(No Model.) 2 Sheets—Sheet 1.

D. B. MORISON.

PROPELLER SHAFT FOR MARINE ENGINES.

No. 569,116. Patented Oct. 6, 1896.

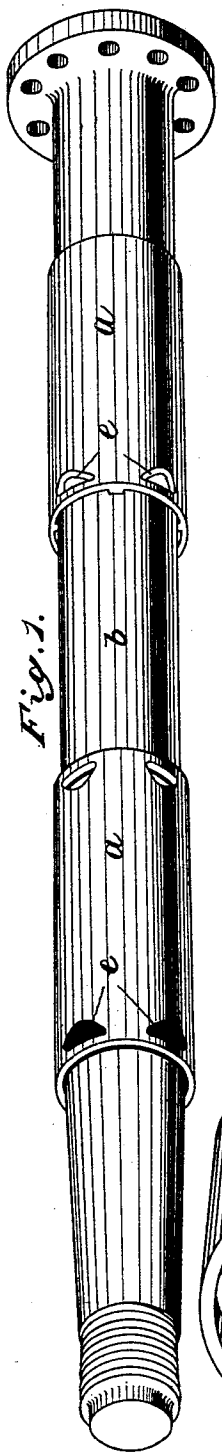

Fig. 1.

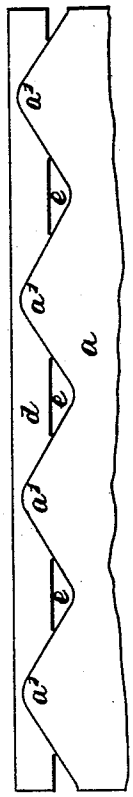

Fig. 5.

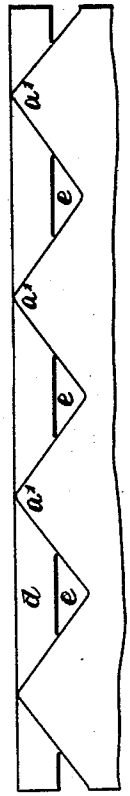

Fig. 6.

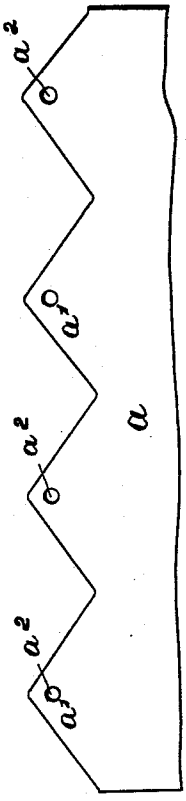

Fig. 7.

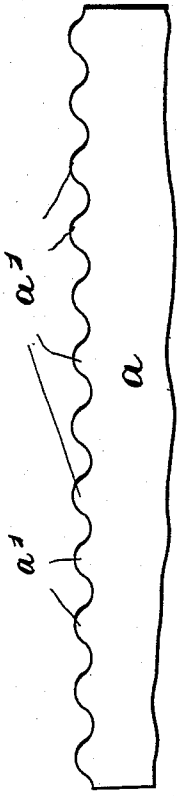

Fig. 8.

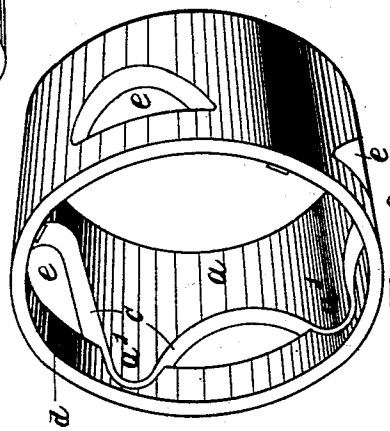

Fig. 2.

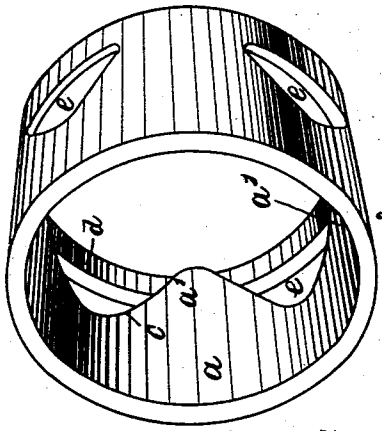

Fig. 3.

Witnesses.
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Samuel N. Byrnes.

Inventor.
D. B. Morison
by Pattison & Peabody's

(No Model.) 2 Sheets—Sheet 2.

D. B. MORISON.

PROPELLER SHAFT FOR MARINE ENGINES.

No. 569,116. Patented Oct. 6, 1896.

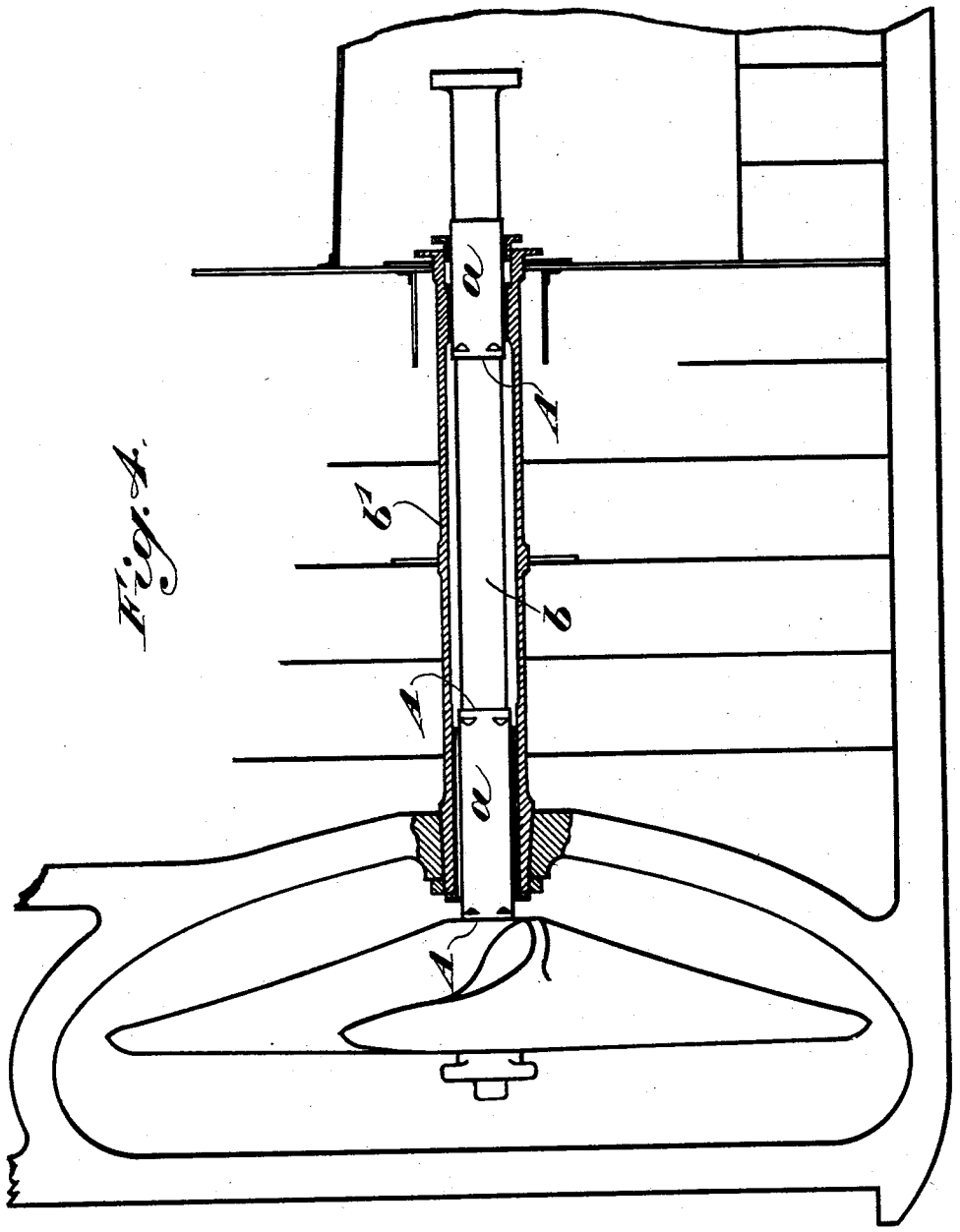

Fig. 1.

Witnesses.
Geo. C. Fuch.
James A. Evans

Inventor
D. B. Morison,
by Pattison & Peshut, attys

UNITED STATES PATENT OFFICE.

DONALD BARNS MORISON, OF HARTLEPOOL, ENGLAND.

PROPELLER-SHAFT FOR MARINE ENGINES.

SPECIFICATION forming part of Letters Patent No. 569,116, dated October 6, 1896.

Application filed August 7, 1895. Serial No. 558,546. (No model.) Patented in England October 15, 1894, No. 19,596; in France July 27, 1895, No. 249,235, and in Belgium July 30, 1895, No. 116,895.

To all whom it may concern:

Be it known that I, DONALD BARNS MORISON, a subject of the Queen of Great Britain and Ireland, residing at Hartlepool, in the county of Durham, England, have invented Improvements in Propeller-Shafts for Marine Engines, (for which foreign patents have been granted as follows: in the United Kingdom of Great Britain, dated October 15, 1894, No. 19,596; in France, dated July 27, 1895, No. 249,235, and in Belgium, dated July 30, 1895, No. 116,895,) of which the following is a specification.

As is well known, with steamship propeller-shafts of the usual construction, comprising a plain shaft of iron or steel on which are shrunk one or more brass cylinders, tubes, or liners, (hereinafter called "liners,") forming the bearing surface or surfaces in the stern-tube, the liner or liners terminates or terminate in planes at right angles to the axis of the shaft, and at the end or ends of the liner or liners exposed or liable to be exposed to the action of sea-water galvanic action produces in the shaft proper local corrosion in such a manner as to seriously weaken the shaft, so that it is liable to be rendered inoperative through fracture. Now my invention is designed to mitigate this serious evil. For this purpose I form the end or ends of the liner or liners that is or are exposed or liable to be exposed to the action of sea-water in the manner I will now proceed to explain by the aid of the accompanying drawings, wherein—

Figure 1 is a perspective view of the propeller-shaft provided with liners according to this invention. Figs. 2 and 3 are perspective views, to a larger scale than Fig. 1, showing end portions of the liners. Fig. 4 is a section showing part of the stern of a vessel having a propeller-shaft furnished with liners constructed according to this invention. Figs. 5 to 8, inclusive, are developed views showing the inner surfaces or portions of liners having different forms and numbers of end projections.

The outer exposed end surfaces A A of the liners *a a*, fixed upon the propeller-shaft *b*, which extends through the stern-tube *b'*, to which sea-water has access, Fig. 4, are, according to my invention, each made to terminate in a curved or irregular form instead of in a plain circular form, so that the dividing-line or line of contact between the periphery of the shaft and exposed liner end will not be located wholly or mainly in or approximately in a plane at right angles to the axis of the shaft, as heretofore. For this purpose each exposed liner end may be made to terminate in a toothed, zigzag, or notched form, as shown, for example, at *c* in Figs. 2 and 3. This formation of the end of the liner is obtained by forming such liner end with projections *a'*, which are kept in close contact with the surface of the shaft, so that the line of contacts (at which local corrosion due to galvanic action usually takes place) between the peripheral surface of the shaft and the end surface of the liner exposed or liable to be exposed to the action of the sea-water when in use will not be located wholly or mainly in or approximately in a plane at right angles to the axis of the shaft, but in planes inclined to the axis of such shaft. By this means the sectional area of the shaft over which fracture could possibly take place owing to local corrosion of such shaft will be much greater than the cross-sectional area of the shaft taken in a plane at right angles to the axis of the shaft. Consequently it will offer a greater resistance than the latter area to fracture. In this way the liability of shafts to fracture resulting from weakening due to local corrosion is considerably reduced.

Furthermore, by forming the liner end as described the projections *a'* serve as auxiliary supports that prevent the bending strains to which the propeller-shaft is subjected when in use being concentrated on the material of the shaft in a plane at right angles to the axis of the shaft. Consequently stress on the material of the shaft at the liner end, due to such bending strains, is not so local as in the ordinary form, and therefore is not so liable to produce intense local corrosion as heretofore, even if the shaft is exposed directly to the action of sea-water.

In order to maintain the joint between the projections *a'* of the liner *a* and the shaft *b*, I prefer to connect the said projections by a ring *d*, whose outer diameter corresponds to

the outer diameter of the liner, but whose inner diameter is greater than the diameter of the shaft, so as to leave recesses or spaces between the ring, projections, and shaft, which may be filled through the openings *e* with suitable protective material, such as gutta-percha or elastic cement. The ring *d* may be formed in one with the liner, as in Figs. 1, 2, and 3, or independent thereof, in which latter case it may be pinned to the liner, or to the shaft, as may be desired.

At the outer end of the liner next the propeller the free ends of the projections *a'* may advantageously terminate within the ring *d*, as shown in Fig. 2, so that the filling material or cement inserted within the aforesaid recesses is connected between each two recesses, thus forming a continuous body that will serve to prevent contact between the shaft and liner where the same are exposed to the action of sea-water, or the ring may extend entirely over the projections, in which case there would be no openings *e*. In the event of the liner being continuous within the stern-tube the outer end thereof next to the propeller would be the only end to which my invention could advantageously be applied.

The form and number of the projections *a'* on the end of liner may obviously be varied within wide limits without departure from the essential characteristic of my invention. Thus there may be only one projection on a liner end, and the line of contact between the end surface of liner and the peripheral surface of the shaft may then be in a single plane inclined to the axis of the shaft. In this case the single projection, or "tooth," as it may be called, would require to be pinned to the shaft in order to prevent its rising in use.

Fig. 5 is a development of the inner side of the liner shown in Figs. 2 and 3, which has four projections with rounded ends terminating inside the outer end of the ring *d*.

In Fig. 6 the projections are of angular form, as in Fig. 5, but their ends are less rounded and terminate flush with the outer end of the ring *d*.

In Fig. 7 there is no connecting-ring *d*, the ends of the projections *a'* being each formed with a hole a^2, through which a screw or equivalent can be secured into the propeller-shaft for the purpose of holding the end of the projection closely down upon the shaft.

In Fig. 8 the end of the liner is of corrugated form, the projections *a'* thus formed being more numerous and of less length than those shown in the other constructions.

What I claim is—

1. A propeller-shaft provided with a liner in the form of a tube or hollow cylinder whereof the end or ends exposed or liable to exposure to the action of sea-water, is or are each made to terminate in an uneven or irregular form, whereby the line of division or contact between the adjacent exposed surfaces of the shaft and liner will not be located wholly or mainly in a plane at right angles to the axis of the shaft.

2. A propeller-shaft provided with a liner having one or each end formed with one or more projections extending lengthwise of the shaft, substantially as herein described for the purpose specified.

3. A propeller-shaft provided with a liner the end or each end of which is exposed or liable to exposure to the action of sea-water, terminates in a toothed, zigzag or notched form, substantially as described for the purpose specified.

4. A propeller-shaft provided with a liner formed at one or at each end with one or more projections extending longitudinally of the shaft, and means for holding said projection or projections against said shaft, substantially as herein described.

5. A propeller-shaft having a liner formed at one or at each end with projections extending longitudinally of the shaft, and a ring connecting said projections and covering them either partially or entirely and maintaining them in close contact with said shaft, said ring having its outer diameter equal to that of the liner and its inner diameter of greater diameter than said shaft, substantially as herein described.

6. A propeller-shaft having a liner formed at one or at each end with projections extending longitudinally of the shaft, and a ring adapted to connect said projections and form therewith and said shaft, a space for the reception of filling material, said liner and ring having holes formed between them and communicating with said space, substantially as described for the purpose specified.

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

DONALD BARNS MORISON.

Witnesses:
I. BAKEWELL STROVER,
JOHN WILLIAMS.