

BILGE PUMPS & THEIR STRUMS.

THE importance of the subject must be my excuse for asking you to give me your attention for a little time this evening. In looking back over many years of steamship practice, the most important thing in a gale of wind on board a steamship (next to the working of the main engines in maintaining the position of the vessel) is, in my opinion, the working of the bilge pumps, which, although they may be said to form part of the main engines, are yet quite separate from them in the duty they have to perform, viz., clearing the vessel from the water which by any circumstances has got into the ship, endangering her buoyancy and efficiency.

I need hardly remind you of the perilous position of a steamship to whose engine-room the sea has got access, beaten the pumps by choking the strums, washed up the stokehold plates, and is fast putting out the fires; the engines meanwhile, for want of steam, only just turning over the centres.

The end of such a ship is not far off if she is distant from port and the gale does not moderate.

The slow speed of the engines renders the bilge injection connected to the circulating pump of little effect, and not to be depended upon (the strums in most cases being in an inaccessible position and choked), and baling, even if resorted to, is seldom of much use in a gale of wind.

Many of you will no doubt say, "In a well regulated engine-room this should not occur," and I agree with you; but before I have concluded my remarks on the subject, I think you will acknowledge that, although an experienced and careful engineer may have charge of the engine-room, and may have in force good

regulations for the same, he may under certain circumstances be completely beaten, owing to defective connections and arrangements of the bilge pumps and strums, although on the tracing of the pump and pipe arrangements of the vessel they may appear to be nice and effective.

In looking into this subject I would like to take you back to the time when the steamships of this country were constructed of wood, and some noble specimens of naval architecture they were, but many of them had a fault which is not often found in an iron vessel, they leaked considerably through straining when in a sea way, and this water had to be kept under by the bilge pumps and bilge injection, led into the condenser. The bilge pump in these vessels was a pump therefore of much importance, and required to do its work with as little trouble to those in charge as possible. The engines most in use at that time were of the side lever pattern, and the bilge pumps were bolted on the wooden floors of the vessel, and worked from a stud in the side lever a little out from the main centre. It was an open-mouthed pump with a solid packed piston, having an eye on the top of the piston, to which was attached the rod, coupled at the upper end to the stud in the side lever of the main engines. The valve chests were cast on the pump seat, and hinged valves were fitted to the chests. A pipe on the suction side led into the bilges, on which was fixed a strum, and the discharge was carried up the side of the vessel (generally above the load water line) and discharged overboard.

The solid piston, which worked generally low down in the pump, forced out what air got access to the pump through the discharge valve, and left very little windage in the pump, and the pumps being placed so low down, they were from this cause pretty effective, and did not give much trouble.

Should the strums choke, they were easily got at by lifting a plate of the starting platform which was placed low down between the engines.

New ideas came in with iron steamers, and new designs of engines, and it became the practice to attach the feed and bilge-pump of the plunger-pole pattern to the air-pump cross-head of the engines. This made a prettier engine, and if carried out with a view to the effective working of the pumps, nothing could have been said against the design or arrangement; but, looking back now over a long vista of years, much can be seen to militate against the good working of the pumps.

In many cases the valve chests were placed at a distance outside the side levers and connected to the bottom of the pumps by a pipe between them and the valve chests. This arrangement, although looking well on paper, and possessed of the advantage of having the valve-chest outside of the working of the side lever, had this defect, that the windage around the plunger-pole of the pump, and in the intervening length of pipe to chest, was so great that the pump would continually cease to work when most required, owing to the pump becoming charged with air; and this, to such an extent, that in bad weather, an engineer's attention was almost wholly (if not quite) taken up with the duty of clearing the vessel of the water which in so many ways, through low freeboard, coamings, &c., got into the vessel, and resource had frequently to be made to the condenser bilge injection.

With the advent of screw steamers the defects in the construction of bilge pumps have not been entirely eradicated, but have in some cases been intensified by the sole or foundation of the engines being raised to suit the centre of the shaft, thus also raising the bilge pump to a greater height from the water they have to clear out of the vessel. It may be noted here that the plunger-pole pump is the worst form of pump that can be made for the purpose of raising water from any depth below its level; and when used for this purpose, as it is, in steamships, it should be so designed and arranged in such a manner (as it has been graphically expressed by Mr. J. McFarlane Gray, one of your Vice-Presidents) that all the water in the pump should run out through the valves and barrel of pump, and the pump be left empty when turned upside down.

This can only be the case when the outlet or discharge valve is placed close to the neck of the stuffing box or upper part of the pump, thus clearing the pump chamber of all air at each down stroke of the pump plunger-pole.

You will naturally ask: "What shall we do with pumps already fitted, and which have the defects pointed out in this paper?"

A ready remedy, and one that no doubt many of you have found out, can easily be applied to a defective pump, if the valves of the pump are in order, viz., by fitting a small non-return pet valve in the position under the neck of the stuffing box, thereby allowing the air to be forced out at each down stroke of the pump plunger-pole in the same manner as would be the case if the discharge valve chest was fitted in its proper place under the neck of the stuffing box. The arrangement must be valvular, so as to pre-

vent return of air to the pump on the upstroke. Lining the pump barrel to fit plunger-pole is a useful remedy in case of bad arrangement of valve chests, as it reduces the windage of the pump around the plunger-pole, and increases the efficiency of the pump.

I now come to the second part of the paper, viz.:—Pump Strums; and will not detain you much longer. It has been the general practice to fit these on the lower end of the bilge pipes between the floors of the vessel as close to the bottom as possible. This arrangement, although it may look well on a tracing of the pipe arrangement, has very serious defects in practice. In some cases the strums so placed are most difficult of access even in harbour or in smooth water; but in a seaway, with a little accumulation of water in the bilges, it is a matter of almost impossibility for a man to remain at his post and keep the strums clear.

This, in my opinion, should not be. All strums should be reasonably accessible, even when some water may have got into the bilges. Inaccessibility of bilge pump strums has, I am much afraid, led to the loss of many a vessel and her crew. To remedy this defect, in fixing strums of bilge pumps they should, in my opinion, be fitted above the engine-room or boiler platforms, with a straight, open-mouthed pipe led into the bilges. This would avoid all necessity for men crawling below platforms to get access to strums, or getting wet by the splashing of water in the act of clearing the pump strums, a result which I am sure you will all agree with me is much to be desired. At the same time it would conduce much to the safety of the vessel, by the engineers in charge having a better command of the pumps and their strums.

A design of a mud or bilge box for a new steamer is shown, from which it will be seen that the whole of the work of cleaning the strum is performed above the engine or boiler platforms.

Enlarged views of the mud or strum box are also exhibited.

MR. WYMER'S REMARKS IN ADDITION.

I have brought here to show you a design of the strum boxes which have been made for a new vessel. This is the strum box fitted above the engine bed plates. The object which I have in view, and which has concerned me most, is to have more easy access to, and more facility for, clearing the strums. You can all picture in your minds the bilge pumps being choked, and the engineer going down to cut the pipes; why it is a foregone conclusion that

the vessel will be lost if the strums will not work. I have in my mind's eye just now a vessel which came into Falmouth a little time ago with water over her stokehole plates and on her beam ends. The strums were fitted under the engine-room, and when I asked the engineer where his strums were, he went to the other end of the engine-room and got a man to go down and crawl about 16 feet under the floors to get at the only one in the engine-room. I think that if we could get the strum fitted above the engine-room floors it would be a great improvement. Another vessel I went on board, I found the strum under the fore eccentric; and in another vessel they were fitted under the cranks. I think that you engineers cannot be too careful on this point, as you are the men whose certificates take the ship to sea; and, if anything goes wrong afterwards, you are responsible for it.

CHAIRMAN'S OPENING REMARKS.

(Mr. W. J. CRAIG).

You have heard Mr. Wymer's able paper on bilge pumps and strums. There are a good many of you here who have had a great deal to do with them, and you are now at liberty to express your opinions and relate your experiences. I know from my own experience that there are a great many different kinds of these pumps fitted, and fitted in various parts of the ship. There are a good many steamers built under low competitive prices where this subject does not get much attention, and where, in fact, a good few seem to have no idea where the bilge pumps should be placed. I notice a good many of those who "handle the levers" present to-night, and such a subject as this is bound to be well within their experience, and it will be interesting to hear what they have to say on the same.

MR. HAWTHORN'S REMARKS.

There is not the slightest doubt that the bilge pumps and strums give rise to very important questions. There is one very painful experience which I had, where we had 9 ft. 6 in. of deck-load and the ballast-tank carried away. We got about 30 tons of coal into the bilges. The strum was under the centre of the engine-room, and we could not get to it without going down the crank pits. I was on board that ship for five days without food, and had to be carried out of the engine-room at last utterly exhausted. The firemen had to carry the coal along the bilges

and throw it into the fires as best they could. I am strongly in favour of having an open-ended bilge pump-pipe, with the rose on the engine-room platform, as shown on the diagram.

MR. ROWE.—Would Mr. Wymer show by a rough sketch what he referred to about his method of expelling the air from the bilge pumps?

MR. JAMES ADAMSON'S REMARKS.

We are indebted to Mr. Wymer for his presence here to-night and for the Paper he has read to us on a subject which though too often made light of, is of very great importance not only in the economy of the engine room, but also in regard to the lives and property hazarded on the sea.

We have all doubtless experienced some of the discomforts and dangers due to what has been referred to ; it is no pleasant duty to lie in the bilges, becoming for the nonce amphibious animals, with the engine-room half full of water, in efforts to clear the rose boxes and bilge pipes. Some years ago it was my lot to be caught in a typhoon in the China seas ; heavy seas were shipped, and with the pitching and rolling of the vessel all the loose coal and debris were washed into the bilges, resulting in the choking of the pump suctions, and a man being stationed at the rose boxes to try and clear them. It was a hopeless task ; the pipes had to be cut ; this helped the pumps for a time, but soon proved ineffectual, and in the meantime the water gained upon us ; the stoke-hold plates were washed up and the firing tools joined them in the race from port to starboard and starboard to port with every roll of the ship. Hand-to-hand firing was resorted to, but with the water lashing into the centre fires, steam could hardly be kept to move the engines round. In the meantime the ash buckets were being used to assist the pumps, and by hard work and unflinching energy the sea was held at bay till the violence of the storm was past ; the ship was saved, but by a narrow majority.

The scene next day in the engine-room and stoke-hold, as well as on deck, was desolate in the extreme, chaos was rampant, but soon order was restored and we proceeded on our voyage. I carry with me to this day, as a memorial of the event, an impress from a stoke-hold plate, a token which I afterwards found useful as a reminder when designing bilge pipe arrangements in the drawing

office, where I think most of the fault lies, and where also the results of discussions such as these may, with advantage to all, be considered, and the defects and disadvantages experienced at sea be rectified in following steamers.

MR. GRAY'S REMARKS.

I will just point out to you one or two faults in these mud-boxes, in which I think you will agree with me. I have sometimes asked engineers to show me a sketch of the very best mud-box they could make, *regardless of expense*, but few of them seemed to awaken to the conviction of the importance of mud-boxes. Some put the rose-plate in the middle, others put it in such a position that the suction of the pump was on the reverse side to what it should be. I think, with Mr. Wymer, that this question has only just begun. The mud-box and rose-plate, you see, Mr. Wymer puts on the top of the platform. Most engineers put it at the bottom of the ship, but it ought to be above the platform; otherwise, when the rose gets blocked up there is great trouble in clearing it. These mud-boxes were introduced a long time ago. The first mud-boxes I ever saw were in the *Oneida*, sailing from Liverpool with cavalry for the Crimea about 1854. A. Logan took out the patent for it, and I think A. & R. Brown made it. His idea was to keep the mud-boxes high up; and I think it was a very good one. There is one thing in connection with pumps I would here refer to, and that is, whether the connection to the feed pump ought to be on the middle or bottom of the barrel. Most engineers say the bottom of the barrel. I should like to hear an expression of opinion on this. You all know how important these pumps are. When bilge pumps are tasked to their utmost there is generally a great demand for presence of mind and calm judgment in the engineers. Without that the best pumps will sometimes not be sufficient to save a ship. A remarkable instance of this was once brought under my notice, and as I think that the lesson it teaches is very important and obvious, I will tell you about it. There was a steamer lost some years ago through water being admitted to the engine space by the bulkhead sluices faster than the pumps could take it. The steamer was not actually leaking, but a good deal of water had come on board during a gale in the previous night, and some of it had found its way to the main hold from above, through holes in the deck. The vessel had left the docks a few days before, many feet by the stern, exceptionally so, but nothing improper in that. The engine room was in the after hold, open to the stern pipe, where the hull was fine, and, therefore, the water which had before been only a few feet on the top of the ballast tank in the main hold, when run into

the engine space, was soon over the flooring plates and the fires were put out. There was a heavy swell on after the gale, which had now subsided, and the steamer rolled very much, and the flooring plates were washed about, and by that the ashes cock pipe was cut and a real leak produced. This was not attended to by those who ought to have done so, and the water continued to rise, the stern becoming more and more immersed and the bows more elevated, until she sank stern first about five hours after the bulkhead sluices were opened.

A horizontal pump, with the suction valve and discharge valve both above the barrel, on the same level, the suction valve opening downwards, is an excellent form of bilge-pump for drawing through a great length of suction pipe, or from a considerable depth. This is the best form for a salvage pump. Such a pump can never become dry through the valves being temporarily gagged.

MR. HAWTHORN'S REMARKS.

I notice that it is considered by some that the suction should be kept as high up as possible in the pump. I cannot understand why the branches should be kept high; you are bound to lose water between the suction pipe and bilges. It has suggested itself to my mind that packing rings might be fitted on the plunger, say three rings in the length, and also have the plunger bearing on the walls of the chamber the whole way in place of merely at the neck and gland bushes. As to windage, which has been referred to, are we to assume that the barrel is full of air, and you have to pump this up at each stroke? I cannot see any great benefit from having the valve-box at the top of the pump in place of at the bottom.

MR. SOMMERVILLE'S REMARKS.

I find it a great advantage to have placed on the main suction pipe a vacuum gauge, because the engineer on watch can see immediately how the pumps are acting. When the pumps are working well the gauge usually stands from 12 to 15 inches, but should it remain steady at 15, and the water rise in the bilges, it shows him the pipes are choked. On the other hand, should the gauge indicate no vacuum at all, it shows him he has neglected to shut some cock leading to the various compartments of the ship, or that something is preventing the valves from working.

My engineers tell me that it saves them a great deal of trouble, and they wonder it was not thought of before. I quite agree with Mr. Wymer that all bilge pumps should be fitted with an atmospheric valve, so that the plunger on its down stroke expels the air. I have also tried this, and find it acts admirably. It surprises me that all bilge pumps are not fitted with one of these valves, through which, automatically, the air may be expelled.

Some time ago I designed a simple method of clearing the roses in the various holds when the ship is full of cargo, and there is no other means of getting at them; and I submit to you, Gentlemen, a tracing of the drawing, which requires no explanation, as it is so simple. In my opinion no ship ought to go to sea without some apparatus after this style, whereby the engineer has a safe and sure method of clearing his roses without putting him to any inconvenience under any circumstances.

Twenty years ago I encountered a cyclone in which 16 ships were lost or driven ashore between Point de Galle and Madras. The engines were of the oscillating geared type, and the cylinders were unusually low down, the bottoms merely clearing the frames of the ship. As the cyclone increased, the ship, being very light, rolled heavily; in fact so much that the little water we had in the bilges displaced the stokehole and engine-room plates. Of course, a certain amount of waste and coal-dust got in the roses and choked the pumps, and we found it impossible to keep the roses clean, owing to the curious position in which they were situated. As I had been in the engine-room 16 hours my chief ordered me to get some rest, and they would do their best till I was called. When I took my watch in the morning the water had increased in the bilges so much that the bottoms of the cylinders were oscillating in water nearly up to the fourth of the length of the stroke. As we saw that the fires would undoubtedly soon be extinguished, and the ship of course become helpless, the chief and the other engineers and myself had a consultation together, and I suggested we should disconnect the pipes, take the roses from their places, and then put the pipes in their former positions, and try that plan. And in a short time we were recompensed by seeing the pumps work admirably. By 8 a.m. the bilges were pumped dry and the ship safe. From that day till two years afterwards, when I left her, we did without the roses and strum-plates, and every ship I have been in since I have made a practice of disconnecting the roses and strum-plates, because it does away with a deal of labour, and keeps the bilges clean by pumping overboard, with the water, the sediment which usually forms in bilges. Of course, Gentlemen, you know the strum-plates act as a sieve, and the water being pumped through them, it allows the clean water to go overboard and leaves the sediment in the bilges.

MR. GRAY'S REMARKS.

I think Mr. Sommerville has misunderstood me. When the plunger is down there should be nothing but water in the pump, and the up-stroke of the pump then forms a vacuum into which the water rushes. Imagine a pump filled with water between the suction valve and discharge valve, and imagine the pump then turned upside down. In a properly designed pump the whole of the water will then leave the pump by the discharge valve. In a badly-designed pump there will be a space still filled with water, because it is now below the discharge; and when the pump is in use that space will be above the discharge valve. The connection to the discharge valves ought therefore to be at the highest part of the pump chamber.

MR. BRUCE.—One remark I would make in reference to the suction-pipe rising direct from the bilge, as shown on the drawing. The area between the top of the pipe and the cover seems to me to be small as well as the area of the pipe itself. I think it is advisable to have a good large area to allow for a good clear waterway.

MR. ROWE'S REMARKS.

While on the way to China, in 1862, on board a man-of-war frigate, we had occasion to use the bilge injection. Mr. Wymer remarked we could not use the bilge injection so well now as then. In the case I refer to clear water flowed readily up the bilge injection. I am of opinion there should be, in addition to the usual pump attached to main engines, a special pump fitted on board, so that it could be driven at any time and so clear the bilges. The mud-box shown to us seems to be as perfect as a mud-box could be made, the chief advantages of which have been pointed out. We ought to endeavour to try and stop all dirt getting into the bilges. I think it is a most disastrous thing when you get anything into the bilges, such as coal, for instance. I think there is one point not mentioned, and that is stability. For instance, when a ship is rolling heavily, and goes, say, over to starboard, the pump is rendered ineffectual, the water also rolls over, and prevents the ship righting herself. There should thus be a provision made for reaching the water by the bilge pump on both port and starboard sides, as well as amidships.

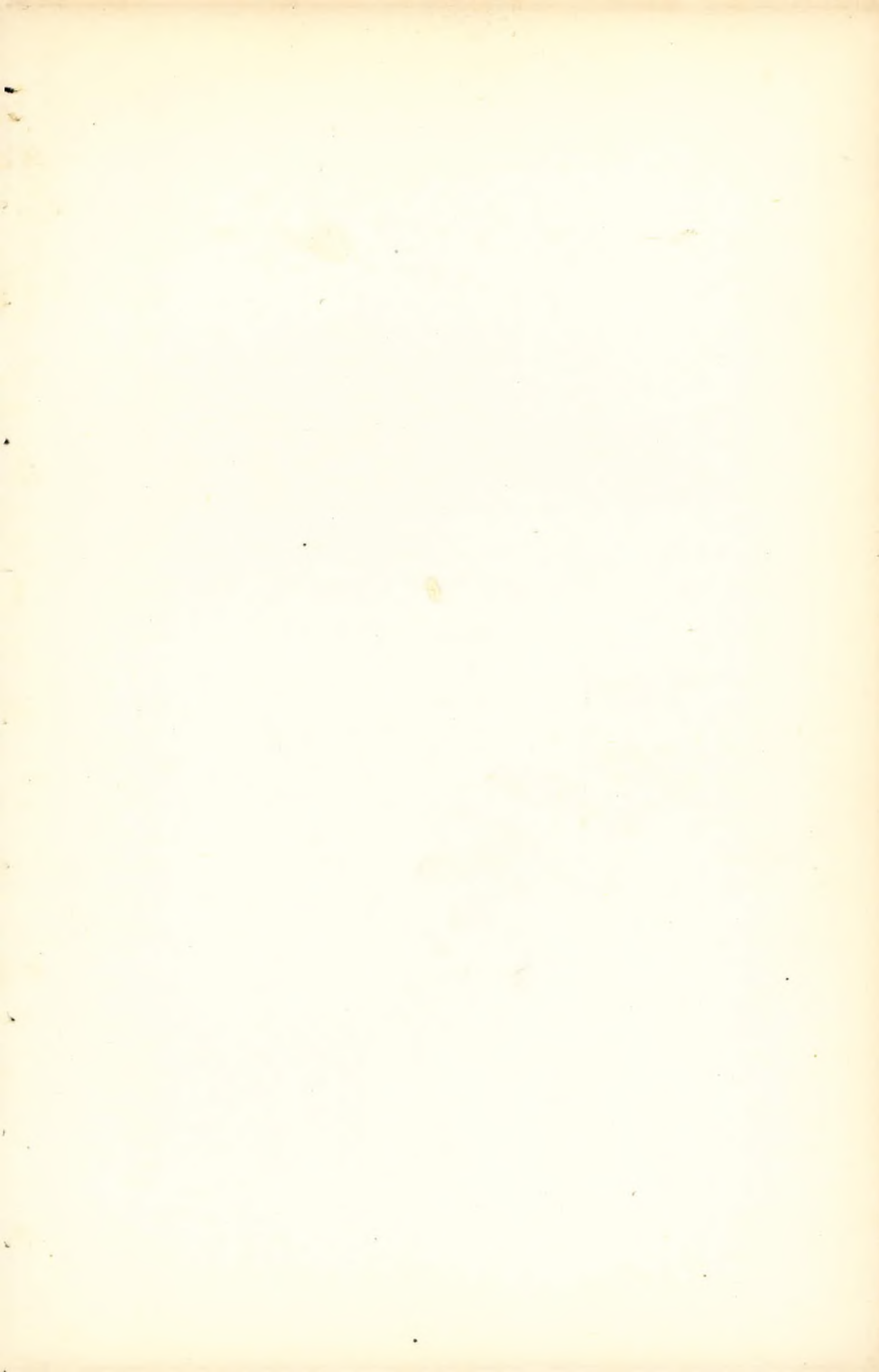
MR. THOMSON.—A few years ago I had a painful experience of having the roses in the bilges choked. I had frequently to stay below the platform during the greater part of the watch to keep them clear.

MR. SOMMERVILLE.—I never use the strum. I always take it away. I think the plunger ought to go as near to the bottom of the chamber as possible, that is, just sufficient for clearance, and that as little as possible.

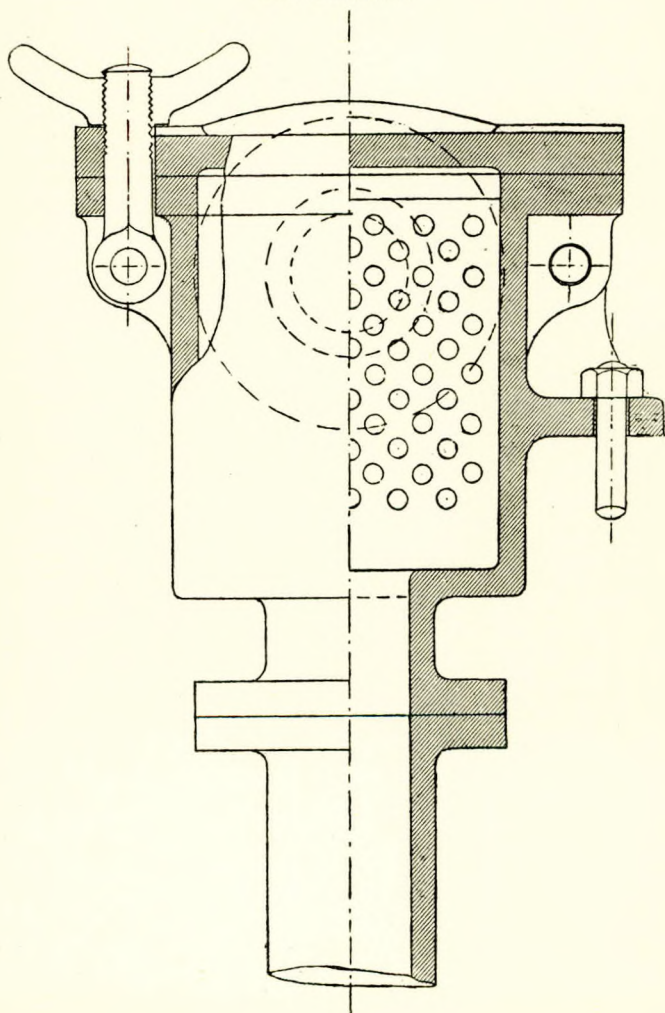
MR. WYMER'S REPLY.

There are pumps and pumps. The first and best pump I know of is the bucket-pump. That pump goes down to the suction-valve and takes air and water, lifts it up to the top, and discharges it over the top of the pump. The next is the plunger pole pump, if it is so constructed that it runs itself clear of water when it is turned upside down. Always make the discharge valve at the top, next to the stuffing-box. The next is the double-acting pump.

I listened to Mr. Hawthorn's remarks with reference to water in his engine-room, and think he had plenty of it on that occasion. I have been a week without bed, while at sea, but not five days without food. Mr. Gray has given us all a great many things to think about, and we all owe a great deal to him for them. He gave us a very graphic description of the *La Plata's* loss. I hope no engineer would allow a $1\frac{1}{4}$ -inch pipe to be cut without blocking it up.

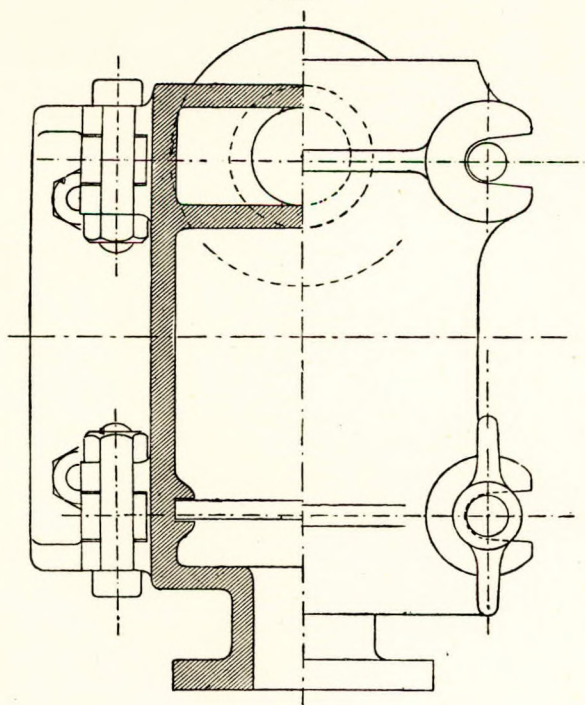


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E 1.

PLAN.





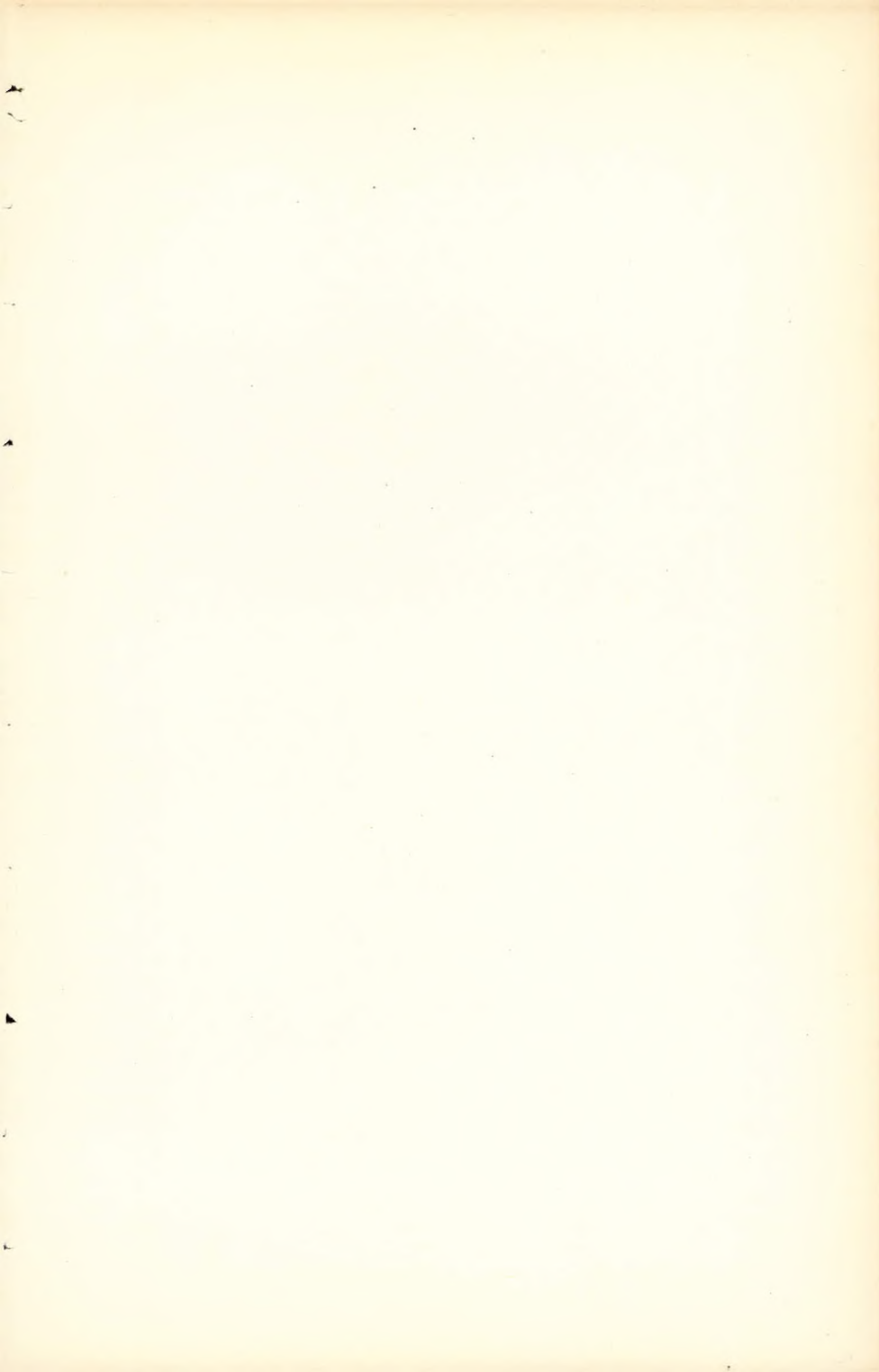


FIGURE 2.

ELEVATION.

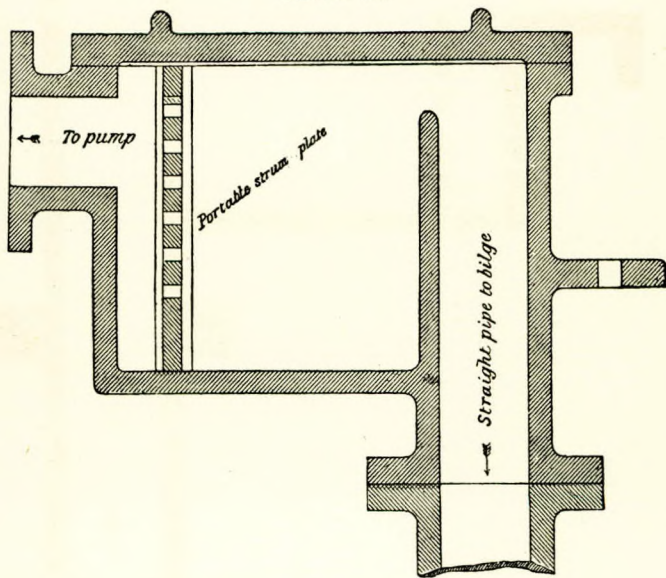


FIGURE 3.

ELEVATION.

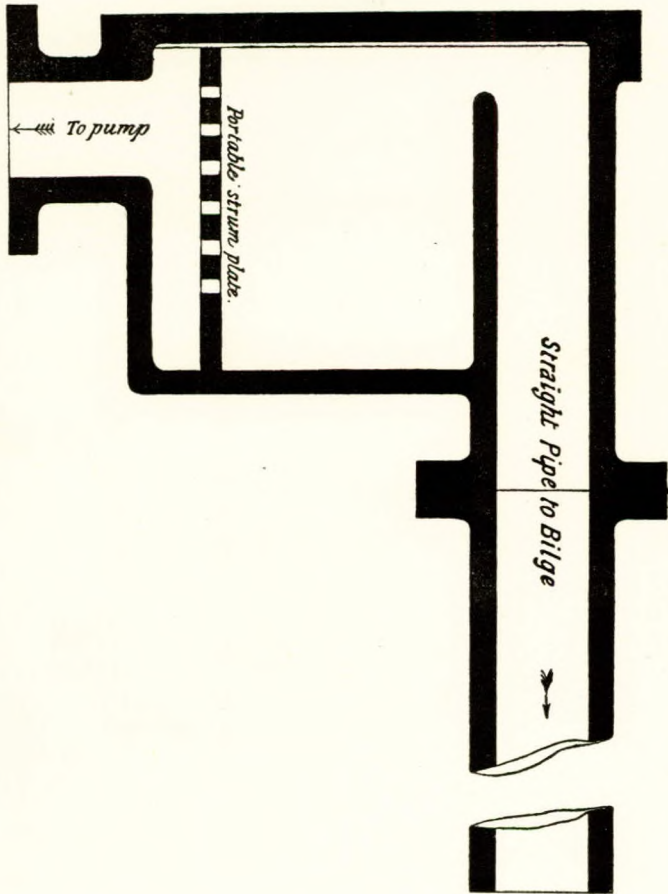
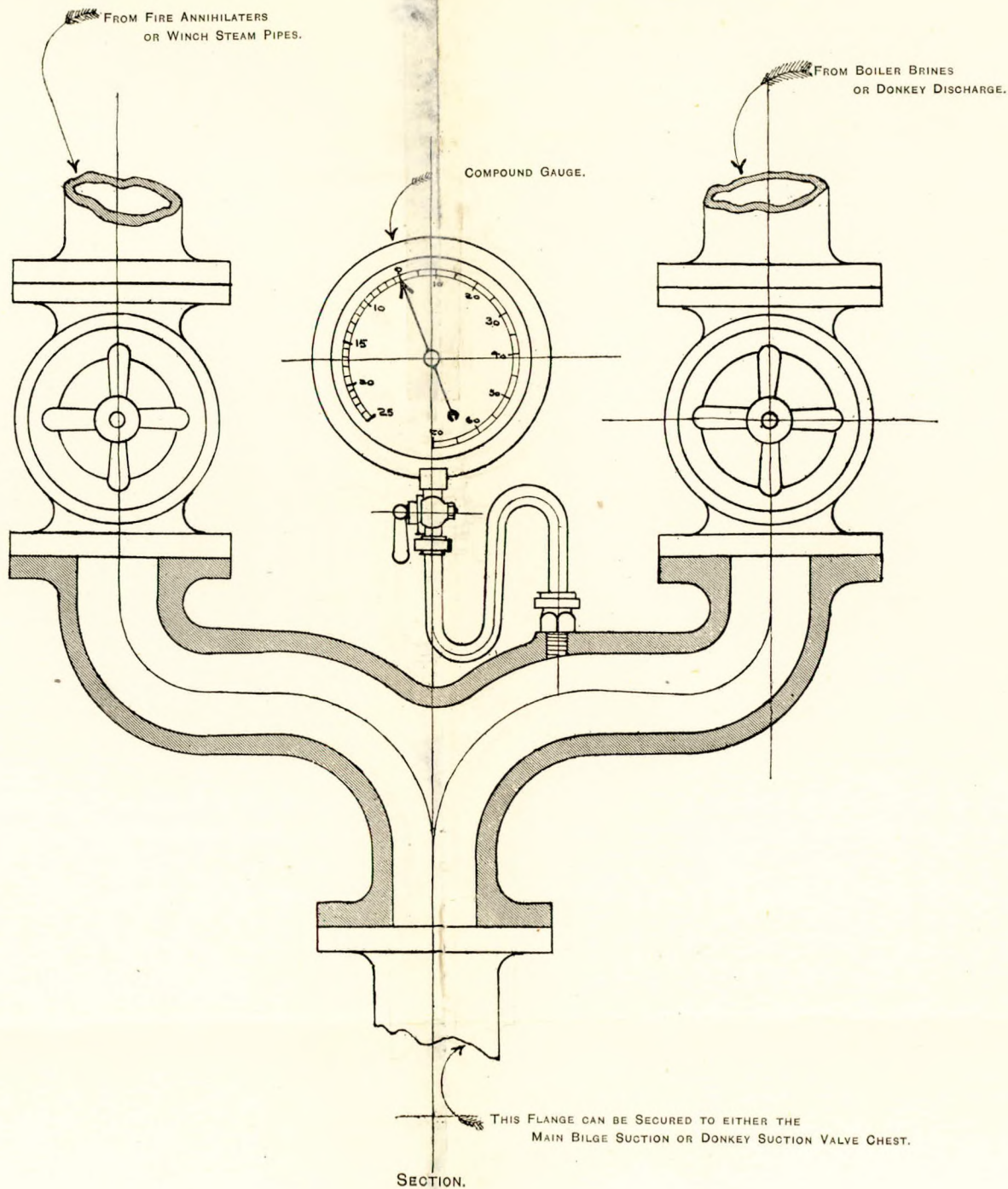


FIGURE 4.

PLAN FOR CLEARING BILGE BOXES AND PIPES BY MEANS OF STEAM.



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P R E F A C E .

THE LANGTHORNE ROOMS,
STRATFORD, *October 19th, 1889.*

A meeting of the Institute was held here this evening, when Mr Jos. Williams read a Paper on "Forced Draught," as given—followed by the discussion which ensued—in the following pages.

The subject of which the Paper treats is of considerable importance, and has many sides and many side issues; it should not, therefore, be allowed to rest here, but be continued in another Paper, for which there is ample material. As a strong desire exists that "Forced Draught" should be the title of an early Paper, it is hoped that members will keep the subject before them, with a view to contribute to the literature of the Institute, and to the general good, on this subject.

The attention of members is called to the Reading Room and Library, which are open for their use every evening from 5 to 10.

The First General Meeting will be held on Friday, 1st November, at 7 o'clock, in the Langthorne Rooms.

A *Conversazione* for Members and their personal friends will be held in the Town Hall, Stratford, on Friday, 6th December, at 6.30 p.m. Tickets (2/6 each) may be had on application to Mr Leslie, Convener of the Recreation Committee.

The Annual Meeting and Election of Office-bearers will be held in March.

JAMES ADAMSON,
Hon. Secy.

