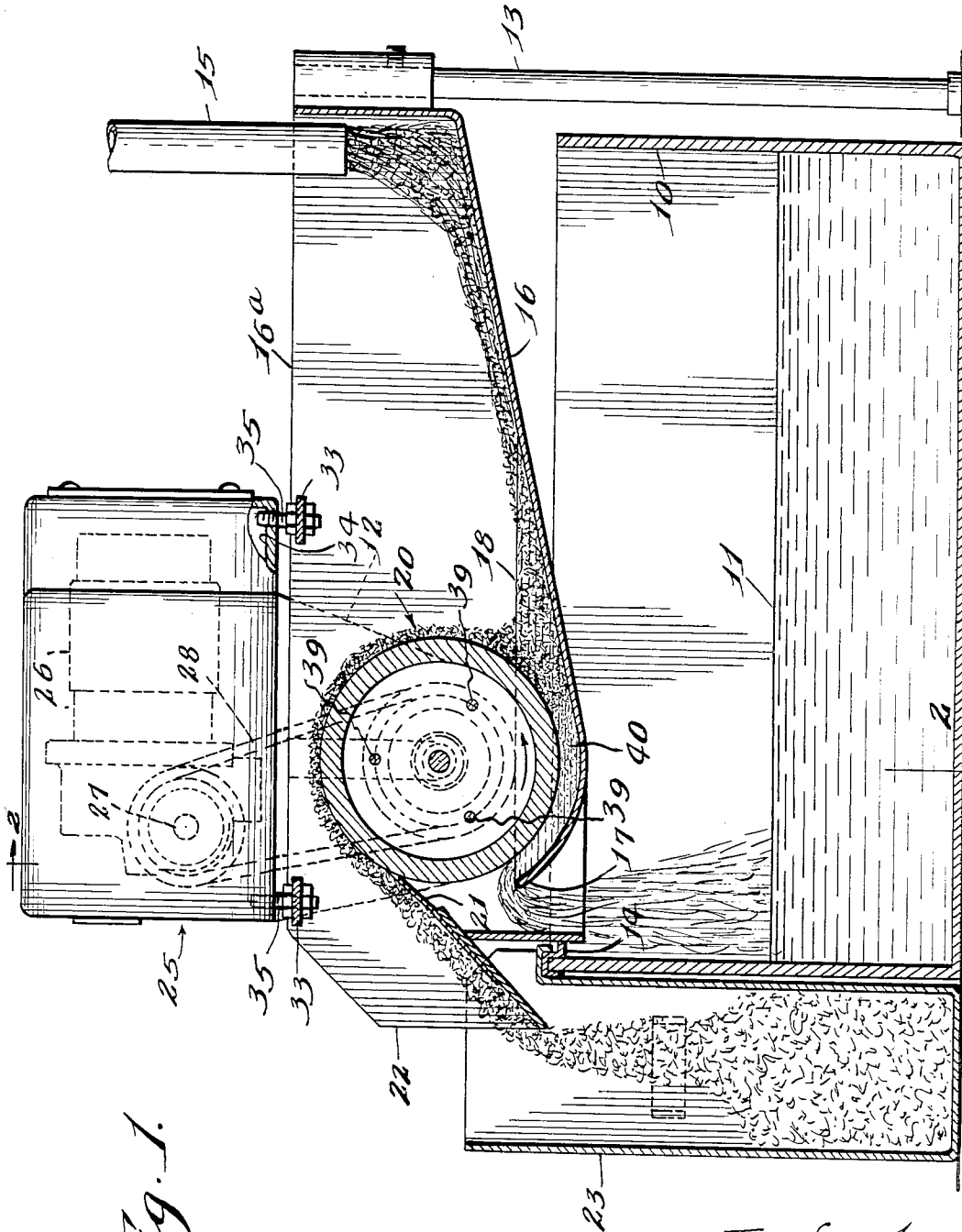


Fig. 1.

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Fig. 3.

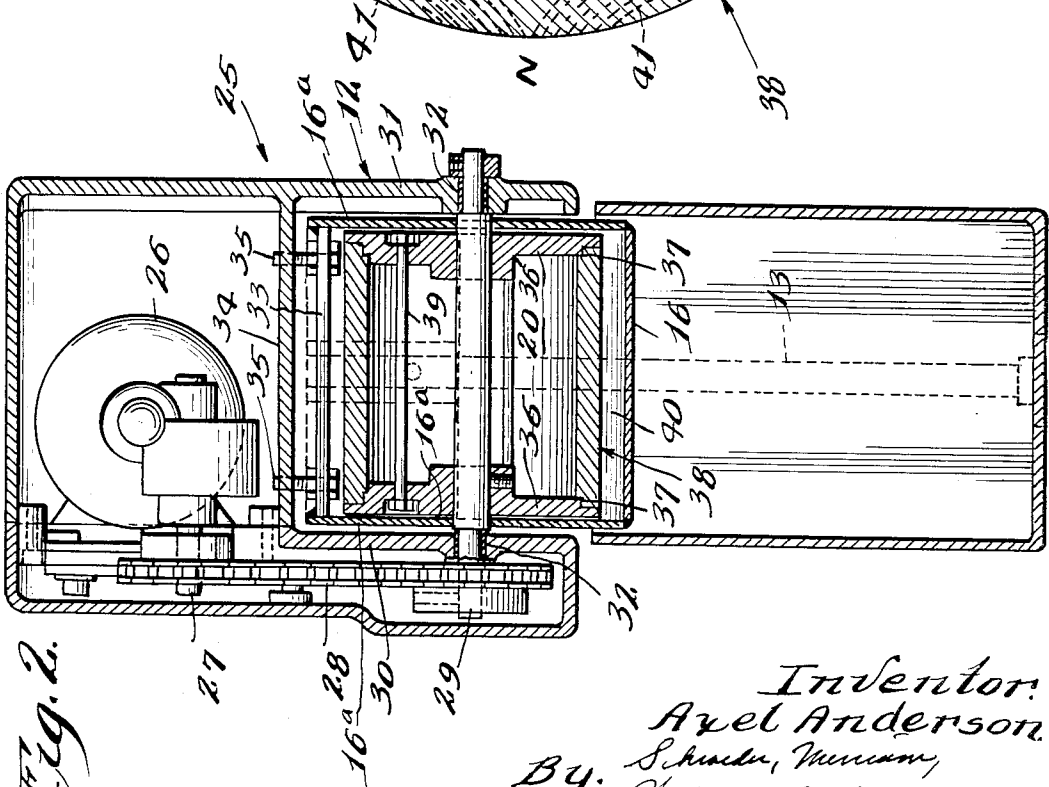
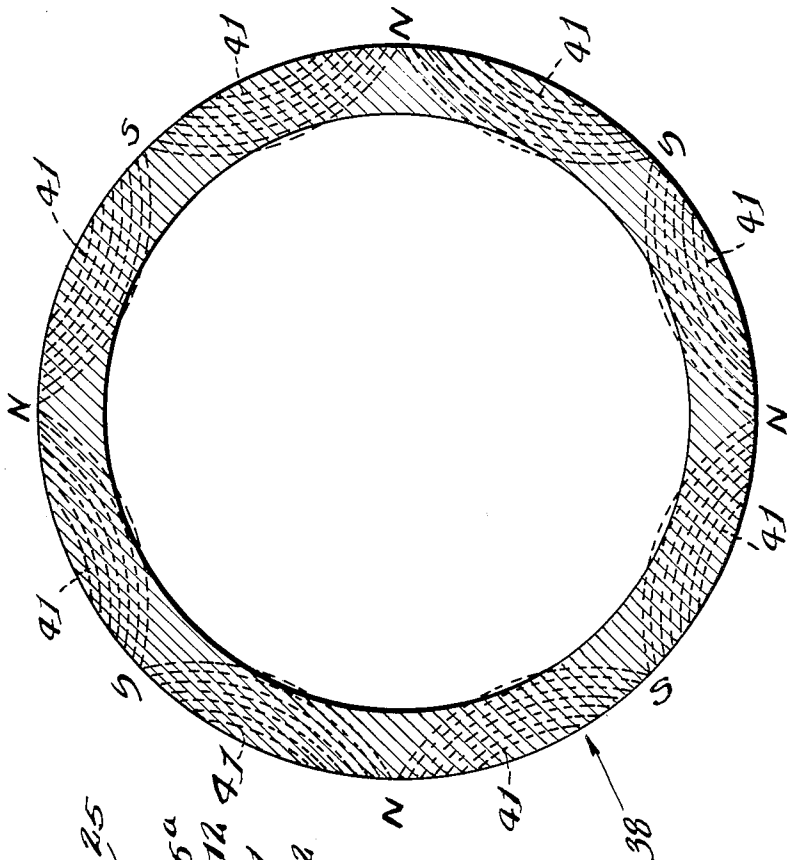


Fig. 2.

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MAGNETIC SEPARATOR

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3 Claims. (Cl. 210—1.5)

This invention relates to magnetic separators and more particularly to magnetic separators adapted to remove magnetic material from a liquid.

It is the general object of this invention to produce a new and improved magnetic separator.

It is a more specific object of this invention to produce a magnetic separator for removing magnetic particles from a carrying liquid.

A further object of the invention is to produce a magnetic separator having a magnetized surface of permanently magnetizable metal such as Alnico, which surface is magnetized to form a plurality of magnetic poles therein with adjacent poles being of opposite polarity so that the entire surface serves to attract magnetic particles thereto.

Yet another object of the invention is to produce a drum-type magnetic separator in which the outer surface of the drum is made of a single continuous cylinder of metal which is permanently magnetized so as to present a substantially continuous magnetic surface to which magnetic particles suspended or carried by a liquid are attracted for removal from the liquid.

Another object of the invention is to produce a separator of the type described in the preceding paragraph in which said surface is magnetized to form a plurality of poles with adjacent poles being of opposite polarity and to rotatably mount the drum for rotation through a flow of liquid carrying magnetic particles to remove the particles from the liquid.

Other and further objects of the invention will be readily apparent from the following description and drawings, in which:

Fig. 1 is a vertical section through an apparatus embodying the invention;

Fig. 2 is a vertical section taken along line 2—2 of Fig. 1; and

Fig. 3 is a sectional view of the magnetized cylinder illustrating the location of the poles therein and the lines of force thus created.

While this invention is susceptible of embodiment in many different forms, there is shown in the drawings and will herein be described in detail one specific embodiment, with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the embodiment illustrated. The scope of the invention will be pointed out in the appended claims.

In the operation of many machine tools a liquid is employed to be flowed over the tool and work piece to serve as a coolant. The flowing liquid picks up small particles of metal and thus becomes contaminated for future use. It is customary in the art to carry a supply of such liquid in a tank or other container positioned adjacent the machine tool and to use a pump for circulating the liquid from the tank over the tool, the return from the tool being usually a gravity flow back to the tank. The apparatus of this invention is par-

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ticularly adapted to be used in conjunction with such an arrangement and is positioned as to intercept the return flow of liquid from the tool to remove metallic particles therefrom and then to direct the particle-free liquid back into the tank for future use.

Referring now to Fig. 1, there is illustrated an apparatus embodying the invention which is adapted to be positioned over a tank 10 which contains a supply 11 of the liquid. To this end the apparatus has a frame member 12 and a leg 13 adapted to rest on the floor or other base with the frame having a lip portion 14 formed at the end opposite the leg which overlaps one of the upstanding sides of the tank. Contaminated liquid is returned from the tool through a pipe 15 and the apparatus is positioned so that the return flow is over a trough portion 16 formed in the bottom thereof. The trough is provided with sides 16a and an upturned end 17 which acts in the nature of a dam so that during operation a pool 18 of contaminated liquid is formed. A separating drum 20 is rotatably supported so as to dip into the pool 18 to collect on its surface magnetic particles carried by the liquid. Rotation of the drum in the direction indicated by the arrow in Fig. 1 carries the magnetic particles attracted to the surface of the drum around and against a scraper blade 21 located on the side of the frame in the base of a chute 22 which serves to direct the particles scraped from the drum into a separate container 23. Particles collected in the collector 23 may be periodically removed therefrom whenever desired. Particles directed into the collector 23 may carry a certain amount of liquid into that container and in order to prevent an overflow onto the floor should an excessive amount of liquid accumulate within the collector, the lip 14 is positioned below the other side walls of the collector 23 so that excess liquid therein may flow over the lip and into the tank 10.

Referring now to Fig. 2, a housing 25 is formed in the upper part of the frame and carries an electric motor 26 which drives through suitable reduction gearing a shaft 27 provided with a sprocket carrying driving chain 28. The chain drives a second sprocket secured to a shaft 29 rotatably mounted in the sides 30 and 31 of the housing. Suitable bearings and seals 32 are provided for the shaft. A pair of bars 33 are secured between the upper portions of the side walls 16a of the trough and are suspended from a cross frame brace 34 by bolts 35.

The drum 20 includes a pair of side plates 36 and 36' each provided with a shoulder portion 37 adjacent its outer edge in which is fitted a cylindrical sleeve 38 of permanently magnetizable metal such as Alnico. The sleeve is retained in position between the side plates by the tension provided by a plurality of bolts, such as the bolts 39, which extend from side plate to side plate as illustrated, to form an outer exposed cylindrical sleeve consisting of uninterrupted permanently magnetized material.

The length of the drum 20 closely approximates the width of the trough 16 so that substantially the entire flow of liquid through the trough is directed into the space 40 between the drum and the bottom of the trough. In this relatively narrow space the maximum permissible distance between the sleeve and any particle carried by the liquid is such as to bring the particles well within the range of magnetic attraction of the sleeve to attract such particles to the sleeve. The space 40 can be adjusted by raising and lowering the trough relative to the drum through the medium of the adjusting bolts 35.

The sleeve 38 has a relatively wide surface, extending almost from end to end of the drum, which surface is magnetized in the manner shown in Fig. 3 about substantially its entire extent so that all portions of the

outer surface of the sleeve carry a magnetic charge. Preferably the sleeve is magnetized to form a plurality of poles, such as indicated as N or S, with adjacent poles being of opposite polarity. It is preferred that the poles be located approximately two and one-half to three inches apart so that there are a number of magnetic poles in the sleeve. This arrangement produces lines of force 41 which extend between the poles so that a substantially no portion of the sleeve is without a magnetic charge. In actual operation of the device it has been noted that the concentration of magnetic particles attracted to the sleeve is highest at the location of the poles and least along a line substantially midway between the poles. While the magnetic forces at such an intermediate area are the weakest, their existence at such intermediate area cannot be controverted and thus it can be said that the entire surface of the sleeve is magnetized.

The sleeve can be magnetized in a number of ways known in the art. One such way, for example, is to place the sleeve within a hollow cylinder which is provided with an electromagnetic coil in its walls with the coil being passed back and forth longitudinally of the cylinder a number of times so as to surround the sleeve. Each line in the cylinder along which the coil passes determines the median point between north and south poles to be formed in the sleeve. Thus if the coil passes eight times, eight poles will be created in the sleeve when a suitable current is applied to the coil. Another method of magnetizing the sleeve is to rest the sleeve on a section of a cylinder provided with a single coil extending longitudinally therethrough, the coil having two spaced parallel sides which are joined together exteriorly of the cylinder by looped portions at each end. When the sleeve is placed on the cylinder section and a suitable current is passed through the coil, the part of the sleeve in contact with such section will become magnetized. The sleeve may then be rotated to bring an adjacent part in contact with the section and current again applied to magnetize such adjacent part, and the operation may be repeated to magnetize the entire circumference of the sleeve.

I claim:

1. A magnetic separator for separating magnetic material from a liquid comprising a trough having a bottom and spaced sides, a housing disposed above said trough and having sides depending downwardly adjacent the sides of said trough, a drum disposed above the bottom of the trough, said drum including a pair of spaced circular side plates and an outer exposed cylindrical sleeve consisting of uninterrupted permanently magnetizable material carried by the side plates and extending between the peripheries of said side plates, said sleeve being substantially completely permanently magnetized over its entire extent to form a plurality of magnetic

poles therearound with adjacent poles being of opposite polarity, means connected to said side plates and extending through the sides of the trough and housing rotatably supporting the drum, means connected to said supporting means for rotating the drum, and a blade-like scraper contacting the sleeve to scrape magnetic particles therefrom as the drum rotates.

2. A magnetic separator for separating magnetic material from a liquid comprising a housing having downwardly depending spaced sides, a drum including a pair of spaced circular side plates and an outer exposed cylindrical sleeve consisting of uninterrupted permanently magnetizable material carried by the side plates and extending therebetween, means located within the sleeve interconnecting said side plates, said sleeve being substantially completely permanently magnetized over its entire extent to form a plurality of magnetic poles spaced around its periphery with adjacent poles extending the length of the sleeve and being of opposite polarity, means supported on said sides of the housing and connected to said side plates for supporting and rotating the drum, means for directing the liquid into contact with the rotating drum, and a metallic blade-like scraper contacting the sleeve to scrape magnetic particles therefrom.

3. A magnetic separator for separating magnetic material from a liquid comprising a rotatably mounted drum having its peripheral surface formed from an outer exposed cylindrical sleeve consisting of uninterrupted permanently magnetizable material, said sleeve being substantially completely permanently magnetized over its entire extent to form a plurality of magnetic poles therearound with adjacent poles extending along the length of said sleeve and being of opposite polarity, means for rotating the drum, means for flowing the liquid into contact with the surface of the rotating drum, and means for removing magnetic material from said surface.

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