No. 725,137. PATENTED APR. 14, 1903.

G. QUANONNE.

AIR EJECTING APPARATUS FOR VESSELS.

NO MODEL. APPLICATION FILED JUNE 15, 1901.

2 SHEETS—SHEET 1.

Fig. 1.

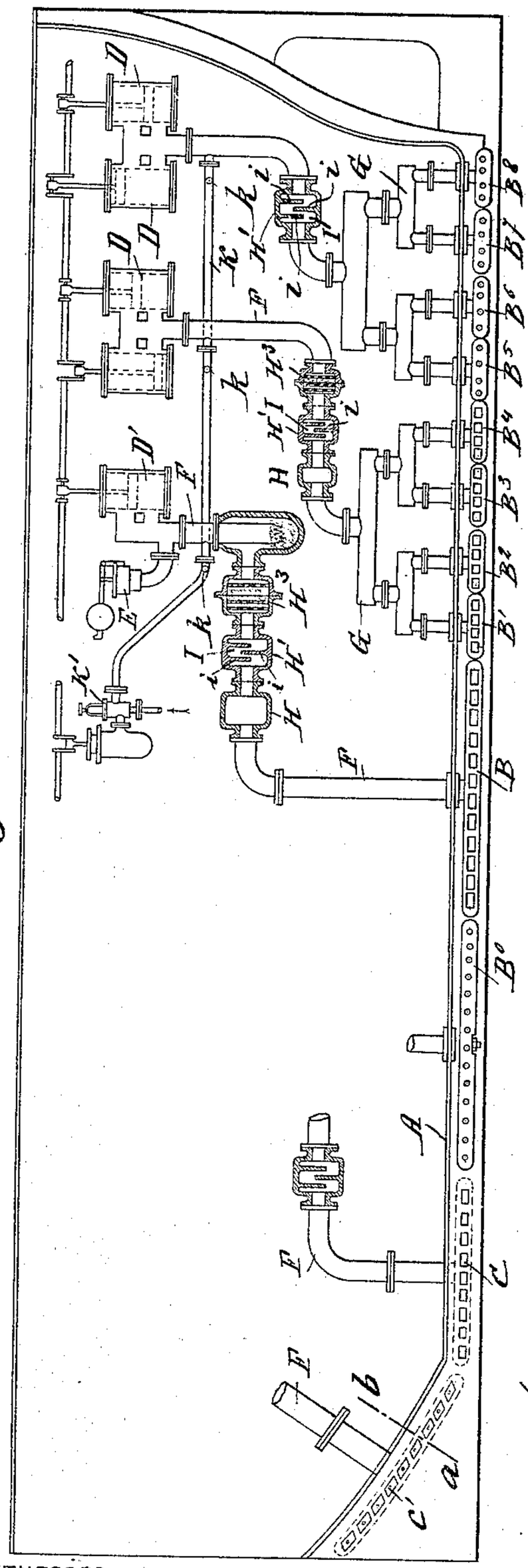


Fig. 5.

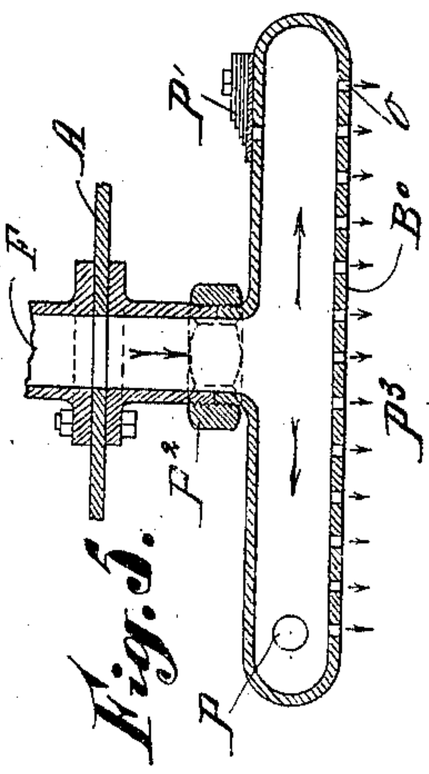


Fig. 6.

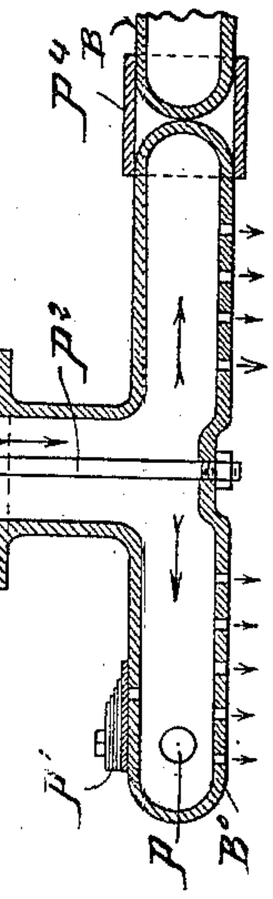


Fig. 4.

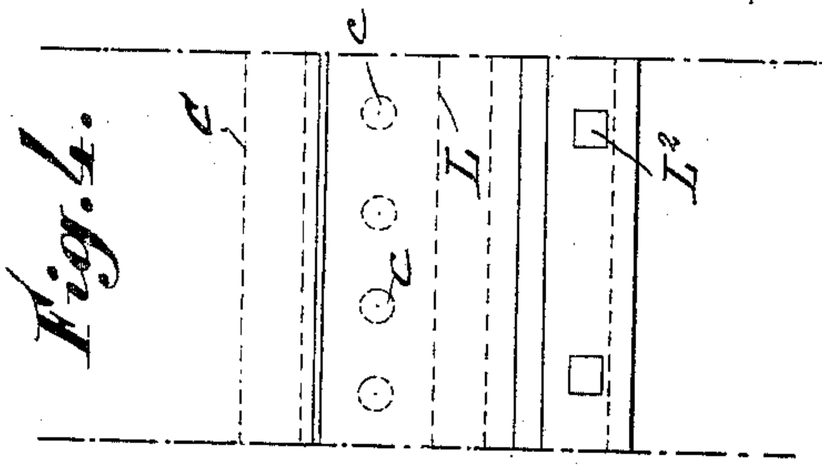
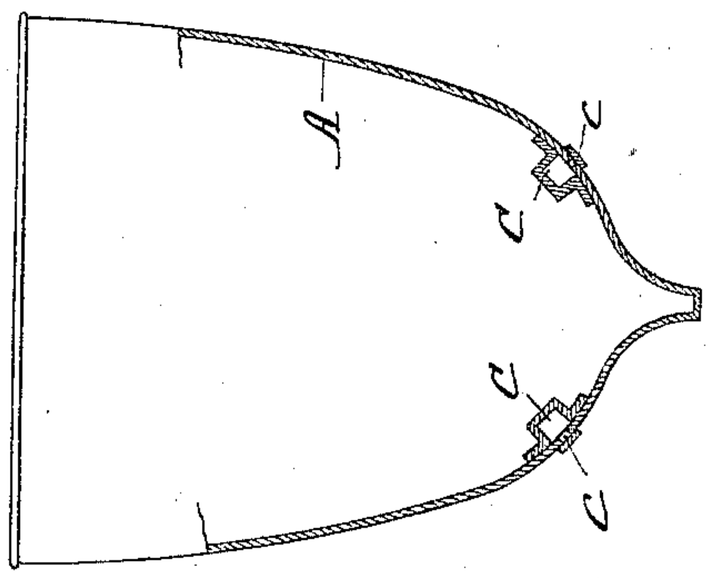


Fig. 3.

Fig. 2.



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ATTORNEYS.

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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 10.

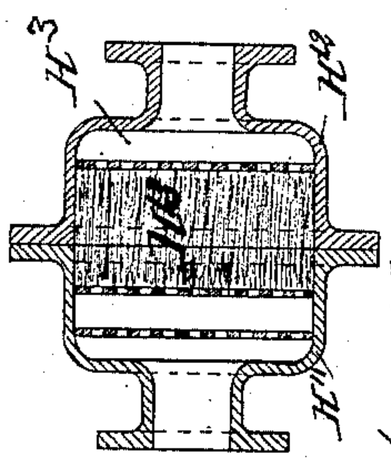


Fig. 14.

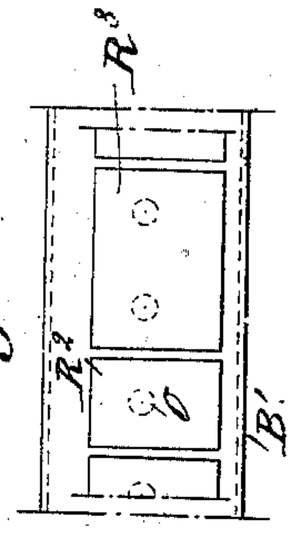


Fig. 17.

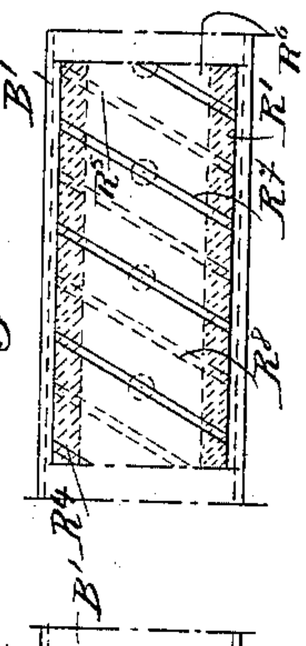


Fig. 21.

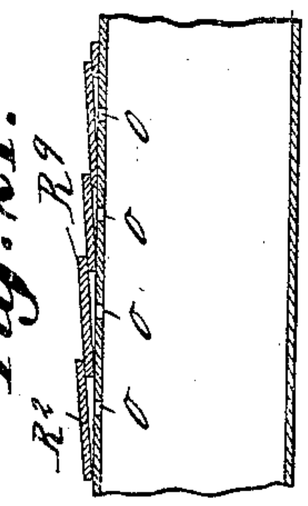


Fig. 9.

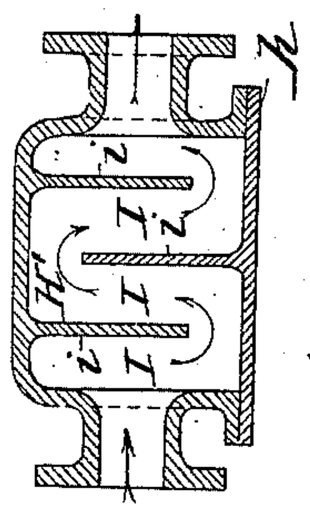


Fig. 13.

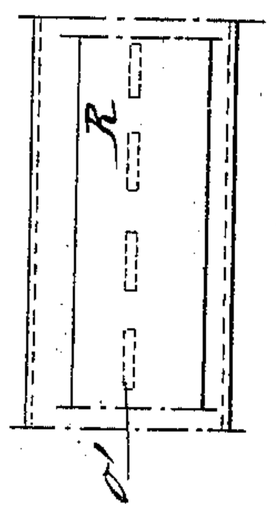


Fig. 16.

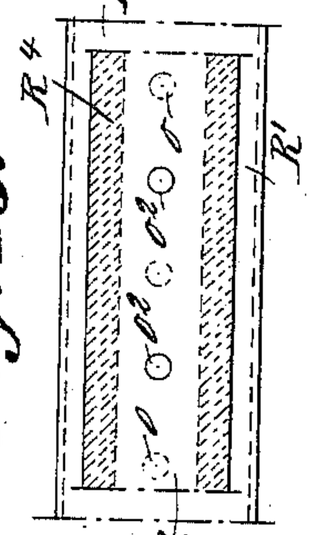


Fig. 20.

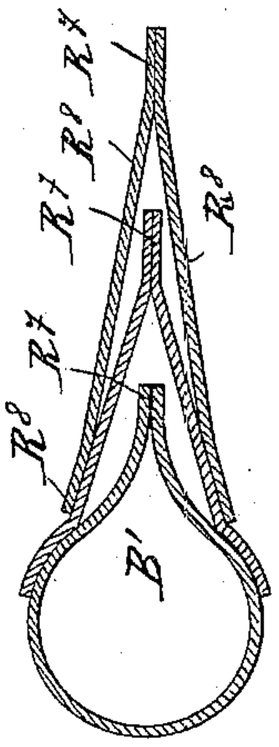


Fig. 8.

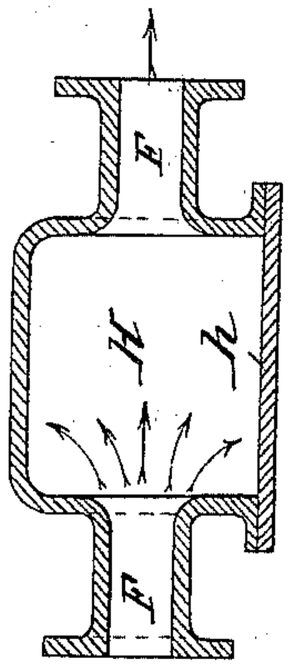


Fig. 12.

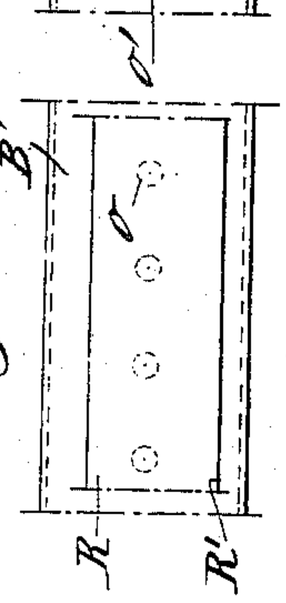


Fig. 15.

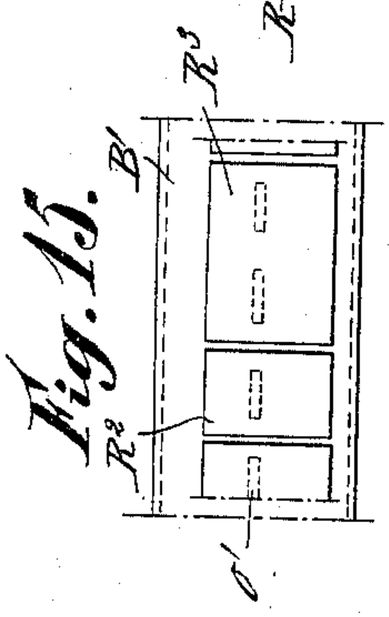


Fig. 19.

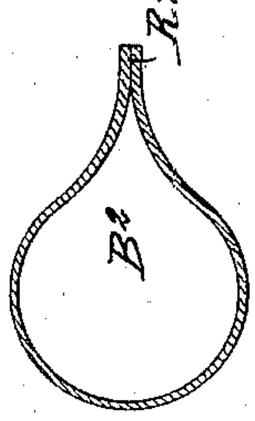


Fig. 7.

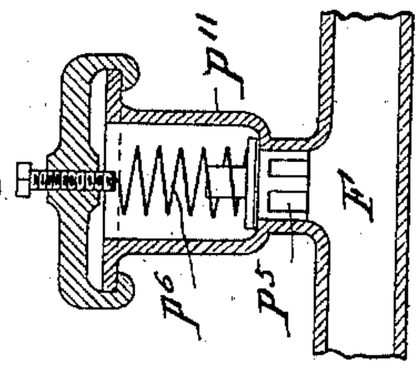


Fig. 11.

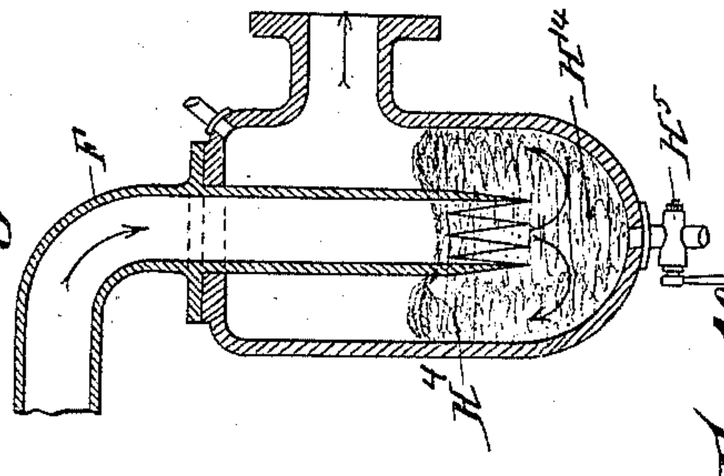
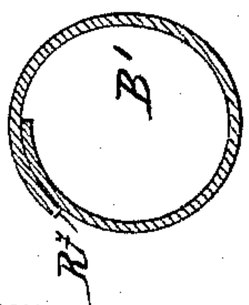


Fig. 18.



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ATTORNEYS.

UNITED STATES PATENT OFFICE.

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AIR-EJECTING APPARATUS FOR VESSELS.

SPECIFICATION forming part of Letters Patent No. 725,137, dated April 14, 1903.

Application filed June 15, 1901. Serial No. 64,735. (No model.)

To all whom it may concern:

Be it known that I, GUSTAVE QUANONNE, engineer, a subject of the King of Belgium, residing at Houdeng-Goegnies, in the Kingdom of Belgium, have invented certain new and useful Improvements in Protecting Devices for Air-Ejecting Apparatus for Vessels, of which the following is a specification.

This invention relates to improvements in apparatus (of the class described in my previous patent, No. 640,946) designed to facilitate the propulsion of ships by the injection of air into the water.

The object of this invention is to provide means adapted for use in combination with the devices serving to produce the distribution of air—such, for instance, as referred to in the patent aforesaid—so as to obviate any obstruction of the air-distributing orifices liable to be caused by an untimely influx of sea-water or by impurities or like foreign matter finding their way into the distibuters, say, in consequence of the air itself drawing particles of fatty matter originating from the compressors or dust or other foreign substances into the said distributers. With a view to accomplishing this effect there have been devised certain special combinations of means, which will be hereinafter particularly described and claimed, with reference to the accompanying drawings, in which—

Figure 1 is an elevation of the hull of a ship, showing the complete system of distributing devices carried out in accordance with my invention. Fig. 2 is a cross-section of the hull of the ship on line *a b* of Fig. 1, this section merely illustrating the arrangement of air-passages in the interior of the hull. Fig. 3 is a similar section on an enlarged scale. Fig. 4 is an elevation of the arrangement shown in Fig. 3. Fig. 5 is a detached view of an air-distributing pipe arranged outside the ship's hull. Fig. 6 shows a modification of the arrangement shown in Fig. 5. Fig. 7 is a section of an air-supply pipe and of a safety-valve fitted to such pipe. Figs. 8, 9, 10, and 11 are vertical sections, on an enlarged scale, of various constructions of dust-collectors or air-purifiers. Figs. 12 to 17 are detail views of various forms of air-distributing systems. Figs. 18, 19, and 20 are sections of still further modifications of air-distributing pipes, and Fig. 21 is a longitudinal section of an air-distributing pipe of special form.

In Fig. 1 I have represented two systems of air-distributing pipes best adapted for practical purposes, B^0 B B′ B^2 B^3 B^4 B^5 B^6 B^7 B^8 designating air-distributing channels or ports to be arranged outside the planking, while C C′ are similar air-distributers placed within the hull A, as will be more fully described hereinafter.

D D′ are air-compressors, which may be coupled together, as shown at D, or, as represented in the case of D′, they may be combined with a compensating receiver E, serving to insure continuity in the supply of air. The compressors, which may be set in operation in any suitable manner, force the air into the pipes F, which may be fitted with branch pipes G, as described in the previous patent aforenamed, or may feed the air-distributers direct, as shown in the case of the distributer B and as assumed in the case of the distributers B^0 C C′, whose air-compressors are not shown in the drawings hereunto annexed.

According to my invention I place one or more dust-collecting chambers H in the line of pipes F for the purpose of purifying the air driven by the compressors D D′ toward the distributing-channels B^0 B B′ B^2 B^3 B^4 B^5 B^6 B^7 B^8 and C C′. These collecting or intercepting chambers may be constructed in any one of the forms represented in Figs. 8 to 11.

In the construction shown in Fig. 8 the collecting-chamber H is constituted simply by an enlargement of the pipe F, which is made to form a receptacle, wherein the air as it passes through deposits any dust it may carry with it and any particles of fatty matter that may be given off by the oil used in lubricating the pistons of the compressors, seeing that these are apt to form a greasy mixture or coom, which must tend to clog the air-distributing orifices. This chamber H for intercepting impurities may be provided with a removable bottom *h*, so as to facilitate the removal of the coom or fatty matter deposited by the air. In the construction shown in Fig. 9 the collecting-chamber H′, having the removable bottom *h*, is furthermore provided with partitions *i*, arranged as deflecting-

plates, so as to afford a zigzag passage I for the air, and thereby to cause the air to travel a longer distance and add to the efficiency of the collecting-chamber. In the modified arrangement shown in Fig. 10 the collecting-chamber H^3 is formed of two parts H^{11} H^{12}, bolted together, and contains filtering material H^{13}, through which the air is made to pass as it is conducted to the system of distributers. In the construction shown in Fig. 11 the collecting-chamber H^4 contains a washing or "scrubbing" fluid, as at H^{14}, through which the air is forced (agitating the fluid as it does so) before passing on to the system of distributing-pipes. To this end the pipe F, through which the air is delivered on leaving the compressor, is extended into the interior of the chamber H^4 and immersed in the scrubbing fluid at H^{14}, while the bottom of the chamber H is fitted with a nozzle H^5, serving to discharge the said scrubbing fluid after it has been impregnated with impurities. As will be seen from Fig. 1, these collecting or intercepting chambers may be used all concurrently or each separately, according to requirements. Thus in the example shown the branch pipes G feeding the distributers B^5 to B^8 are joined onto a single collecting-chamber H', having deflecting-plates *i* in alternate planes, while the branch pipes G feeding the distributers B' to B^4 are joined onto three collecting-chambers H, H', and H^3, arranged in succession, one behind the other, one of such chambers containing filtering material, as at H^3, in accordance with the construction represented in Fig. 10, the other being provided with partitions or deflecting-plates *i*, as represented in Fig. 9, and the third being simply a plain chamber H of the construction shown in Fig. 8. As for the pipe F, connecting the compressor D' to the air-distributers B, it is represented as comprising four intercepting-chambers constructed in accordance with Figs. 8 to 11, respectively.

In Fig. 1, K designates a water-pipe, whereof one end is connected to a pump K', while its other end joins the air-distributing pipes F, extending from the compressors D D'. The pipe K may be shut off from the pipes F by means of cut-off valves *k*, and it is intended, conjointly with the said pump K', to serve the purpose of filling the air-pipes F and G with pure water when required during the stoppages of the blast or injector, as will be more fully described farther on.

As already stated, the air-distributing passages or air-distributers proper, B^0 B B' B^8 and C C', may be placed either within or without the hull A of the ship. Figs. 2, 3, and 4 are detail views of the construction adopted when the said passages (or pipes) are disposed within the hull, as in the case of the distributers C C', Fig. 1. In this case the hull A, as shown in Figs. 2 and 3, carries internally a pipe C, extending either from end to end of the hull or through part of its length only. The hull A has air-outlet orifices formed in it, and in order to check or retard the obstruction of these outlets by the impurities brought up by the sea-water, especially when the seas come to force a passage through such outlets, as they are apt to do in stormy weather, for example, the outlets are covered over with removable and more or less flexible plates L. The plates L may, for example, be welded or riveted to a bar L', secured in position by means of bolts L^2, having their heads embedded in the said bar L', so as to afford no protruding parts for the water to bear on and avoid the progress of the vessel being impeded thereby, while at the same time forming a set of detachable parts for the outside of the hull.

When the air-distributing pipes or channels are arranged outside the hull A of the ship, as B^0 B' B^2 B^3 B^4 B^5 B^6 B^7 B^8 are assumed to be, these air-distributers should preferably be removable, to which end I propose to adopt the constructions represented in Figs. 5 and 6.

In the construction shown in Fig. 5 the distributer B^0 consists of a T-shaped tube perforated with a number of air-outlets *o* and having, furthermore, a discharge-orifice P, providing for the escape of such small amounts of water as might find their way into the distributer or be deposited therein as a result of the expansion of the air, and a safety-valve P', consisting, say, of one or more flat springs. The discharge-orifice P is only provided in order to allow a free and non-obstructed opening for the escape of the small amounts of water just referred to, and the section of the said orifice is held sufficiently reduced in such a manner that only a small part of the volume of air contained in the distributer may find its exit therethrough after the water has been expelled out of the distributer. This orifice acts then in conjunction with the other air-outlet orifices *o* in order to distribute the air in the water. The distributer B^0 may be secured or coupled with the pipe F or to one of the branches G by means of a ring or collar P^2, which it is only necessary to unscrew to enable the said distributer B to be removed for purposes of cleaning.

In the construction shown in Fig. 6 the distributer B^0, which is also provided with a discharge-orifice P and a safety-valve P', is secured to the air-supply pipe F by means of a bolt P^2 engaging in a cross-piece P^3, forming part of the said air-supply pipe F. This figure also shows that the successive distributers B^0 B, &c., may, if required, be joined together, say, by means of rings or sleeves P^4, serving to counteract the swell and to strengthen the system of pipes. The safety-valve P', fitted to the distributers, may of course be of any suitable construction. Thus it may take the form of the valve P'', Fig. 7, for example, where the flap P^5 is subjected to the action of a spiral spring P^6. This construction, however, is adopted in preference in the case of the air-

supply pipes F, as shown in Fig. 7, in order to prevent the bursting of those pipes, such as is liable to result from an abnormal counter-pressure put upon the air-delivery orifices of the distributers.

While the air-distributers themselves may be removable for cleaning purposes, their orifices may be protected from obstruction by means of yielding or resilient protecting-plates. These protecting-plates may be constructed and combined with the distributers after any one of the methods illustrated in Figs. 12 to 17.

In the construction shown in Fig. 12 the outer distributer B′, for example, is provided with air-outlets *o*, of circular section, covered over by a yielding plate R, secured to the tube B′ by welding, by an adhesive substance, or by any other convenient means of attachment, such attachment being effected at its edge R′. The construction represented in Fig. 13 only differs from that shown in Fig. 12 in the particular that the air-outlets here assume the shape of narrow slots *o*′, which are protected in the same manner as the circular orifices in Fig. 12—viz., by means of a flexible plate R.

The constructions shown in Figs. 14 and 15 are substantially identical with those of Figs. 12 and 13, except that the protecting-plate R is here subdivided into several plates, one plate R^2 being provided for each orifice *o* or *o*′ or one plate, such as R^3, serving to protect two or more orifices *o* or *o*′.

In the arrangement shown in Fig. 16 the protecting-plate R, covering one or more orifices *o*, is secured in place by its two edges R′ and R^4 and provided with perforations o^2, interposed each between two consecutive air-outlets *o*, so that the air in leaving the distributer passes between the outer surface of the tube B′ and the inner surface of the protecting-plate R.

The construction shown in Fig. 17 differs from that represented in Fig. 16 in the feature that the protecting-plate here is a double or compound one, one plate R^5 being covered over by a second plate R^6. Each of these plates is secured to the tube B′, for example, by its two edges R′ and R^4 and is provided with a series of slots R^7 and R^8, arranged break-joint fashion, so as considerably to retard the return of the water into the pipe.

Figs. 18 and 19 are respectively cross-sections of two forms of distributing-pipes—such as B′ or B^2, for example—themselves constructed of more or less elastic material, so that the covering R^7 forms a means of protection for keeping the water out of the pipe. In the pipes constructed in accordance with these figures the air escapes through the joint formed by the covering R^7, expanding the pipe as it does so, while the water acting externally tends to compress the lips of the covering device which form the joint R^7. The construction shown in Fig. 20 is substantially the same as that shown in Fig. 19, except that here a number of successive joints R^7 are formed by means of a series of separate plates R^8, fastened one upon the other.

In the construction represented in Fig. 21 the protecting-plates R^2 employed are of the same class as those shown in Figs. 14 and 15, but their edges R^9 overlap, so that, if required, one plate may open a passage in the water before the other.

The operation of the complete arrangement hereinabove described is as follows: The compressed air forced by the compressors D or D′ into the pipes F passes through the dust-intercepting chambers H before reaching the distributers B^0 B′ B^2 B^3 B^4 B^5 B^6 B^7 B^8 or C C′ and in so doing deposits in such chambers any fatty matter, coom, or dust wherewith it may be charged. On being thus purified it is delivered into the distributing-pipes in such a condition that the danger of obstruction of such pipes by impurities carried outward by the air is considerably attenuated. The air as it escapes through the distributers B^0 B′ B^2 B^3 B^4 B^5 B^6 B^7 B^8, arranged outside the hull, or though the distributers C C′, arranged inside the hull, will, in the manner already known, form a layer of air along the hull which is calculated to lessen the friction of the ship. Should for any reason, such as excessive pitching or rolling or in stormy weather, the pressure of the air prove incapable of resisting the counter-pressure of the swelling seas and should the water in consequence show a tendency to reënter the distributers and to carry into them from without impurities liable to clog the air-distributing orifices, such tendency will be counteracted by the protecting appliances above described, which will effectually prevent the water from entering the distributers or at all events introducing impurities into the same, as these will be detained by the protecting-plates R, R^2, R^3, R^5, or R^6, described above, and assuming that a small amount of water should after all find its way into the distributers such water will without difficulty be expelled through the discharge-orifices P under the action of the compressed air or when the compression of air will be again put in action. While the blowers are at rest—in harbors, for example, or in rough weather rendering the operation of blowers utterly ineffectual—a possible influx of impure sea-water into the distributers, whether provided or unprovided with protecting-plates, may be effectively prevented by setting in operation the pump K′. This pump by forcing pure water into the pipes F and into the distributers will keep the said pipes and distributers in a condition of perfect cleanness and may with certainty be relied upon to prevent any obstruction.

In the case of ships habitually frequenting places where the waters are comparatively clean and fitted with compressing apparatus so constructed as not to pollute the air under pressure the means for keeping the air-distributing devices in proper working or-

der while they are in the water may simply consist of external detachable pipes or channels, such as are shown in Figs. 5 and 6. The object contemplated will in this case be attained simply by the periodical cleaning of the lengths of distributing-piping by means of suitable scouring-bath or the like. In the case of ships frequenting impure waters, however, the keeping in order of the air-distributers cannot be sufficiently provided for by the sole use of cleaning appliances, but will require in addition the employment of protecting-plates, such as have above been described with reference to Figs. 12 to 20, or in case of need temporary protective and preventive measures may be adopted where the danger of obstruction by accessions of muddy water is to be apprehended only in ports or harbors and not under way. In that case perfectly clean water should be injected into the air-pipes by means of the pump K′, as already described, (the action of the fans or blowers being of course suspended in the meantime.) The water confined in the pipes will then, as has already been explained before, only be allowed to flow in the outward direction, thus being discharged outside the ship, so that the prevention of clogging through any impurities contained in the water will, although temporary, be absolutely reliable. Besides, there is nothing to prevent the preventive protection by means of pure water from being combined with the protection secured by means of the protecting-plates. According as the blowers are in or out of operation the injection of air under pressure or the confinement of the pure water (as the case may be) may successively coöperate with the protecting-plates in retarding any inward obstruction of the orifices, though in course of time it will nevertheless be necessary to resort to cleaning.

The employment of covering-plates must be expected to facilitate the formation of deposits in the distributing-orifices from impurities brought along with the air, seeing that in practice it is hardly to be anticipated that the air can be brought to a condition of absolute purity, and it is for this reason that cleaning at greater or less intervals of time will be absolutely necessary and is made easy by the detachable and removable nature of the parts to be cleaned, to which access may be readily had by diving.

What I claim is—

1. In a ship, in combination with blowing apparatus designed to facilitate her progress, and with air-distributers fed from said apparatus, means for counteracting the outward obstruction of the air-outlets, and means for preventing the burtisng of the pipes in case of excessive air-pressure.

2. In a ship, in combination with blowing apparatus designed to facilitate her progress, and with air-distributers and pipes connecting the blowing apparatus with the distributers, means for preventing the obstruction of the air-passages both in the pipes and in the distributers.

3. In a ship, in combination with blowing apparatus designed to facilitate her progress, and with air-distributers fed from said blowing apparatus, protecting devices fitted to the distributers, and means for cleaning, such as employment of the water-pipe K capable of counteracting the obstruction of the air-passages, where they open into the water.

4. In a ship, in combination with blowing apparatus designed to facilitate her progress, and with air-distributers fed from said blowing apparatus, means for confining a fluid in the pipes and orifices through which the air is discharged into the water, for the purpose of counteracting the obstruction of said orifices.

5. In a ship, in combination with blowing apparatus designed to facilitate her progress, and air-distributers fed from said blowers, apparatus adapted to purify the air to be forced into the water, substantially as and for the purpose specified.

6. In a ship, in combination with her hull and with a blowing apparatus designed to facilitate the progress of the ship, air-distributing pipes and compound overlapping flexible protecting-plates applied to the air-outlet orifices, said compound plates being detachable or removable without breaking their fastenings, substantially as described and for the purpose specified.

7. In a ship, in combination with her hull and with a blowing apparatus designed to facilitate the progress of the ship, air-distributing pipes permanently secured to the ship and compound overlapping flexible protecting-plates, such plates being divided into fractions and applied over the air-outlet orifices so as to be removable therefrom without breaking their fastenings, substantially as described and for the purpose specified.

8. In a ship, in combination with a blowing apparatus designed to facilitate her progress, air-distributing pipes and a system of pipes adapted to confine water or any other fluid into the said air-distributing pipes while the blowing apparatus is inoperative, as and for the purpose specified.

9. In a ship, in combination with a blowing apparatus designed to facilitate her progess and with air-distributers fed from said apparatus, external protecting devices for the distributers, and apparatus for purifying the air under pressure, as and for the purpose specified.

10. In a ship, in combination with a blowing apparatus designed to facilitate her progress and with distributers fed from said apparatus, means for forcing water or other fluids into the air-pipes, while the blowing apparatus is inoperative, and apparatus capable of purifying the air under pressure, substantially as and for the purpose specified.

11. In a ship, in combination with a blowing apparatus adapted to facilitate her progress,

and with air-distributers fed from said apparatus, means for confining water or other fluid in the air-pipes while the blowing apparatus is inoperative, external protecting devices for the said distributers and apparatus capable of purifying the air under pressure, as and for the purpose specified.

12. In a ship, in combination with air-ejecting appliances designed to facilitate her progress, air-distributing pipes provided with air-outlet orifices and a discharge-orifice, independent of the air-outlet orifices, and adapted to discharge the water admitted in the air-distributing pipes, as and for the purpose specified.

In witness whereof I have hereunto set my hand in presence of two witnesses.

GUSTAVE QUANONNE.

Witnesses:
GEORGE BEDE,
GREGORY PHELAN.