W. R. MACDONALD.

CLEANER FOR SHIPS' HULLS AND THE LIKE.

APPLICATION FILED NOV. 21, 1908.

959,566.

Patented May 31, 1910.

2 SHEETS—SHEET 1.

Fig: 1.

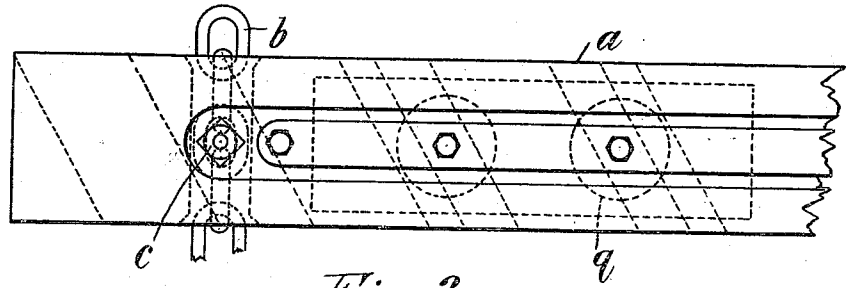
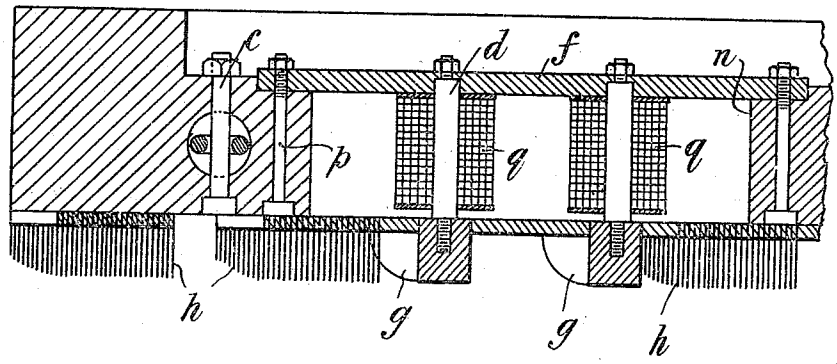


Fig: 3.



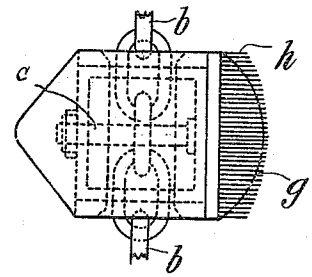


Fig: 2.

Witnesses.
L. C. Barkley.
E. G. Gibbs

Inventor:
William Richard Macdonald
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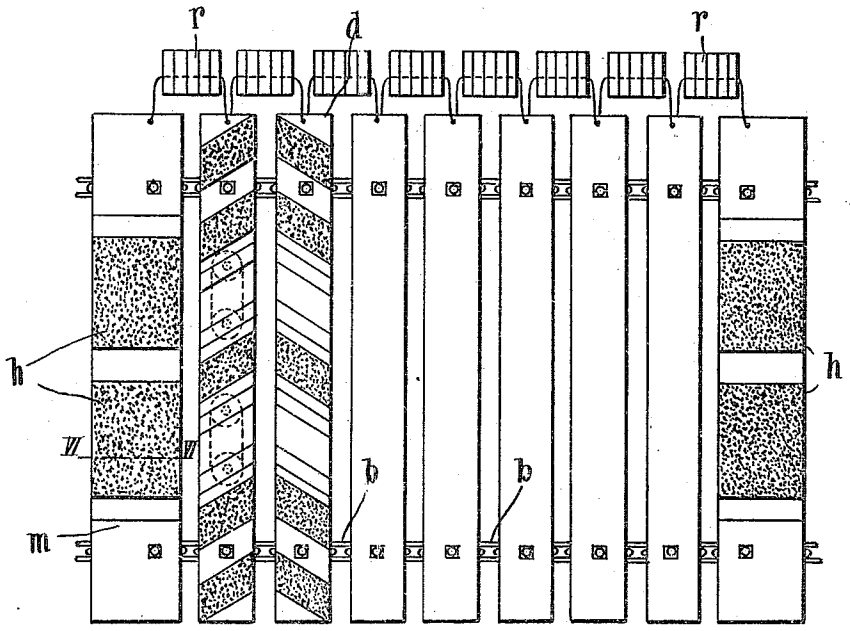
2 SHEETS—SHEET 2.

Fig4.



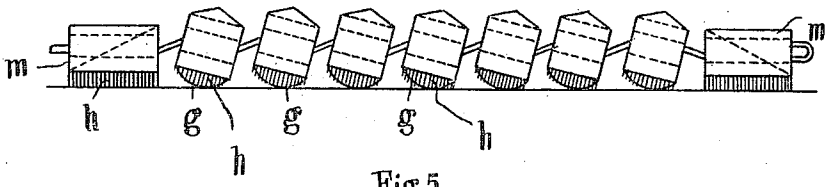


Fig.5.

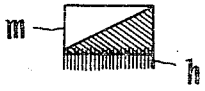


Fig:6.

Witnesses:
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am Lerch

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UNITED STATES PATENT OFFICE.

WILLIAM RICHARD MACDONALD, OF EEL PIE ISLAND, TWICKENHAM, ENGLAND.

CLEANER FOR SHIPS' HULLS AND THE LIKE.

959,566. Specification of Letters Patent. **Patented May 31, 1910.**

Application filed November 21, 1908. Serial No. 463,897.

To all whom it may concern:

Be it known that I, WILLIAM RICHARD MACDONALD, engineer, a subject of the King of Great Britain, residing at Eel Pie Island, Twickenham, in the county of Middlesex, England, have invented new and useful Improvements in Cleaners for Ships' Hulls and the Like, of which the following is a specification.

This invention relates to improvements in the mats employed for cleaning the surfaces of sea-going vessels, pontoons and the like, from barnacles and other growths. As generally constructed these mats consist of a series of parallel beams flexibly secured to one another and the beams carry suitable stiff brushes. By drawing such a mat backward and forward over the surface of a vessel the adhering growths can be quickly and easily removed. In order that the mat may be pressed against the sides of the vessel with sufficient force, it has been suggested that electromagnets should be attached to the beams so as by their attraction toward the ships' plates to force the brush against the side. It is to this class of mat that the present invention particularly relates and it consists chiefly in novel provisions designed with a view to securing a greater magnetic attraction between the mat and the vessel and for otherwise producing the desired pressure between the two.

The invention is illustrated in the accompanying drawings in which—

Figure 1 shows a part of a single batten in elevation; Fig. 2 is an end view of the same, and Fig. 3 a sectional view of the same. Fig. 4 shows somewhat diagrammatically a whole mat in elevation, and Fig. 5 is a view of the mat in the position it assumes when working. Fig. 6 is a section of a detail on the line VI—VI of Fig. 4.

As is apparent from Fig. 4 the mat consists of a series, say about seven, of wood battens *a* which are linked together by means of two or more chains *b*. The attachment of the battens to these chains is better seen in Fig. 2 where it is apparent that there is a hole passing transversely through the batten while a pin *c* is secured to the batten across this hole and this pin engages with one of the links of the chain *b*. Within each batten there are secured two or more electromagnets according to the amount of pull required. These are seen in detail in Fig. 3 where *d* are the cores of the magnets, *f* the yoke and *g* the pole pieces. The pole pieces *g* are solid and project down in the center to the same extent as the bristles, these latter being secured within a wood or other backing *h* at intervals along each batten. Preferably the brushes slope alternately in opposite directions as shown and have spaces between to allow the detached growths to fall away. As will be seen from Fig. 2, the solid pole piece *g* has its outer face curved much more sharply than the face of the brushes *h*.

With regard to the arrangement of the electromagnets it should be noted that the greater the number of separate magnets, the greater the number of points of contact at which the attraction may be exerted and the more uniform the total pull on the whole mat toward the ship. The advantage of this construction is that when the mat is first hung against the ship and the magnets excited, the solid pole pieces *g* can actually come into contact with the plates of the vessel at the outermost points of their curved surface. By this means the air or water gap in the magnetic circuit is wholly eliminated and consequently the total flux which can be set up by a given magnetomotive force and thus the total attraction is very much increased. When the mat begins to be drawn along the ship's side the battens will naturally assume the sloping position shown in Fig. 5—the provision of sufficiently large holes through which the chains are passed allowing of this turning, and the pull of the pole pieces *g* against the ship's plates resisting the longitudinal pull of the chains *b*. Such turning of the battens results in the bristles *h* being pressed very firmly against the side, this pressure being due to the resistance of the pole pieces *g* to separation from the iron of the ship. If the battens have flat tops, however, the pressure of the water upon these tends to prevent turning; it is therefore better to slope the top surface of the batten as shown. It will be readily obvious that the force which can be applied in this way to the bristles is much greater than that which would be attained by merely making the bristles themselves the pole pieces of the magnets.

The end or dummy battens *m* should preferably be beveled in the middle part of their length as shown particularly by the sectional

view in Fig. 6 so that the lateral movement of the mat causes these battens to be pressed firmly toward the side of the ship. Moreover as will be seen from Fig. 4 the dummy battens carry brushes so arranged that they clear a path for the solid pole pieces which follow them and thus permit these latter to maintain contact with the ship's plates. It is convenient that a hole of considerable size should be cut in the batten as shown by the lines *n* to receive the electromagnets. This hole is partially closed by a plate *f* which forms the yoke of the electromagnets and which is secured to the beam by any suitable bolts *p*. This plate, however, does not close the hole in a water tight manner because it is preferable to allow the water to circulate around the windings *q* of the electromagnets in order to keep these cool. The windings are of course insulated with rubber or other material which is not harmed by the moisture and by permitting the free circulation of the cold water it is possible to pass a considerably greater current through windings than could be allowed if there were no means for cooling.

In order that there may be no trouble in getting the mat to assume its correct position for scrubbing purposes it is desirable to attach to one edge a series of corks *r* which will serve to keep this end always uppermost in the water so that the mat cannot turn with its back toward the ship. Instead of this in cases where the mat is already very buoyant it may be better to load the lower edge with lead, which will attain the same purpose.

If desired the battens may be divided along their length so as to secure greater flexibility in this direction and enable the mat to adapt itself to the shape of the ship's side. Obviously in this case there should be one or more electromagnets in each part of the batten.

What I claim is:—

1. In an apparatus for cleaning submerged iron surfaces the combination of a plurality of battens, flexible connections between said battens, curve faced brushes on said battens, and electromagnets on said battens side by side with said brushes, with pole faces more sharply curved than the brush faces.

2. In an apparatus for cleaning submerged iron surfaces the combination of a plurality of battens, continuous chains securing said battens flexibly together, curve faced brushes on said battens, and electromagnets on said battens side by side with said brushes, with pole faces more sharply curved than the brush faces.

3. In an apparatus for cleaning submerged iron surfaces the combination of two end battens each having an outward bevel on its upper side, intermediate battens having the two upper edges beveled, flexible connections between said battens, curve faced brushes on said battens, and electromagnets on said battens side by side with said brushes, with pole faces more sharply curved than the brush faces.

4. In an apparatus for cleaning submerged iron surfaces the combination of two end battens each having an outward bevel on its upper side, intermediate battens having the two upper edges beveled, continuous chains securing said battens flexibly together, curve faced brushes on said battens, and electromagnets on said battens side by side with said brushes, with pole faces more sharply curved than the brush faces.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM RICHARD MACDONALD.

Witnesses:
JOHN A. JORDAN,
A. E. O'DELL.