United States Patent

Happ et al.

[15] **3,669,274**

[45] **June 13, 1972**

[54] MAGNETIC STRUCTURE FOR TREATING LIQUIDS CONTAINING CALCAREOUS MATTER

[72] Inventors: **George M. Happ; Merrill F. Kottmeier,** 5800 Dempster Street, Morton Grove, Ill. 60053

[22] Filed: **Dec. 29, 1969**

[21] Appl. No.: **888,643**

[52] **U.S. Cl.** **210/222**

[51] **Int. Cl.** **B01d 35/06**

[58] **Field of Search** 210/42, 222, 223, 304, 458; 209/212, 223, 213, 221, 224; 204/248

[56] **References Cited**

UNITED STATES PATENTS

2,583,522	1/1952	Winslow et al.	210/223
3,376,529	4/1968	Miyata	210/222 X
1,948,419	2/1934	Granigg	209/221
2,939,830	6/1960	Green et al.	210/222 X
3,228,868	1/1966	Ruskin	210/222 X

FOREIGN PATENTS OR APPLICATIONS

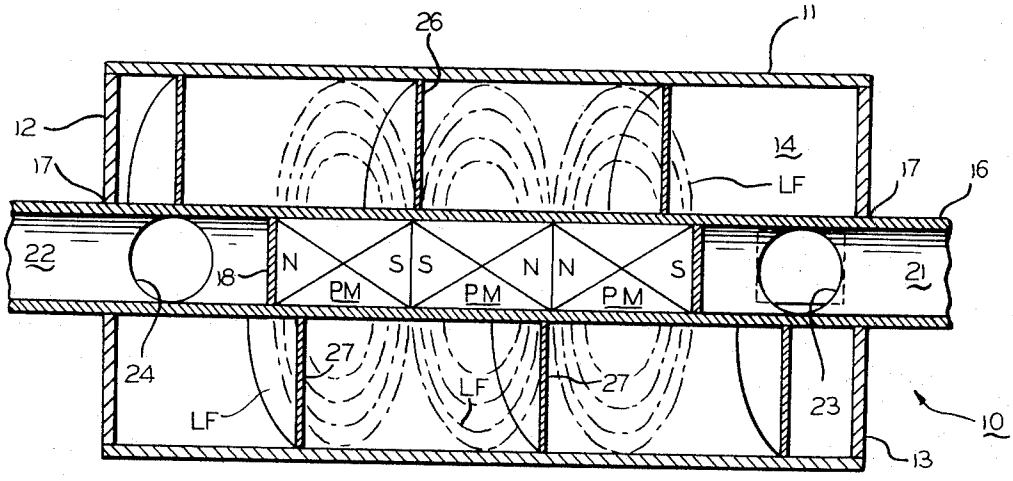
673,369	7/1952	Great Britain	210/222
855,928	12/1960	Great Britain	210/222

Primary Examiner—Reuben Friedman
Assistant Examiner—T. A. Granger
Attorney—Richard C. Lindberg

[57] **ABSTRACT**

A structure for subjecting liquids having a dissolved and suspended calcareous content to magnetic lines of force. The liquid is caused to pass around a number of permanent magnets developing lines of force through which the liquid moves in a path intersecting such lines of force. This is achieved by mounting the magnets in a non-ferrous carrier with the poles thereof in opposed relationship, i.e., north to north, and south to south. The liquid is confined in such a manner so that it has a substantially helical flow path enabling the lines of force to be cut at right angles thereto.

1 Claim, 7 Drawing Figures



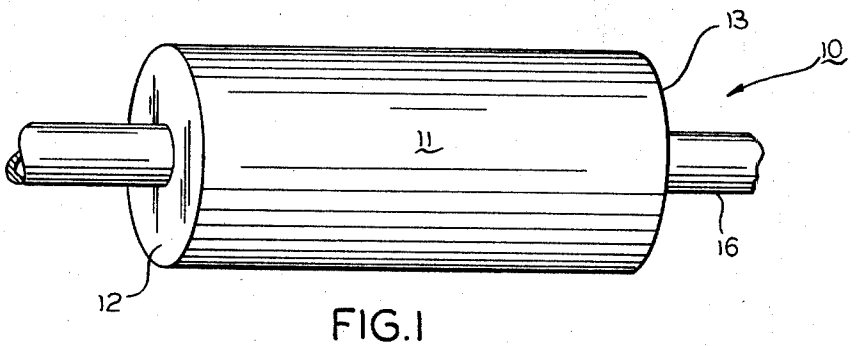


FIG.1

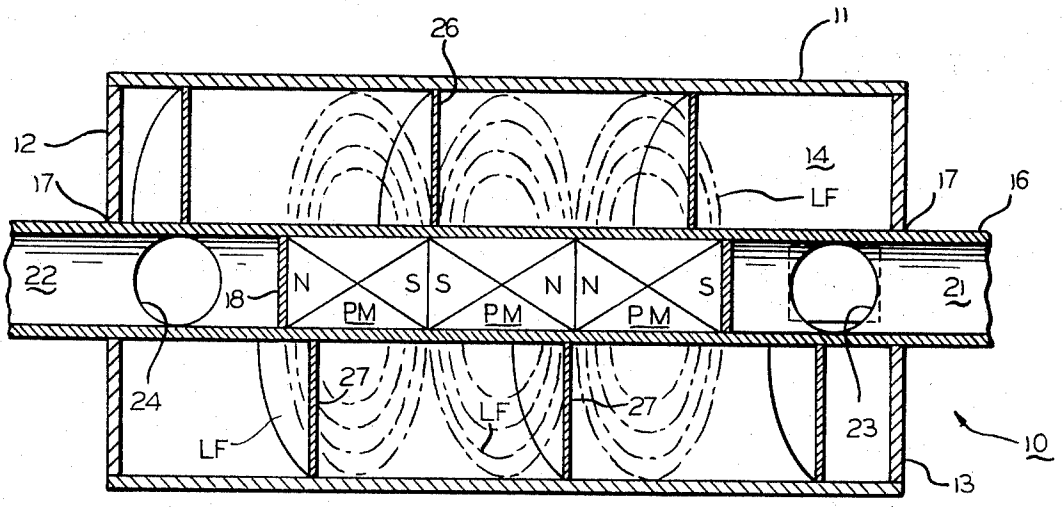


FIG.2

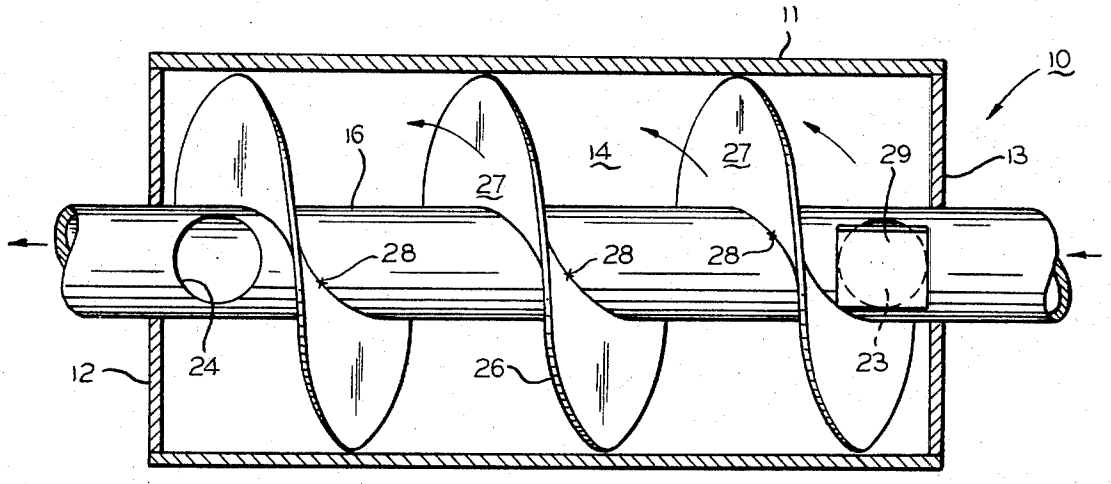


FIG.3

INVENTORS
GEORGE M. HAPP
MERRILL F. KOTTMEIER
BY Richard C. Lindberg
ATTORNEY

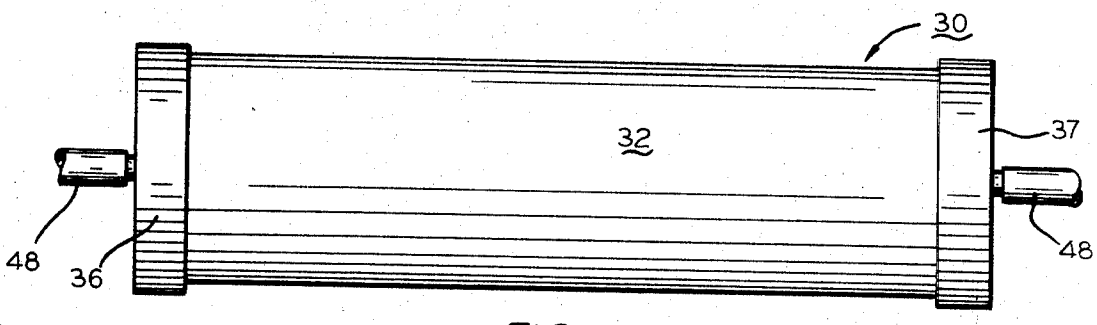


FIG.4

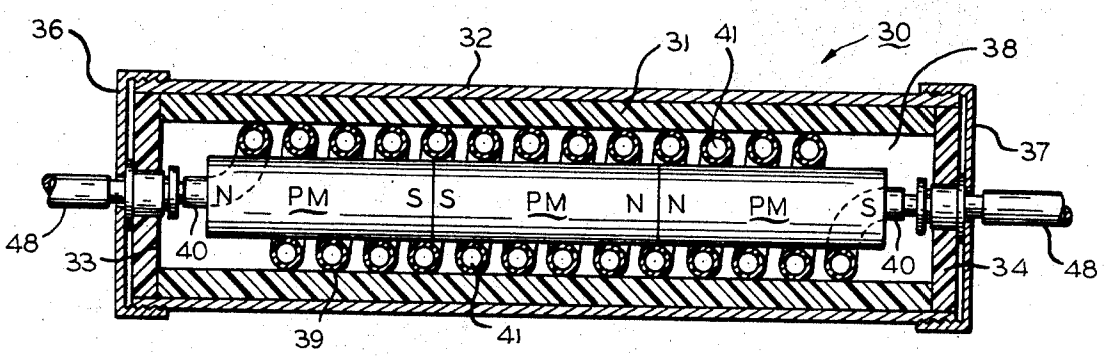


FIG.5

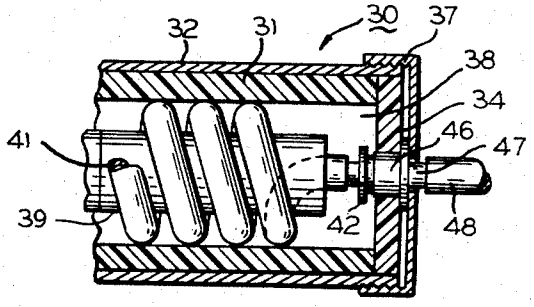


FIG.6

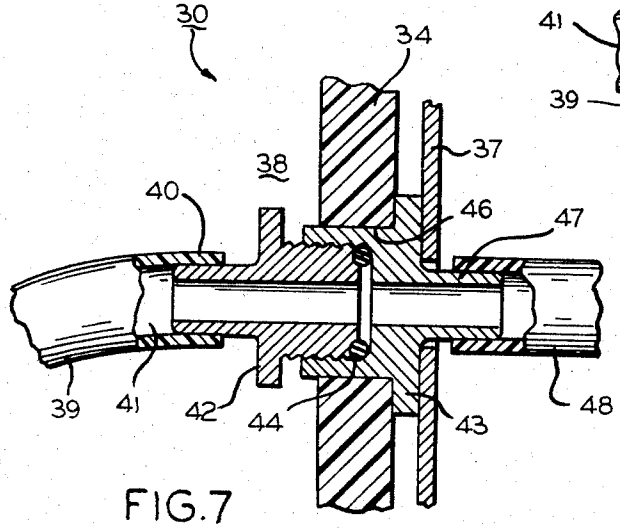


FIG.7

INVENTORS
GEORGE M. HAPP
MERRELL F. KOTTMEIER
BY
Elmer J. Lindberg
ATTORNEY

MAGNETIC STRUCTURE FOR TREATING LIQUIDS CONTAINING CALCAREOUS MATTER

BACKGROUND OF THE INVENTION

1. Field of the Invention.

This invention relates to devices having the property of treating calcareous laden liquids with a magnetic field. Such treatment appears to have the effect of modifying the scale producing propensities of the liquid, and it has been found that liquid treated magnetically does not deposit the calcareous components thereof as a hard scale. Rather the calcareous material is soft in texture and does not adhere as readily to heat exchange surfaces.

2. The Prior Art.

The prior art is exemplified in U.S. Pat. No. Mack 2,825,464; Green et al. 2,939,830; Vermeiren 2,652,925 and 3,345,594.

SUMMARY OF THE INVENTION

The structures according to the present invention consitute an improvement over that shown in the referred to patents in the fact that the liquid to be conditioned is confined in a path giving it maximum exposure to magnetic lines of force. The liquid is introduced to the conditioning chamber and withdrawn therefrom by a nonmagnetic pipe which also supports the magnet array. The liquid is guided helically in its path past the magnetic lines of force.

THE DRAWING

FIG. **1** is an isometric view of the magnetic structure according to one embodiment of the present invention;

FIG. **2** is a longitudinal section therethrough; and

FIG. **3** is a longitudinal section showing the supply tube and the directing vane in elevation;

FIG. **4** is an elevational view of a magnetic structure according to another embodiment of the invention;

FIG. **5** is a longitudinal section therethrough;

FIG. **6** is a detailed section of one end of the magnetic structure; and

FIG. **7** is a similar section to an enlarged scale.

The improved magnetic structure according to one embodiment of the present invention is denoted by the reference numeral **10** and comprises an essentially cylindrical outer jacket **11** constructed of ferro-magnetic material and walls **12** and **13** closing the ends thereof to define a treating chamber **14**.

A hollow supply tube **16** of non-magnetic corrosion resisting material such as copper is supported in openings **17** in end walls **12** and **13**. Walls **12** and **13** have fluid tight connections with jacket **11** and tube **17** also has fluid tight connections to said walls. The axis of tube **17** is coextensive with the longitudinal axis of jacket **11**.

Tube **16** affords a support for a plurality of permanent magnets PM of high retentivity and high flux density. These are preferable cylindrical in form and may be made of barium titanate, alnico or ferrite compounds. They are shown as three in number, but more may be employed, and are arranged in a line with like poles of contiguous magnets adjacent each other to create lines of force LF extending laterally of said supply tube. A closed path for said lines of force is provided by outer jacket **11**.

The magnets PM are held in position within tube **16** by plugs **18** and **19** which make a fluid tight seal with tube **16**.

Tube **16** has an entrant portion **21** and a discharge portion **22**. An inlet opening **23** in tube **16** and within chamber **14** admits the liquid to chamber **14**, and an exit opening **24** in tube **16** connects with discharge portion **22**.

The liquid thus moves through chamber **14** cutting the lines of force LF created by magnets PM to treat the water as

described. Structure is provided for insuring that the path taken by the water is such as to cut the lines of force with optimum effect, and to this end a helix **26** comprised of a single continuous vane **27** is arranged to be supported on tube **16** within chamber **14**. Vane **27** is preferable of non-magnetic material such as copper and is brazed or soldered to tube **16** as at **28**.

In order to divert the water to the helical path provided by helix **26** the inlet opening **23** has a diverter vane **29** thereat.

A second embodiment of the invention is shown in FIGS. **4** to **7** and is denoted by the reference numeral **30**. It is comprised of inner and outer cylindrical jackets **31** and **32**, the former being made of resinous material such as polyvinyl chloride, polyethylene or the like, and the latter being preferably of magnetically permeable ferrous material. Inner end walls **33** and **34** close inner jacket **31** and are cemented thereto, and outer end caps **36** and **37** are threaded to outer jacket **31**. The assembly thus far described defines a chamber **38**.

A plurality of magnets PM of high retentivity and high flux density are supported within the chamber **38**, and are of a type and number as previously described, and arranged in like fashion. Magnets PM are adapted to be supported by a helically wound tube **39**, the inside of helically wound **39** tightly embracing the magnets PM, and the outside thereof in contact with the inner surface of inner jacket **31**.

Liquid to be treated by the lines of force of magnets PM courses through a passageway **41** in tube **39**, and the ends **40** thereof are connected to a male fitting **42** threadably connected to a female fitting **43** with a gasket **44** therebetween. Female fitting **43** is received within an opening **46** in wall **34**, and has a hollow boss **47** extending outward from end cap **37**.

It will be understood that the opposite end of the device **30** is constructed in like fashion, and the supply to the device is by tubes **48**.

We claim:

1. Apparatus for the treatment of calcareous water with magnetic lines of force comprising:

a. an essentially cylindrical outer jacket formed of magnetically permeable material;

b. walls closing the ends of said outer jacket to define a treating chamber;

c. a supply tube of non-magnetic material for calcareous water, said supply tube having an inlet opening therein to said outer jacket and an exit opening therefrom;

d. said supply tube being supported in said walls and having entrant and discharge portions extending outward from said walls;

e. a plurality of permanent magnets mounted in said supply tube between said inlet opening and said exit opening;

f. said magnets being arranged in line with like poles of contiguous magnets adjacent each other to create lines of force extending laterally of said supply tube;

g. means extending between said supply tube and said cylindrical outer jacket for directing water entering said chamber in directions to cut said lines of force as the water moves to said exit opening comprising:

i. means disposed between said supply tube and said cylindrical outer jacket for constraining said water for movement in an helical path between said supply tube and said cylindrical outer jacket;

ii. said last named means being in the form of a helix made of non-magnetic material unaffecting the distribution of the lines of force provided by said permanent magnet;

iii. whereby the movement of said water provides maximum cutting of said lines of force and minimum movement of said water in directions parallel to said lines of force.

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