PART II.

PAPERS.

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TROUBLES DUE TO THE AERATION OF WATER IN PUMPS.

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The author has come across several instances of trouble with air vessels and pumps, due to the presence of air in the water, which was in some cases salt from the harbour, and in others fresh from the city mains.

The subject is one which, it is apparent, has not always received the consideration it deserves, as is shown by the frequent use of similar air-vessels for single and duplex pumps; and in places where there is a head on the suction side as well as in places where there is a lift.

It will generally be found that both salt and fresh water will absorb, or liberate, large quantities of air, provided of course that the conditions are favourable.

What these conditions are may probably be more easily understood from the following instances which came within the author's personal experience.

A large single pump was drawing through a 6in. main from a high level tank, the pressure in the pipe being about 40 lbs. per sq. inch at the pump. The shock and noise in the suction main, and in several branches, was naturally considerable, and became worse when the duty of the pump was increased. It was eventually decided, after some consideration, to improvise a large air vessel from an old portable boiler, about 6ft. long x 4ft. diameter internally, and this was placed on the suction side of the pump.

It worked admirably, but only for about three days, when the shock was observed to be as bad as before. The many cubic feet of air in the vessel had been absorbed into the water. Different arrangements of the inlet and outlet of the vessel were tried, with varying degrees of success, but without really satisfactory results. It was eventually decided to replace the single pump by one of the duplex type, and without an air vessel. This change was successful.

From a consideration of this, and similar cases, some very interesting points may be noticed. One is that it is useless to erect an air vessel, either on the delivery or suction side of the pump, when the suction side is under pressure.

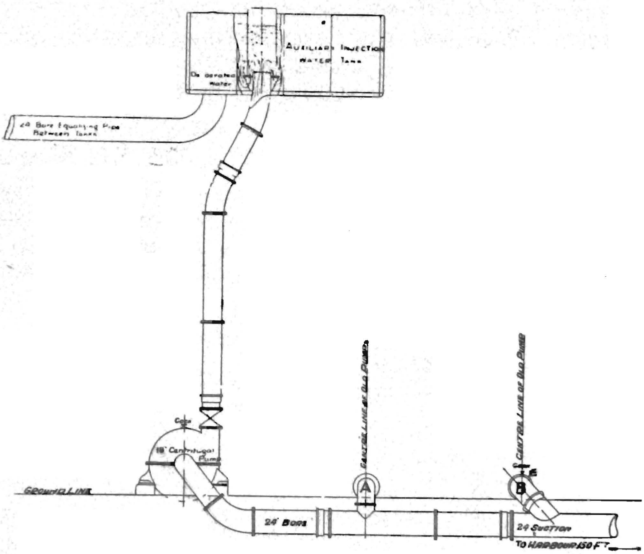
The reason is that the air in most air vessels under pressure is being continually absorbed into the water, especially when such is in commotion. In a pump with a lift on the suction side this loss of air is made up principally by the leakage at the glands, and which is effected in a greater or lesser degree according to the nature and tightness of the packing. But in a pump with a pressure on the suction side there is no such replacement, the result being that the original air in the vessel quickly becomes absorbed, and the interior becomes practically solid water. This is the usual condition of all vessels fitted as stated above.

Of course these statements do not apply when there exists a means for mechanically replacing the air absorbed by the water, as in large mining pumps.

An air vessel should, to avoid absorption, have as small an area as possible in actual contact with the water, as in the pear-shaped Tangye vessel, and on no account should the delivery pipe and air vessel be combined.

Here is a case of trouble with a centrifugal pump, the causes of which were for some time rather obscure. The 18in. centrifugal salt water pump shown on next page has a capacity of 6000 gals. per minute at 420 revs. It is direct coupled to an Allen engine and works with a total head of about 65ft., supplying the water for the condensers of the vacuum pans. This pump was installed to take the place of two reciprocating pumps ,and it drew its water from the end of a common pipe in the manner shown in the diagram. The mean suction lift is about 15ft. The suction branches to the disused reciprocating pumps are situated on the upper side of the main, the result being that the air bubbles, released because the water is in tension owing to the lift, found the pockets formed by the branches. This went on until in a short time the branches became full of air. This condition would not have mattered much were the speed of the pump constant; but the condenser requirements, due to the different vacua required for sugar boiling, fluctuate considerably. It is thus often necessary to slow down or stop the pump altogether. Now, when starting up again the inertia of the large body of water in the pipes from the harbour to the pump (24in. bore pipe about 150 ft. long) caused a higher tension in the water, and a vacuum in the branches A. and B.

Thus the imprisoned air was released, and it travelled along the short length of pipe and entered the pump, causing it to lose its water. To do this, the air must, the author



thinks, be sufficient to completely envelop the impeller, but this really represents only a small quantity, as there is a partial vacuum. The pump worked badly when it was first installed, and it was some time before the trouble was attributed to the disused branches on the suction side, as it was not expected, on account of their smallness, that they would entrap sufficient air to cause any trouble. But one of the old pumps was removed, and with it its branch, and it was found that the large pump gave less trouble.

Attention was then directed to the other branch B, and a snifting cock was placed in the pump end of it at E, with complete success.

In case of trouble now, the procedure is as follows:—First the pump is stopped (this makes a pressure in the main and branch due to the head of the delivery tank, there being a non-return valve at the harbour end of the pipe), then the cock E. is opened, the air escapes freely for some time before the water comes, the cock is then shut and the pump started without any trouble. This last case shows how elusive are the factors which must be considered in the laying out of such gear.