United States Patent

Modrey

[15] **3,638,600**

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[54] **APPARATUS FOR TREATING FERROUS SURFACES**

[72] Inventor: **Henry J. Modrey**, 158 Eagle Drive, Stamford, Conn. 06903

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[52] **U.S. Cl.** **114/222**

[51] **Int. Cl.** **B63b 59/00**

[58] **Field of Search** 114/222; 335/286

[56] **References Cited**

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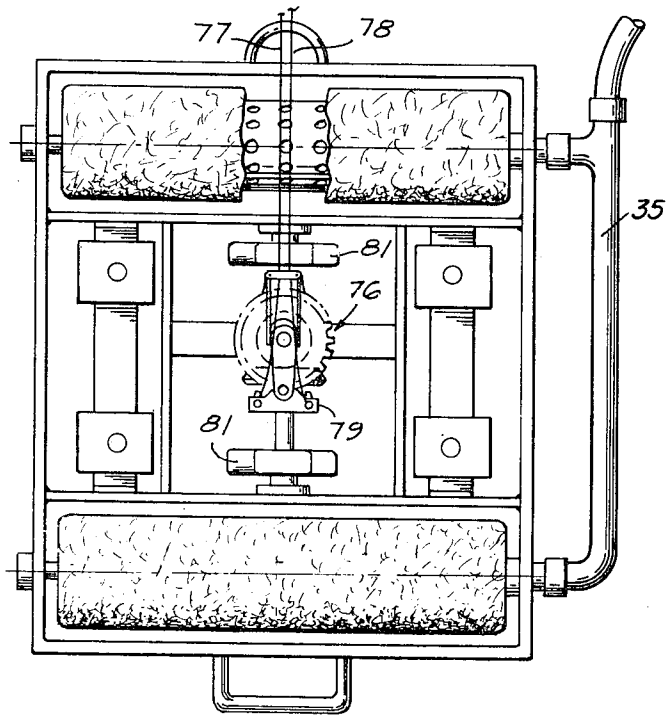
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Primary Examiner—Milton Buchler
Assistant Examiner—Gregory W. O'Connor
Attorney—Hane & Baxley

[57] **ABSTRACT**

This disclosure teaches a device for treating a ferrous surface and contemplates such applications as painting or scrubbing a ship's hull. Preferably, one or more rollers are engaged to the ferrous surface by magnets which are connected to the rollers within the width thereof by means of spring members. Thus engaged, the rollers are easily moved over the surface. Suitable paint applying devices or scrubbing brushes with drives are furnished on the rollers.

9 Claims, 22 Drawing Figures



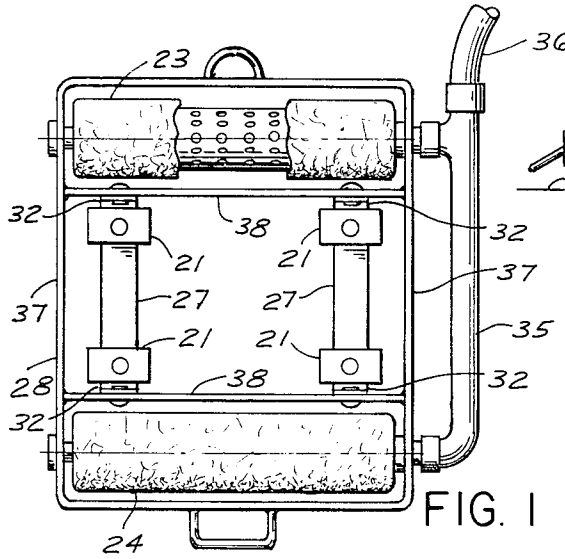


FIG. 1

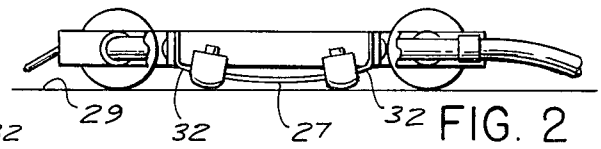


FIG. 2



FIG. 3

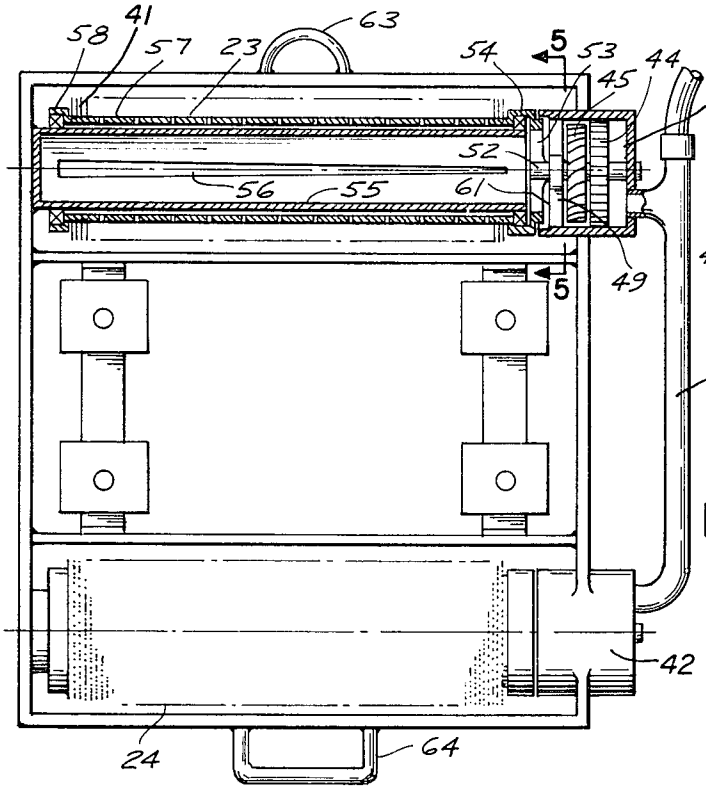


FIG. 4

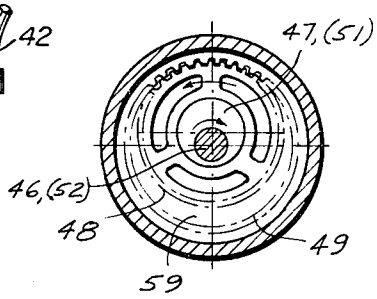


FIG. 5

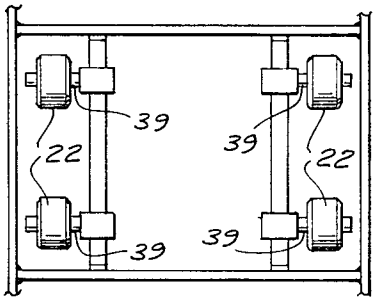


FIG. 6

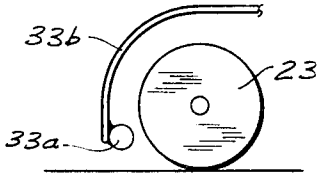


FIG. 6A

INVENTOR.
HENRY J. MODREY
BY Hane and Baxley
ATTORNEYS

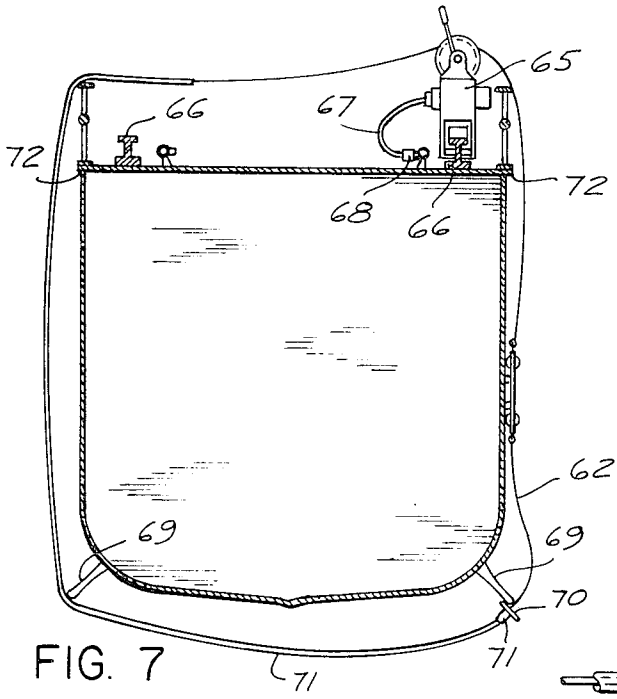


FIG. 7

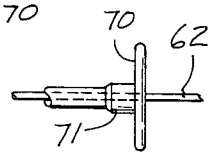
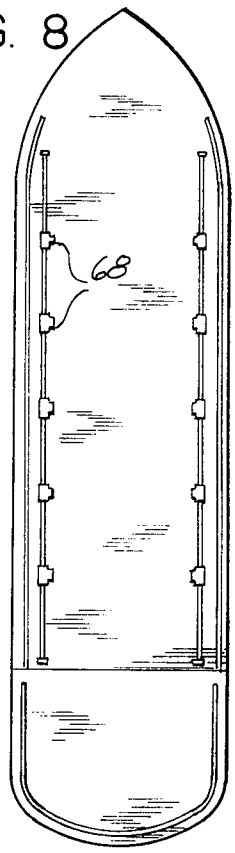


FIG. 7A

FIG. 8



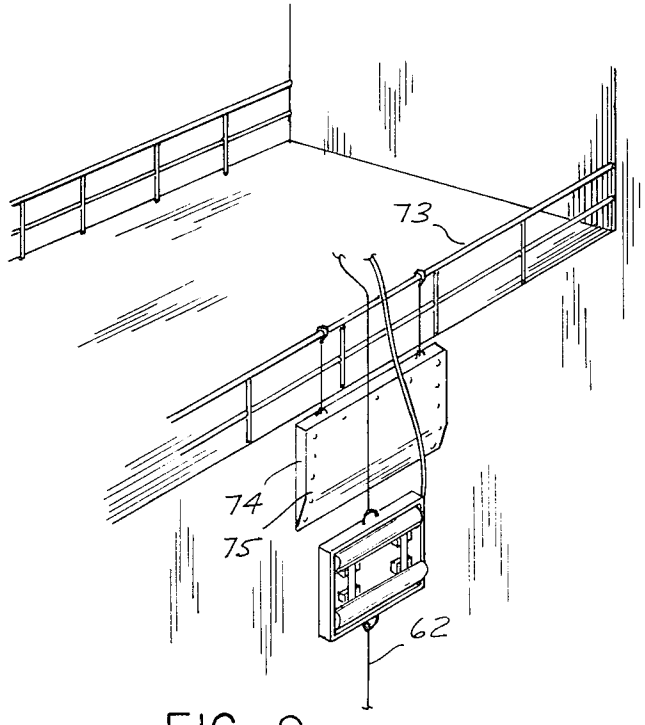


FIG. 9

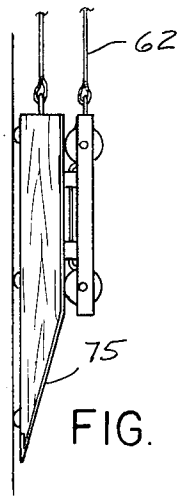


FIG. 10

INVENTOR.
HENRY J. MODREY
BY Hane and Baxley
ATTORNEYS

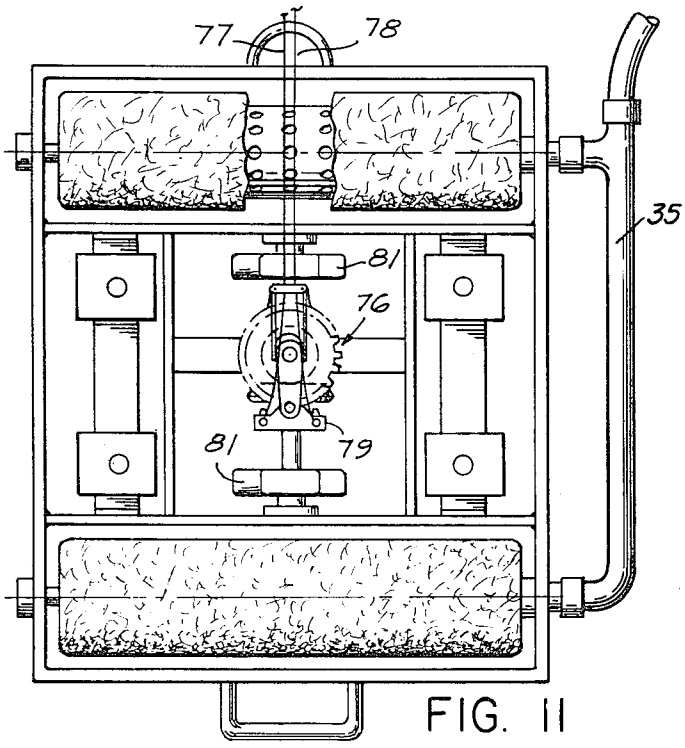


FIG. 11

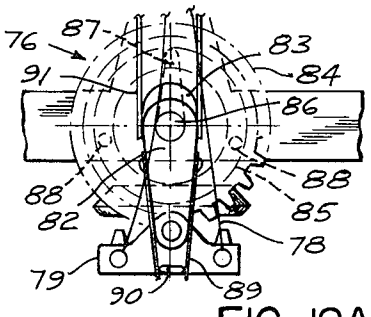


FIG. 12A

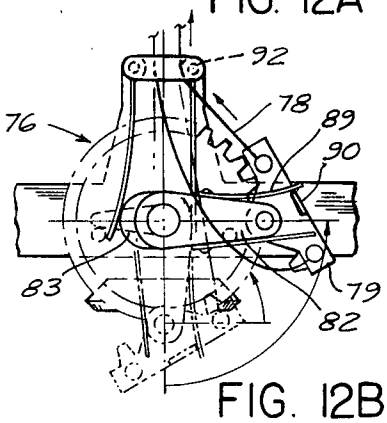


FIG. 12B

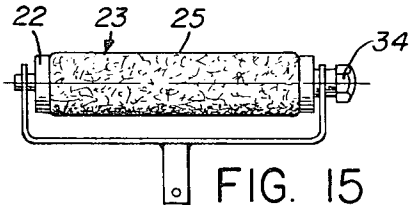


FIG. 15

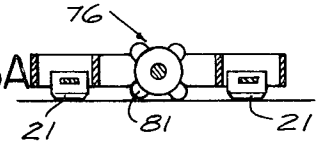


FIG. 13A

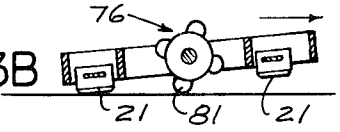


FIG. 13B

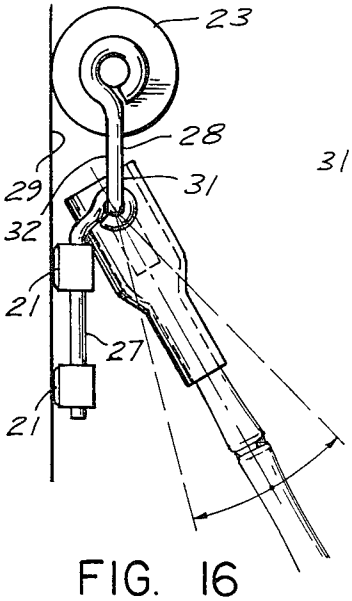


FIG. 16

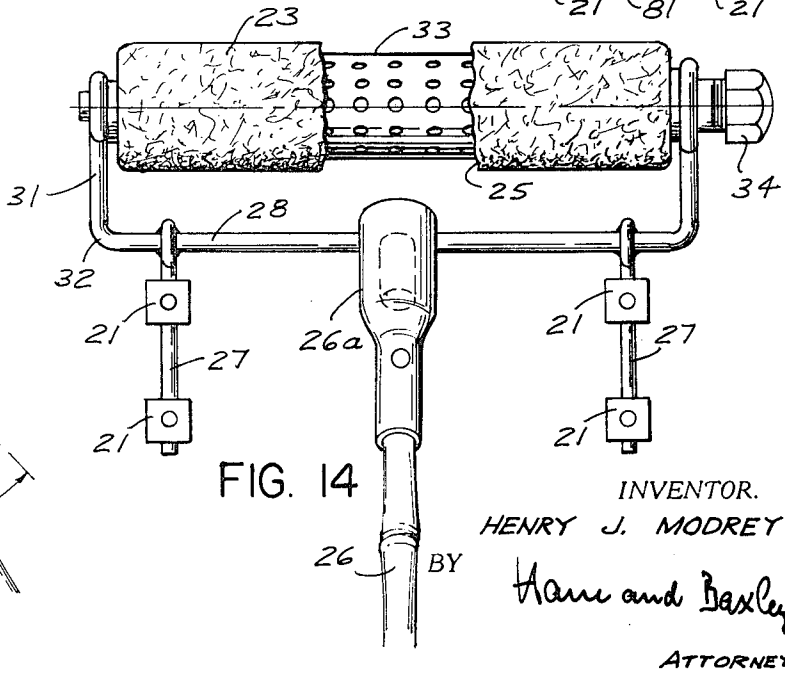


FIG. 14

INVENTOR.
HENRY J. MODREY
BY
Hane and Baxley
ATTORNEYS

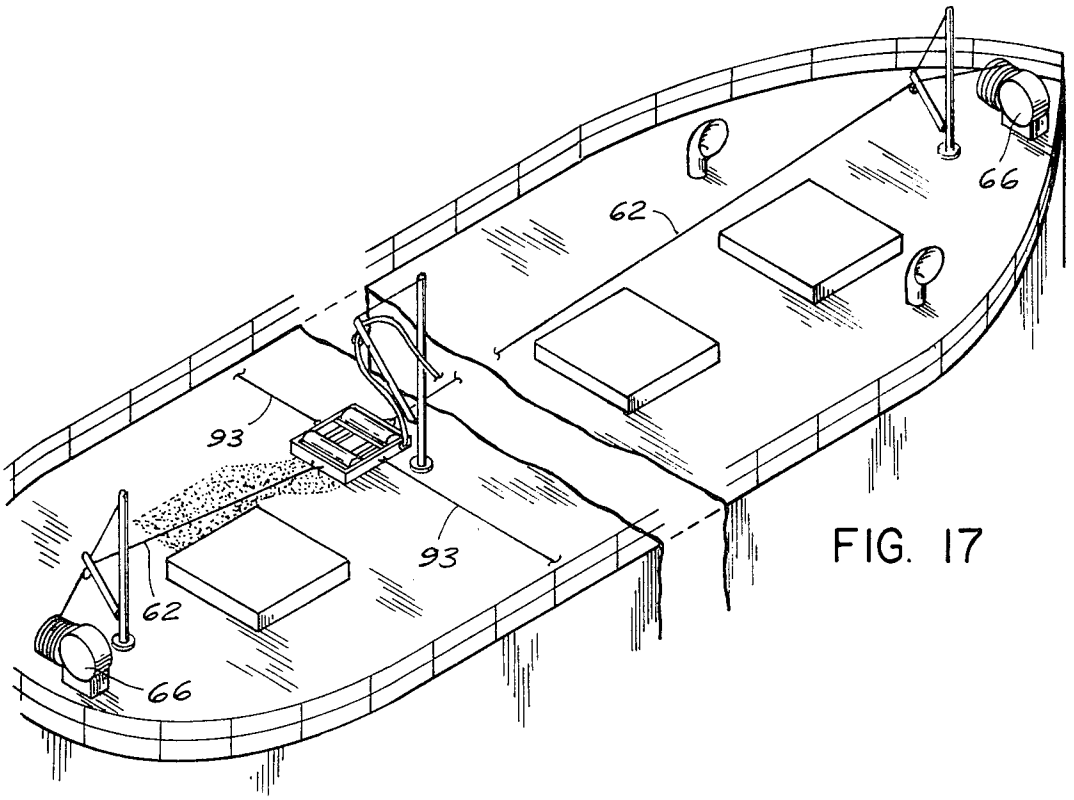


FIG. 17

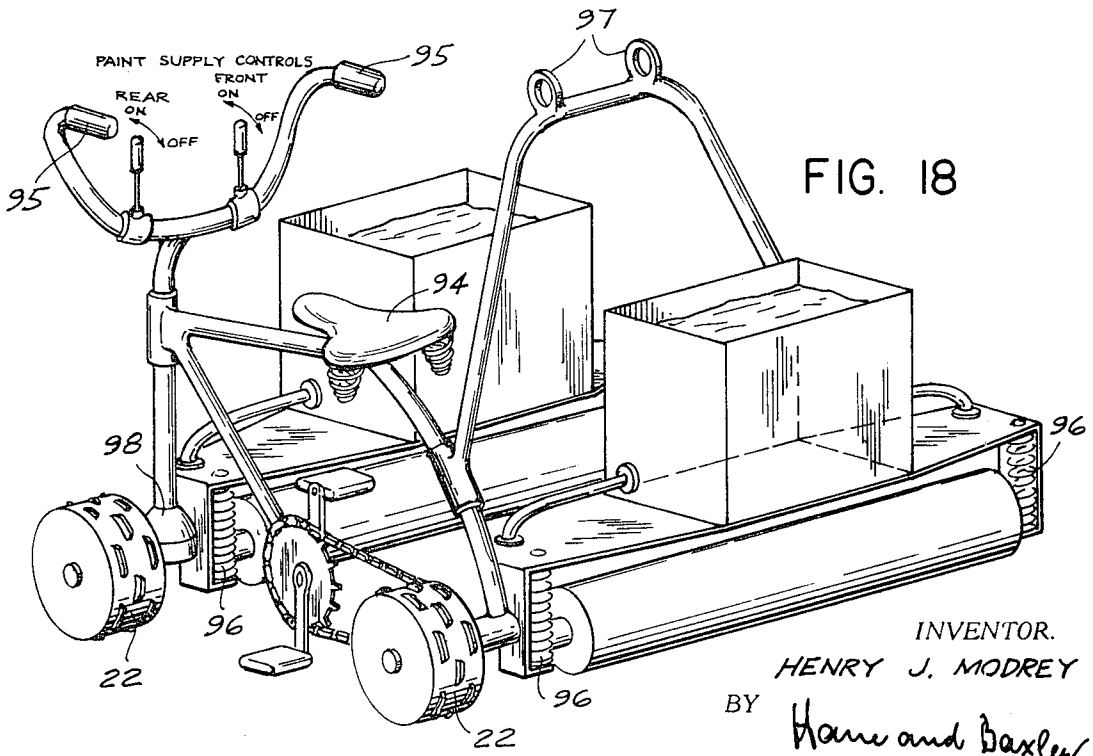


FIG. 18

INVENTOR.
HENRY J. MODREY
BY Hane and Baxley
ATTORNEYS

APPARATUS FOR TREATING FERROUS SURFACES

BACKGROUND OF INVENTION

The invention is here presented in terms of painting the surface of a ship's hull both above and below the waterline; however, it should be understood that the invention is applicable likewise to such other applications as deck painting and scrubbing marine growth from the hull surface. Further, it can serve in kindred applications for ferrous structures.

To apply paint under water, divers are usually required. The paint is applied under pressure by hand rollers which are covered by suitable paint-applying material (such felt, chamois, etc.). Power-driven applicators are also in use, and comprise a rotating brush driven by a pneumatic motor; the paint is fed to the center of the brush. Operations performed by divers are expensive. Moreover, unless scaffolding is employed, the paint application pressure which can be achieved is small, because the diver has nothing against which to brace himself.

After suitable surface preparation, it is application pressure (achieved by working the paint in) which governs the service life of a coat of paint. Therefore, it is desirable to have a marine paint applicator in which adequate and reliable paint application pressure is assured.

SUMMARY

The present invention deals with the foregoing problem in a novel and facile way. One or more rollers are engaged to a ferrous surface (such as steel) by magnets. Thus engaged, the rollers are easily rolled or adapted to slide over the surface.

One object of this invention is to provide a device for treating steel surfaces with application pressure contributed by magnetic adhesion.

A further object is to assure adequate and reliable application pressure.

A further object is to allow adjustment of magnetic adhesion by simple mechanical means.

A further object is to equalize application pressure on a plurality of rollers.

A further object is to facilitate movement of magnets over the surface to be treated.

A further object is to provide for scrubbing of the steel surface with brushes for removal of marine growth.

A further object is to provide for painting of the steel surface with paint-applying material mounted about said rollers.

A further object is to provide for movement of the apparatus sideways.

A further object is to provide convenient storage of the apparatus by attaching it to convenient steel surfaces.

A further object is to provide an apparatus which is simple and robust and which is otherwise well suited to its intended task.

DRAWINGS

The foregoing and other features will appear more fully from the accompanying drawings wherein like numerals refer to like parts and wherein:

FIG. 1 is a partly broken top view, looking inward upon the steel surface to be treated, of an apparatus according to this invention and adapted for painting.

FIG. 2 is a partly broken side view of the apparatus in FIG. 1.

FIG. 3 is an enlarged detail view of the pole surface of a magnet chamfered for easy sliding movement over the steel surface to be treated.

FIG. 4 is a partly broken and partly sectioned top view of another embodiment of this invention adapted for scrubbing to remove marine growth.

FIG. 5 is a partial sectional view taken along line 5—5 of FIG. 4.

FIG. 6 is a partial broken top view of another embodiment of this invention having wheel magnets for easier movement.

FIG. 6A is a broken detail of a different paint-feeding system.

FIG. 7 generally depicts operation of an apparatus according to this invention applied to the side of a ship.

FIG. 7A is an enlarged detail of a stop disk which engages the bilge keel of the ship shown in FIG. 7.

FIG. 8 is a top view which shows the layout of the deck of the ship shown in FIG. 7.

FIG. 9 is a perspective view illustrating the application of a lifting shield for moving the apparatus sideways.

FIG. 10 is a side view of the lifting shield of FIG. 9.

FIGS. 11, 12A, 12B, 13A and 13B graphically illustrate another system, comprising a pawl and spur gears organized to move the apparatus a precise distance sideways, in response to a pull at a lanyard.

FIG. 14 is a broken top view of another embodiment of this invention adapted for painting by hand.

FIG. 15 illustrates another embodiment of this invention adapted for painting and with wheel magnets mounted on its roller.

FIG. 16 is a side view of the embodiment shown in FIG. 14.

FIG. 17 generally shows operation of an apparatus according to this invention applied to painting a ship's deck.

FIG. 18 illustrates an alternate arrangement suited to painting a ship's deck.

PREFERRED EMBODIMENTS

Broadly this disclosure includes surface treating devices having general features in common with conventional paint applicators but provided with magnets 21 such as the one shown in FIGS. 14 and 16, as well as a similar embo;iment shown in FIG. 15 with wheel magnets 22 mounted about roller 23. Because the magnets 22 streak paint while sliding over the freshly painted surface, a second roller 24 (such as in FIGS. 1 and 2) is provided in some embodiments to smooth such streaks. Double roller apparatuses for painting are shown in FIGS. 1 and 2, and for scrubbing in FIGS. 4 and 5. A like embodiment is shown in FIG. 16 with wheel magnets 22.

As depicted in FIG. 15 the most simple form of this invention includes roller 23 which is here adapted for painting and with wheel magnets 22 connected thereto for holding roller 23 in engagement with a surface to be painted. Wheel magnets 22 have a smaller diameter than paint-applying material 25. This apparatus is operable by hand or it can be mounted on the end of a pole such as pole 26 preferably provided with a swiveled ferrule 26*a*, shown in FIGS. 14 and 16. Ordinarily paint rollers have a ferrule which is firmly connected to the frame. The ferrule transmits the application pressure which the operator exercises via pole 26 (which often bends to 90° if the job is done well). In FIGS. 14 and 16 the ferrule swivels, because roller 23 sticks to hull surface 29 and roller 23 is simply pulled up and down by the operator. For this purpose, a swiveled ferrule is far preferred.

The embodiment shown in FIGS. 14 and 16 is a simple, convenient paint applicator for general use on steel surfaces. Several magnets 21 are mounted on spring arms 27 which cantilever beyond one of the paired magnets 21 to rigidly engage frame 28 so that roller 23 is held against surface 29. As best seen in FIG. 16 spring arms 27 and yoke pieces 31 (of frame 28) welded thereto form a crank which is urged by magnets 21 toward surface 29. Application pressure can be changed by adjusting the span of spring arms 27 relative cantilever portions 32. Roller 23 is conventional and includes perforated cylinder 33 having a cover of a suitable paint applying material 25 (such as felt, chamois or the like) and encloses an interior paint reservoir with filler cap 34 permitting either filling the reservoir with paint, or else connecting it to a paint feed hose. This embodiment could also have a nonperforated cylinder 33 by merely dipping roller 23 into a bucket of paint. As shown in FIG. 6A, a different paint-feeding system permits the paint to drip out under gravity through perforated tube 33*a* positioned between shroud 33*b* and roller 23. This last-mentioned paint-feeding system is used with the arrangement of FIG. 18.

Material 25 (usually felt) is quite thick to start with but it abrades rather rapidly. It is ordinarily replaced when it wears

through. This means that the overall diameter of the paint roller will diminish by approximately one fourth inch as the operation goes on. Spring arms **27** and yoke pieces **31** of FIGS. **14** and **16** make up for the decrease in diameter of material **25** and maintain application pressure fairly constant in that embodiment.

The advantage of magnets in paint application service is that application pressure is produced automatically and uniformly by the action of the magnets, independently of the efforts of the painter. This principle is also valid for any other apparatus to treat a steel surface wherein adequacy and/or reliability of application pressure is of concern.

A two-roller apparatus suitable for rope operation is shown in FIGS. **1** and **2**. This apparatus is suitable for both over and underwater painting. Frame **28** has paint rollers **23**, **24** journaled therein in parallel spaced relationship. Either one or both rollers **23**, **24** can be supplied with paint via manifold **35** and paint feed hose **36**. Frame **28** includes side pieces **37** with crossbars **38** connected therebetween. Several permanent magnets **21** are spanned by spring arms **27** which extend beyond magnets **21** for connection at both ends to crossbars **38**. Spring arms **27** are slightly curved to equalize pressure on rollers **23**, **24**. As shown in FIG. **3**, magnets **21** have chamfered pole faces to facilitate their sliding over steel surface **29** which is to be treated. When this apparatus is put against steel surface **29**, here envisaged to be the hull of a ship, it adheres firmly thereto. Resilience of spring arms **27** enables the apparatus to surmount irregularities of the surface without losing its adhesion. The strength of magnets **21** and the geometric relationship of portions **32** of spring arms **27** to the span of spring arms **27** between paired magnets **21** determines paint application pressure. This application pressure can be regulated by shifting the position of magnets **21** on spring arms **27**.

If desirable the slidable magnets **21** of FIGS. **1**, **2** and **3** can be replaced by electromagnets, or by wheel magnets **22** turning on axle stubs **39** as shown in FIG. **6** whereby the apparatus will move more easily. The edges of wheel magnets **22** would also be chamfered as shown.

The apparatus shown in FIGS. **4** and **5** is a scrubber used to remove marine growth prior to painting. For reasons which will become apparent, it is desirable to make this scrubber as a separate unit from the paint applicator because frame dimensions will be different. Rollers **23**, **24** have steel bristles **41**. Manifolds **42** and hose **43** carry air under pressure. Internally, rollers **23**, **24** are air energized. In roller **23** is shown directrix **44** and turbine wheel **45**. Turbine wheel **45** is on shaft **46** which is fixed in eccentric **47**. Eccentric **47** engages gear **48** which engages fixed internal gear **49**. Gear **49** engages a separate eccentric **51** (behind eccentric **47**) fixed on output shaft **52**. Spider **53** on shaft **52** connects to bearing **54** for rotating bristle roller **23**. Fixed cylinder **55** has slot **56** facing surface **29**. Distal end **57** of roller **23** has another bearing **58**. In order for driving air to exit under bristles **41**, it must pass from turbine wheel **45**, and thence between gears **48** and **49** into fixed cylinder **55**. This is possible due to space **59** between gears **48** and **49**, and because of openings **61** in spider **53**. Roller **23** is of open or screened construction.

These two-roller apparatuses are not motorized. They are moved by ropes **62** attached to hoisting rings **63** and **64**. Hoisting ring **64** is shaped to provide a fulcrum for disengaging magnets **21** from a hull by extending supporting rope **62** outward from the hull. By way of example in painting ship hulls without scaffolding, a rope **62** from winch **65** has to be slung across the bottom of the ship as shown in FIG. **7** to effect movement of the apparatus to and fro. Winch **65** can be mounted on rail **66** and can be operated conveniently by air pressure from lines **67** with taps **68** as shown. FIG. **8** shows the layout of the deck. Painting of a hull must be done in two sections, viz above and below bilge keels **69** which the apparatus cannot surmount. To prevent chafing, rope **62** is slidably encased in nylon tubing **71** for most of its length. The lower end of tubing **71** carries stop disk **70** (see FIG. **7A**) which abuts on bilge keel **69** when wire rope **62** is tightened so that movement of tubing **71** is prevented. Winch **65** is able to pull the apparatus up and down between bilge keel **69** and scupper **72**. The procedure is comparable for the other side of the ship. For painting between the bilge keels **69**, which is sorely required in routine maintenance, the device is lifted over one bilge keel by a diver and it thereafter operates between the two bilge keels.

A specific problem is to move the apparatus sideways after it has painted, scrubbed or otherwise treated one strip. It is not practical to pry the apparatus off the hull and affix it again. FIG. **9** illustrates one suitable method for accomplishing this objective. From rail **73** hangs lifting shield **74**. As shown in FIG. **10**, at the end of its upward travel the painting apparatus moves onto lifting shield **74** which is simply a wedge-shaped piece of wood covered with sheet steel **75**. In this way magnets **21** (or **22** as the case may be) transfer this attachment force from the ship's hull to the steel sheet **75**, and lifting shield **74** with the apparatus attached thereto is simply shifted sideways to the next strip.

The simple device of FIGS. **9** and **10** has some disadvantages. A minor disadvantage is that lifting shield **74** covers the top of the strip which must be finished thereafter by hand painting. A major disadvantage is that it is difficult to move pull rope **62** at the bottom of its run (near bilge keel **69**) by precisely a desired distance (for example a strip width). Because this movement takes place under water, it is difficult to move the pull rope a precise amount without using a diver. Therefore, it is expedient to include in the apparatus means which cause it to move sideways with some degree of precision either under or over water. Further, it is preferable that this device be mechanical rather than electrical, in view of the fact that the use of electricity is severely restricted on some ships (tankers for example). Toward these objectives, walking device **76** shown in FIGS. **11** through **13B** was devised. Walking device **76** is operable in either left or right direction by the alternate use of one of the lanyards **77**, **78** operating spur tooth pawl **79** which in turn operates spur gears **81** which may have magnets thereon. Arm **82** has cam **83** at its inner end and spindles pawl **79** at its outer end. Gear **84** fixed to bevel gear **85** turns freely on shaft **86**. Shaft **86** at its far end has crank stop **87** which, meeting pins **88** on the frame, limits rotation of shaft **86** to 90° in either direction. Springs **89** attached to arm **82** are prespread into their normal position about post **90** as shown in FIG. **12A**. Similarly prespread are springs **91** fixed to an extension of the frame. Springs **89** are light compared to springs **91**. Pull on lanyard **78** passing around roller **92** will first turn pawl **79** into engagement with gear **84** which turns bevel gear **85** and spur gears **81**. A 90° turn (as shown from FIG. **12A** to FIG. **12B**) ensures a full repositioning of spur gears **81**. If pawl **79** does not engage gear **84** at first, mismatch is self-correcting. A turn of less than 90° does no harm as the magnets on spur gears **81** will be so close to the hull that they will pull themselves into final position. The center yoking of lanyard **78** over roller **92** is necessary to maintain engagement of pawl **79**. On release of lanyard **78** spring **89** bearing against post **90** disengages pawl **79** from gear **84**. The weight of arm **82** and pawl **79** starts pawl **79** downward. Springs **91** complete return of pawl **79** to its initial position.

The problem associated with painting a ship's deck is to steer the paint-applying apparatus around various obstacles such as cargo hatches, ventilating trunks and the like. A scheme for painting a ship's deck is shown in FIG. **17** wherein the device according to FIG. **1** is pulled fore and aft by winches **66** at either end of the ship. As steering is necessary, it can be accomplished by pulling on ropes **93** attached to the sides of the apparatus. This procedure can be assisted somewhat by guiding the lengthwise pull ropes **62** over pulleys or derricks to align movement of the apparatus. Side pulling, in coaction with the straight winch pull, permits steering in a surprisingly effective manner. One gets about the equivalent of tacking in a sailboat. Trials have shown that about 70 percent of the deck surface of a cargo ship can be painted in this manner, and more than 85 percent of the deck of a tanker.

FIG. 18 shows a bicyclelike arrangement especially suited to painting of decks. A gravity paint feeding system such as the one shown in FIG. 6A is here employed. Seat 94 and handles 95 are adjustable. Staggered wheel magnets 22 provide traction. Springs 96 regulate leveling and application pressure. Steering joint 98 is limited, so this apparatus can be picked up by means of eyelets 97.

Magnetic apparatuses as taught in this disclosure have the added advantage of being easily stored on shipboard by merely attaching their magnets to convenient steel surfaces. Such storage is beneficial to the life spans of these magnets.

What I claim is:

1. An apparatus for treating a substantially planer ferrous surface, said apparatus comprising in combination:

a frame including a pair of parallel sidepieces;

a pair of rollers rotatably supported by said frame and disposed therein in spaced-apart parallel relationship, said rollers being journaled at their ends in said sidepieces and organized for rolling engagement with the surface to be treated;

a pair of crossbars each connected between the sidepieces and inward of said rollers;

magnet means;

spring means supported by said frame and supporting said magnet means intermediate said rollers, said spring means being biased to urge said magnet means into engagement with said surface when said rollers are placed in engagement with the surface, said spring means including a spring arm arranged parallel to and inward of said sidepieces and connected at each of its ends to one of the crossbars and said magnet means being mounted on said spring arm for engagement of both of said rollers with said surface; and

forward drive means attachable to said frame for rolling the rollers on and along said surface.

2. The apparatus according to claim 1 and further comprising sideways drive means supported by said frame for displacing said frame sideways through predetermined increments.

3. The apparatus of claim 1 with said magnet means comprising a chamfered pole surface to facilitate sliding over said surface.

4. The apparatus of claim 1 with the spring arms organized for bowing toward said surface to equalize pressures on said rollers.

5. The apparatus of claim 1 with said magnet means including a magnet rotatably mounted for rolling along said surface.

6. The apparatus according to claim 1 with a paint-applying material mounted about at least one of said rollers and means for supplying paint thereto.

7. The apparatus according to claim 1 with a paint-applying material mounted about both of said rollers and means for supplying paint thereto.

8. The apparatus of claim 1 with

said roller adapted to engage a ship's hull,

sideways drive means including spur gears connected to the frame and arranged to engage said hull sideways relative said rollers,

means operable by a lanyard for turning said spur gears to move said frame sideways relative said rollers through a predetermined distance in response to an operation of the lanyard.

9. The apparatus of claim 8 with said spur gears mounting magnet means.

* * * * *