United States Patent [19]

Kaftan

[11] **3,751,750**

[45] **Aug. 14, 1973**

[54] **MAGNETIC WINDOW CLEANING APPARATUS WITH IMPROVED CLEANING MATERIAL AND LOCATOR**

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[22] Filed: **Nov. 19, 1970**

[21] Appl. No.: **90,900**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 807,524, March 17, 1969, Pat. No. 3,609,793.

[52] **U.S. Cl.** ..... **15/220 A**

[51] **Int. Cl.** **A47l 1/08**

[58] **Field of Search** ..... 161/82, 79, 87, 150, 161/162; 15/210, 220, 220 A, 209, 104.93; 300/21

[56] **References Cited**

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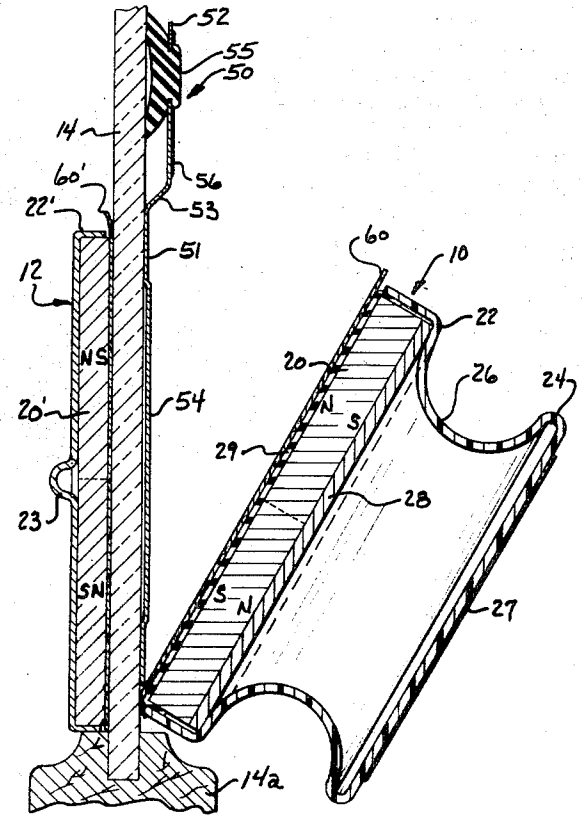
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[57] **ABSTRACT**

Master and slave units are provided and each has a one-piece, plural-polarized permanent magnet. A locator is provided for holding the slave unit in position until the master unit can be brought in position opposite the slave unit. The locator is formed of magnetically-attracted material and has a suction cup for temporary mounting on the window. The cleaning material is formed from a layer of absorbent paper having a discontinuous layer of polyethylene thereon. By being discosinuous, portions of the paper are exposed so that it can perform its absorption function. The plastic also reduces the friction between the cleaning material and window, while each magnet has a rubber surface to provide maximum friction between it and the cleaning material. In this manner the cleaning material stays in place without an external fastener.

The cleaning material is made by spreading polyethylene chips on absorbent paper, heating the paper and chips to soften the chips, and passing the paper and chips between two rollers to press the chips into the paper to provide a discontinuous surface of plastic on the paper.

14 Claims, 12 Drawing Figures



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SHEET 1 OF 3

Fig. 1.

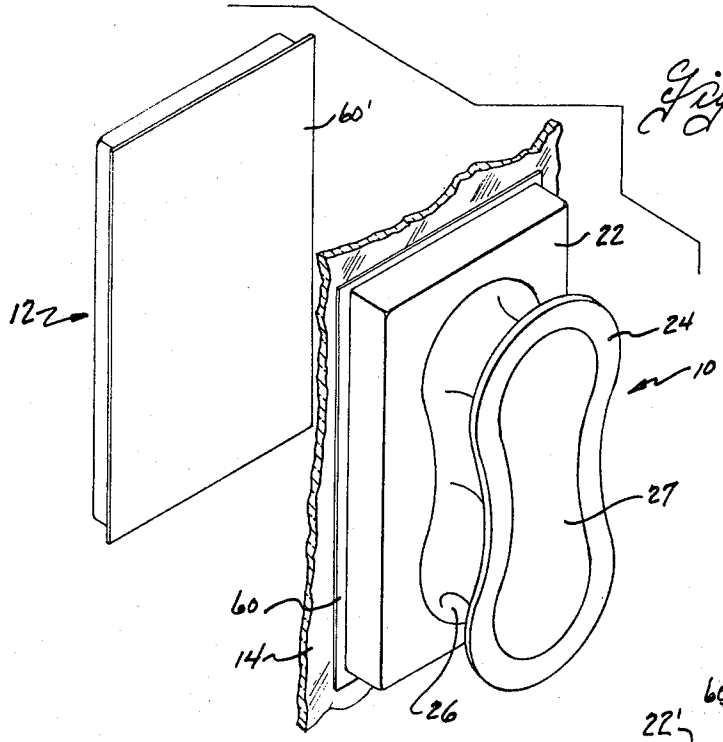


Fig. 2.

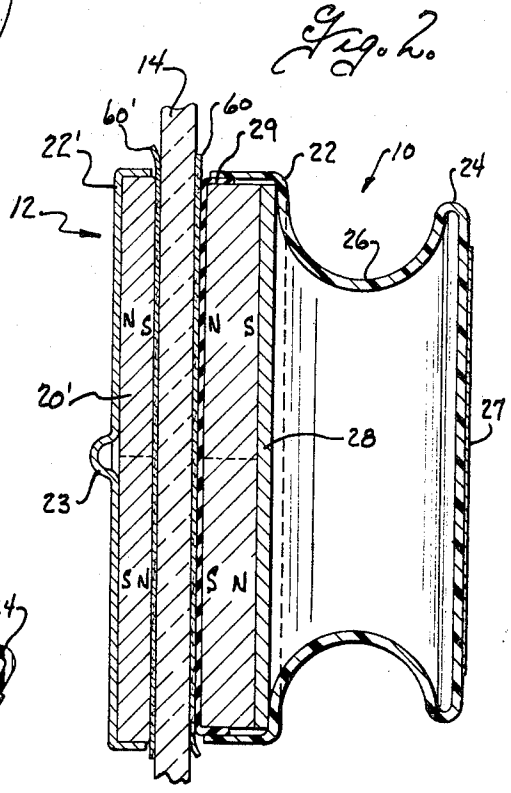
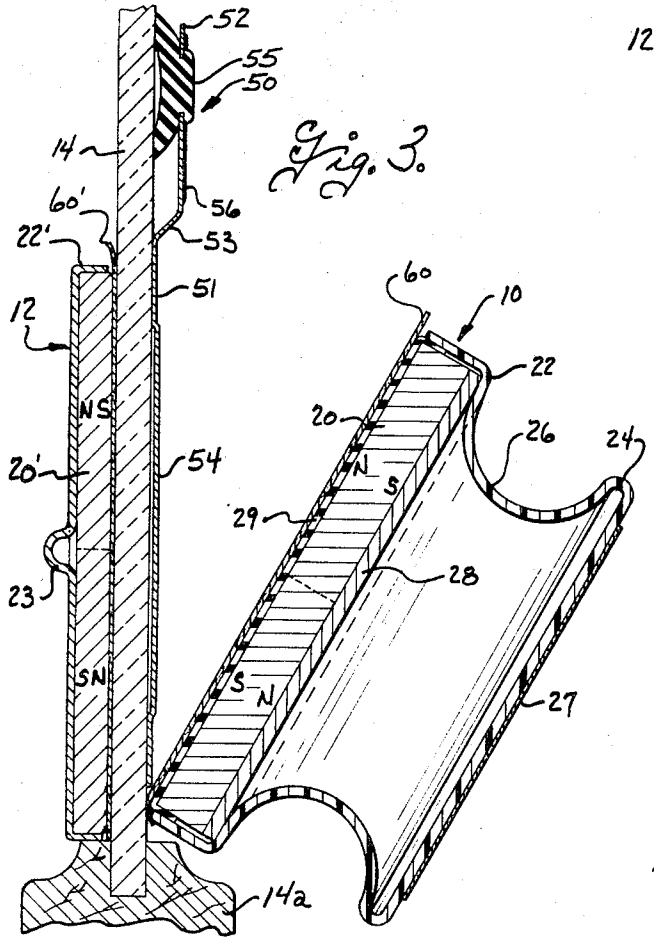


Fig. 3.



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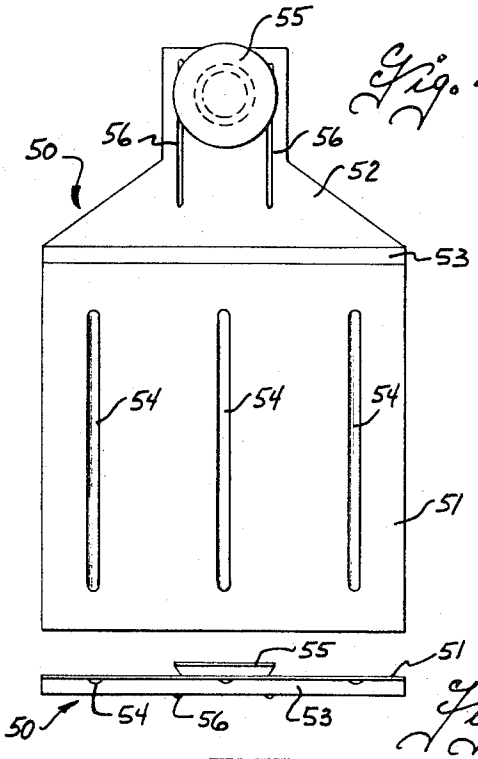


Fig. 4.

Fig. 5.

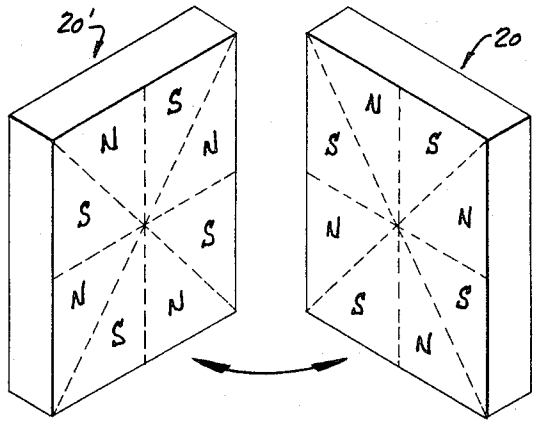


Fig. 6.

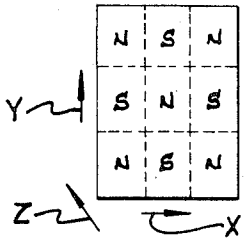


Fig. 7-A.

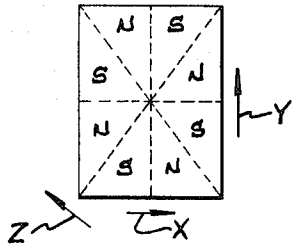


Fig. 7.

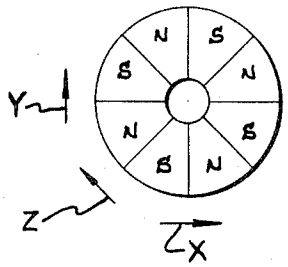


Fig. 8-A.

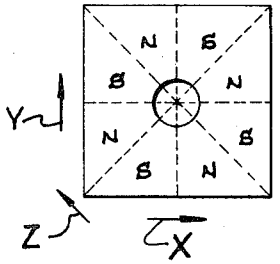


Fig. 8.

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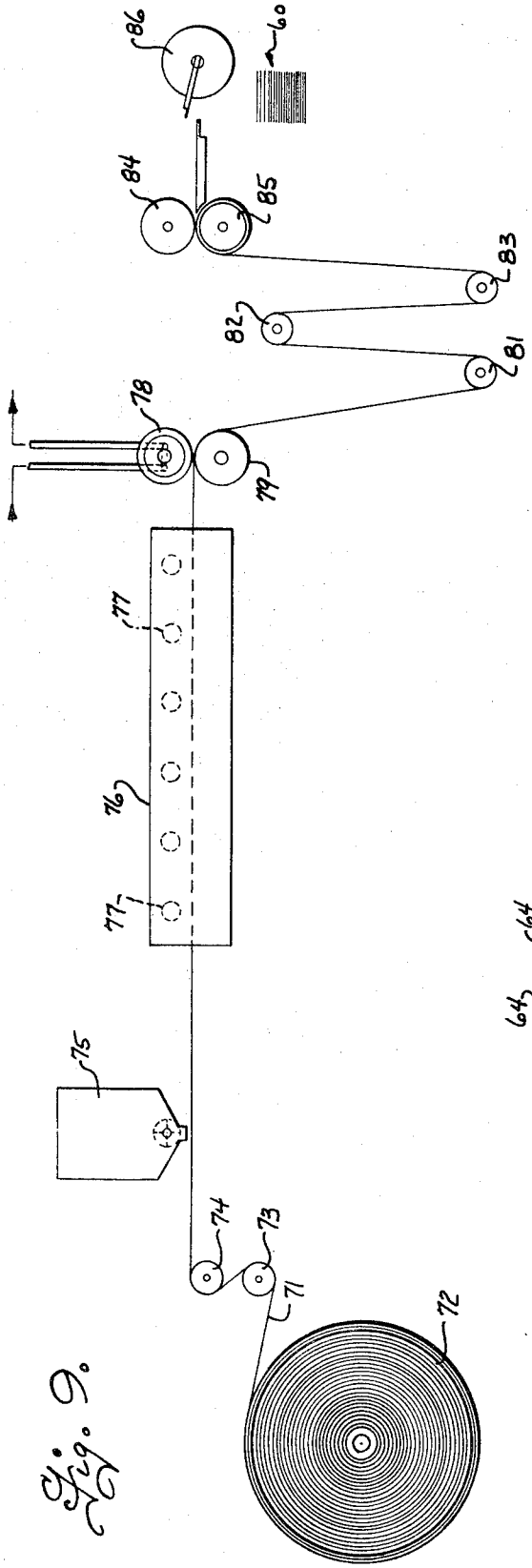


Fig. 9.

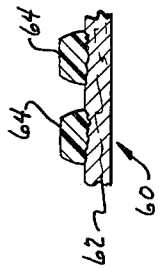


Fig. 10.

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MAGNETIC WINDOW CLEANING APPARATUS WITH IMPROVED CLEANING MATERIAL AND LOCATOR

CROSS-REFERENCE

This is a continuation-in-part application of application Ser. No. 807,524, filed Mar. 17, 1969, and now U.S. Pat. No. 3,609,793.

BACKGROUND

The invention pertains to window cleaners and more particularly to a window cleaner which utilizes magnetic attraction.

Apparatus of this general type is useful for cleaning hard-to-reach portions of a window and is particularly handy in cleaning the outside of a window from the inside. Various devices of this general type have been previously suggested; for example see U. S. Pat. No. 3,296,645, issued Jan. 10, 1967 to Melvin Shore. In general, prior devices have included a pair of units positioned on opposite sides of a window, and having a magnetic member in each unit to provide a magnetic circuit to hold the units contiguous to the window. In theory, the master unit could be moved over the window and the slave unit would follow.

In the prior art, the slave units had to be positioned opposite the master unit to be held in position. Where this could not be accomplished, as in inaccessible areas, the units could not be used for their intended purpose. It is desirable that apparatus be provided so the slave unit can be temporarily held in position on one side of the window until the master unit can be brought into operative position on the opposite side. Also in the prior art, cleaning materials have been either permanently attached to the magnetic units or have been held in position by fasteners. It is desirable that the cleaning material be removable, but be held in position without any fastener. The prior art also has recognized the desirability to reduce the area of contact between the units and the window to reduce friction. In doing so, many moved the magnets away from the window and thereby reduced their effectiveness. It is desirable to have the magnets as close to the window as possible and still reduce the area of contact between the window and the cleaning material.

SUMMARY

The present invention relates generally to cleaning apparatus, and more particularly to a magnetic window cleaning apparatus.

It is an object of the present invention to provide a magnetic window cleaning apparatus in which the cleaning material is held in position without any fastener.

Another object is to provide a magnetic window cleaning apparatus which utilizes friction to hold the cleaning material in position.

Still another object is to provide a magnetic window cleaning apparatus which includes means for reducing the friction between the cleaning material and the window.

Yet another object is to provide a magnetic window cleaning apparatus having a new cleaning material including a layer of absorbent paper and a discontinuous layer of plastic.

Another object is to provide a magnetic window cleaning apparatus with means for temporarily positioning the slave unit without the master unit being in position.

It is another object to provide a magnetic window cleaning apparatus with improved tracking characteristics.

These and other objects and advantages of the present invention will become apparent as the same becomes better understood from the following detailed description when taken in conjunction with the accompanying drawings.

DRAWING

FIG. 1 is a partially exploded perspective view of a preferred embodiment of the present invention with the master unit being illustrated in its operating position adjacent one surface of the window, and the slave unit being shown on the other side of the window and generally opposite the master unit, but positioned away from the window for better illustration of its structure;

FIG. 2 is a vertical sectional view through the apparatus of FIG. 1 and illustrating the master and slave units in operative position on opposite sides of a window;

FIG. 3 is a vertical sectional view through the master and slave units and the locator and illustrating the locator temporarily holding the slave unit in position with the master being moved into operative position;

FIG. 4 is an elevation of the locator as seen from the window-facing side;

FIG. 5 is a bottom view of the locator;

FIG. 6 is a generally diagrammatic view of the magnetic members and illustrating the pattern of the polarity;

FIGS. 7 and 7A are small scale views of one magnetic member of two different embodiments and indicating the direction of tests of the tracking strength of each;

FIGS. 8 and 8A are small scale views of one magnetic member of two different embodiments and indicating the direction of tests of the tracking strength of each;

FIG. 9 is a diagrammatic view of one apparatus for making the cleaning material; and

FIG. 10 is a diagrammatic, cross-sectional view on a greatly enlarged scale through the cleaning material.

DESCRIPTION

Reference is now made more particularly to the drawings wherein similar reference characters indicate the same parts throughout the several views.

The magnetic window cleaning apparatus includes a master unit, generally designated **10**, and a slave unit, generally designated **12**. These units are adapted to be positioned on either side of a window **14** opposite one another.

The master unit **10** includes a one-piece magnetic member **20** which is polarized in a plurality of regions as hereinafter more particularly set forth. The magnetic member **20** is disposed in a housing **22** to which is affixed a handle **24** by means of a reduced neck **26**. The handle, neck, and housing are advantageously molded of plastic in one or two pieces. The handle **24** may have a label **27** for advertising or the like.

As thus far described, the elements of the master unit **10** find counterparts in the slave unit **12** and the counterparts are indicated by the same numeral followed by the postscript prime (′). Accordingly, a general description of the slave unit is deemed unnecessary. Differences, however, will be noted. First, there is no handle on the slave unit but rather the housing **22′** is pro-

vided with an eye 23 through which a chain or string can be passed as a safety measure in utilizing the slave unit. Secondly, the master unit 10 preferably has a shunting plate 28 at the rear side of magnetic member 20. Thirdly, the master unit has a thin layer of rubber 29 on its window-facing side. Its purpose will hereafter be explained. Lastly, it will be noted that the polarity of the magnetic members is generally opposite, but of identical patterns as will now be explained.

Referring to FIG. 6, there is diagrammatically illustrated the magnetic members 20 and 20'. Preferably, these members are one-piece and are made of ferrite material. As shown in FIGS. 2 and 3, the magnetic member 20 is made of barium ferrite. The magnetic member 20' of the slave unit can be similarly constructed and with a rubber cover, or it can be made of a rubber impregnated magnetic material. It is to be understood that these are equivalents. These materials can be permanently polarized and, as indicated, it is possible to polarize a single large sheet of material in a plurality of regions on its face to provide the preferred structure. In operation, the one-piece construction is generally self-shunting at the side away from the window and no shunting plate is required; however, the shunting plate 28 can be used to increase the strength of the magnetic elements by eliminating stray field at the back side. One suitable commercially available material is an oriented ferrite sold under the trademark "Indox 5" by Indiana General Corporation. This material may be magnetized in a magnetizing jig suitably arranged to provide the multiple polarity in the alternating pattern shown in FIG. 6. It can be seen that there are eight poles of equal size on the window-facing side of each member 20 and 20'. In this manner, the number of north and south poles are equal and this balance makes the magnet more efficient. It can also be seen that the pattern at the window-facing side of magnetic member 20 is identical to that at the window-facing side of member 20'. Production is thereby simplified as only one pattern is required and one magnetizing jig can be utilized for both members. It can also be seen that magnetic members 20 and 20' are arranged with the eight poles in a generally triangular shape. This shape presents lines of opposite polarity along the diagonals of the members and results in improved tracking ability.

Referring now to FIGS. 7 and 7A, there will be described tests which illustrate this improved result. The tests were performed on a clean, dry, glass window of ⅛ inch thickness. The rectangular arrangement (FIG. 7A) and the triangular arrangement (FIG. 7) are identical except for the pattern of the polarity. Both sets of magnetic members are formed of oriented ceramic material 3 inch × 4 inch × ¼ inch in size, with ⅛ inch polyether foam on the window-facing side thereof. A cleaning paper was used along with the fasteners described in the above-mentioned parent application. Shunting plates, of 20-gauge material, were used in both arrangements of these tests.

A master unit and slave unit of each arrangement was placed on the window with a spring gauge attached to the slave unit. The master unit was moved in each direction indicated by arrows *x*, *y*, and *z*, with the spring gauge on the slave unit resisting the movement. These directions represent the width, length and diagonal, respectively, of the magnetic members. Readings were taken on the spring gauge at the maximum tension when the units separated with the following results:

Direction	Triangular Pattern (8 pole)	Rectangular Pattern (9 pole)
x	No. 6.0	No. 5.1
y	No. 5.0	No. 4.0
z	No. 5.2	No. 4.3

It can be seen that the triangular pattern (8 pole) was superior in all tests. It is believed that the balance of north and south poles aids in this result. Also, where the corners of several poles meet, there is effectively no magnetism. The rectangular pattern has four such areas, while the triangular pattern has only one such area.

In the diagonal direction *z*, the triangular pattern is more efficient because there are more direct lines of opposing force. In other words, there are edges of poles lying crosswise of the direction of movement. This is advantageous when the master unit is moved in a circular pattern--the way windows are often cleaned.

Square units also have improved tracking ability over circular units. Referring now to FIG. 8 and 8A, there will be described tests which illustrate this. The tests utilized ¼ inch thick ferrite magnetic material. Two circular units were made having a 3 inch outer diameter and a ½ inch opening at the center as in FIG. 8A. Two units were made as in FIG. 8 with a dimension of 3× 3 inch and provided with a ½ inch opening at the center to make the units as close as possible to the circular units disclosed in the above-mentioned U. S. Pat. No. 3,296,645. All four units were magnetized by the same fixture or jig so that they had the same pattern. All four units were provided with back plates made from 18 gauge cold rolled steel. The test was performed on a 0.090 inch thick piece of plate glass, with one magnetic member on each side of the glass. A sheet of cleaning paper of the type hereafter described was saturated with "Windex" cleaner and located between each unit and the glass. A spring gauge which measures the force to separate the units, was attached to one of the members. The pull test was made in the three directions indicated X, Y and Z on the drawings. Three tests were performed in each direction and the average results are as follows:

Direction	Triangular Pattern	Circular Pattern
X	No. 3.6	No. 2.7
Y	No. 3.6	No. 2.7
Z	No. 4.2	No. 2.7

The triangular pattern is superior in all tests; however, in the X and Y direction the improvement appears to result directly from the greater area of material in the triangular pattern. In the Z direction, however, the triangular pattern is over 50 percent more effective than the circular pattern and it is believed that the improvement results from greater efficiency of the tracking forces in the corners. The use of the triangular pattern in a rectangular unit thus gives more efficient utilization of the face area of the unit, increases the strength in the X and Y direction due to the increase in area, and increases the strength in the Z direction due to the increased tracking force along the diagonals.

This application is also particularly directed to a locator 50 (see FIGS. 3–5), a new cleaning material 60 (best shown in FIG. 10), a method of making the cleaning material as by the apparatus of FIG. 9, and structure of the units which allows the cleaning material to be used without any fastener.

The locator **50** allows placement of the slave unit **12** on the window **14** without the master unit **10** holding the slave unit in place. This allows use of the apparatus on windows that do not open or at the front panel of a showcase, for example.

As shown in FIGS. **3–5**, the locator **50** includes a body portion **51**, and a laterally offset neck portion **52** connected thereto by an intermediate portion **53**. These portions are made of magnetically attracted material, such as steel. A plurality of ribs **54** extend outwardly from the master unit facing side of the body **51** to prevent the master unit **10** from coming in full contact with the body **51**. A suction cup **55** is mounted on the neck **52** for attaching the locator to the window as shown in FIG. **3**. Reinforcing ribs **56** are provided on the neck **52** to stiffen the same and prevent bending when the suction cup **55** is removed from the window.

In use, the locator **50** is attached to a window **14** adjacent a lower frame **14*a*** thereof. The slave unit **12** is positioned directly opposite the locator and preferably rests on the frame **14*a***. The slave unit will attract the locator and be held in position by the attraction. The master unit **10** is brought into position as shown in FIG. **3** directly opposite the slave unit. The suction cup **55** is detached and the locator slid upwardly from between the two units while the master unit assumes the position of FIG. **2**. The procedure is reversed for removal of the units.

The new cleaning material **60** comprises a layer of absorbent paper **62** and a discontinuous layer of plastic **64** (see FIG. **10**). The paper is paper toweling purchased from Scott Paper Co., Marinette, Wisc. The paper is about 0.005 inch thick. The plastic is preferably polyethylene chips of 35 mesh size. This works best for reducing friction at the window. One suitable type is PEP 750 sold by Union Carbide Co., Chicago, Ill. The layer of plastic rises about 0.005 inch above the surface of the paper.

FIG. **9** illustrates one suitable apparatus for making the new cleaning material. A sheet of paper **71** is taken from a roll **72**. The sheet passes over rollers **73** and **74** and then under a spreader **75** where the chips are spread on the paper at a rate of about twice the weight of the paper. This gives a coverage of about half of the surface of the paper, but when the manufcturing process is complete, somewhat less than half of the area is exposed. A visual inspection shows about three-quarter coverage by the discontinuous layer of plastic **64**. The sheet **71** is then passed through an infrared oven **76** having six 1000 watt units **77** therein. This melts the plastic chips. As the hot paper and plastic emerges from the oven, the plastic chips are pressed into the paper by means of rolls **78, 79** which are spaced 0.01 inch apart. Roll **78** should be allowed to get hot for this operation and the heat from the heated paper and plastic is sufficient. The cleaning material is passed over idle rollers **81–83** for cooling and then between feed rollers **84, 85**. A rotary cutter **86** cuts the cleaning material to size.

As indicated above, the plastic **64** is discontinuous and this allows the paper **62** to perform its absorbent function. The plastic also reduces the friction at the window-facing side and thereby aids in the tracking function. There is also some scouring performed by the plastic chips.

Although the friction is reduced at the window-facing side, there is no reduction at the side facing the magnetic element. Preferably the magnetic element presents a continuous face for contacting the cleaning material. Also there is either a rubber layer **29** or the magnetic element is rubber impregnated as described above. This increases the friction between it and the back side of the cleaning material and thereby causes the cleaning material to stay in position without any external fastener.

In the specific embodiment illustrated, housing **22'** of the slave unit **12** is made of steel and also serves as a shunting plate.

It is now deemed obvious that there has been disclosed a magnetic window cleaning apparatus with an improved paper and locator.

I claim:

1. A magnetic window cleaning apparatus of the type having a pair of units adapted to be positioned on either side of a window opposite each other, each unit having a window-facing side and magnet means for attracting the opposite unit, one unit being a master unit adapted to be moved over one side of the window and the other unit being a slave unit adapted to follow the master unit, and a sheet of cleaning material overlying the window-facing side of at least the slave unit, wherein the improvement comprises: a locator comprising a plate of ferromagnetic material adapted to be positioned on one side of the window opposite the slave unit to be magnetically attracted by the slave unit and to hold it in position against the window in the absence of the master unit; the locator having a body and means for temporarily attaching to the window so that the locator body is adjacent the window; and the locator being removable after the master unit has been brought into juxtaposition so that its magnet means attracts the slave unit and holds it in position against the window; whereby the locator can be used to position the slave unit and then removed when the master unit is brought into juxtaposition so that the units can be used for remote control cleaning of the slave unit side of the window.

2. The combination of claim **1** wherein the locator has an extension laterally disposed from the body, the attaching means is a suction cup mounted on the extension, and including a plurality of ribs on the extension to rigidify the same and inhibit bending of the extension when the suction cup is detached from the window.

3. The combination of claim **2** wherein the sheet of cleaning material comprises a layer of absorbent paper having chips of polyethylene on the window-facing side of the paper; the polyethylene chips rising above the surface of the paper a distance approximating the thickness of the paper, and the polyethylene chips being about twice the weight of the paper alone but covering substantially less than the entire surface of the paper so that the paper still serves its absorption function.

4. The combination of claim **3** wherein the window-facing side of each unit is at least partly rubber to provide a high-friction surface and so that the cleaning material will having a higher coefficient between the paper and rubber surface than between the polyethylene and glass, whereby the cleaning material will adhere to the rubber surface without additional fastening means as the unit is moved over the window.

5. A locator for use with a magnetic window cleaning apparatus of the type having a pair of units adapted to be positioned on either side of a window opposite each

other, the locator adapted for holding one unit against the window in the absence of the other unit, and comprising: a flat body of ferromagnetic material adapted to be positioned contiguous to the window; an extension at one side of the body and spaced laterally therefrom so that it is spaced from the window when the body is contiguous to the window; and means on the window-facing side of the extension for temporarily attaching to the window to mount the locator on the window; whereby when the locator is attached to one side of the window, one unit can be positioned opposite the locator and held in position by magnetically attracting the locator body.

6. A locator as set forth in claim **5** wherein the attaching means is a suction cup, and including reinforcing means on the extension to stiffen the extension and inhibit bending thereof when the suction cup is detached from the window.

7. A locator as set forth in claim **6** including a plurality of ribs on the body, extending outwardly at the side of the locator opposite the window to prevent the other unit from contacting the locator body.

8. A magnetic window cleaning apparatus of the type having a pair of units adapted to be positioned on either side of a window opposite each other, each unit having a window-facing side and magnet means for attracting the opposite unit, one unit being a master unit adapted to be moved over one side of the window and the other unit being a slave unit adapted to follow the master unit, and a sheet of cleaning material overlying the window-facing side of each unit, wherein the improvement comprises; the window-facing side of each unit being substantially flat over its entire area, the window-facing side being formed at least partly of rubber to provide a high-friction surface for engaging the cleaning material so that the cleaning material will adhere to the rubber surface without additional fastening means as the unit is moved over the window, and the magnet means of at least one unit being formed of rubber impregnated magnetic material to thereby provide the rubber at the window-facing side.

9. A magnetic window cleaning apparatus as set forth in claim **8** wherein the rubber at the window-facing side of the other unit is provided by a thin layer of rubber overlying the magnet means.

10. A magnetic window cleaning apparatus as set forth in claim **8** wherein the sheet of cleaning material comprises a layer of absorbent paper having plastic material on the window-facing side of the paper, the plastic material being discontinuous so that areas of the paper are exposed for its absorption function, and the plastic material providing a reduced friction between the cleaning material and the window.

11. A magnetic window cleaning apparatus as set forth in claim **10** wherein the discontinuous layer of plastic material is formed from polyethylene chips.

12. A magnetic window cleaning apparatus as set forth in claim **11** wherein the polyethylene chips rise above the surface of the paper a distance approximating the thickness of the paper, and the polyethylene chips being about twice the weight of the paper alone but covering substantially less than the entire surface of the paper so that the paper still serves its absorption function.

13. A magnetic window cleaning apparatus as set forth in claim **10** wherein the discontinuous layer of plastic material is formed from plastic chips of about a **35** mesh size.

14. A magnetic window cleaning apparatus of the type having a pair of units adapted to be positioned on either side of a window opposite each other, each unit having a window-facing side and magnet means for attracting the opposite unit, one unit being a master unit adapted to be moved over one side of the window and the other unit being a slave unit adapted to follow the master unit, and a sheet of cleaning material overlying the window-facing side of at least the slave unit, wherein the improvement comprises: a locator comprising a plate of ferromagnetic material adapted to be positioned on one side of the window opposite the slave unit to be magnetically attracted by the slave unit and to hold it in position against the window in the absence of the master unit; the locator being removable after the master unit has been brought into juxta-position so that its magnet means attracts the slave unit and holds it in position against the window; whereby the locator can be used to position the slave unit and then removed when the master unit is brought into juxtaposition so that the units can be used for remote-control cleaning of the slave unit side of the window; the locator having a flat body and a plurality of ribs on the body; and the ribs extending outwardly at the side of the locator opposite the window to prevent the master unit from contacting the body.

* * * * *