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PROVISIONAL SPECIFICATION.

Apparatus for Separating Oil and Air from Water and Recovering the Oil.

I, HEINRICH HINTERBERGER, of Pola, in the Province of Istria, in the Empire of Austria, Engineer in the Imperial and Royal Austro-Hungarian Navy, do hereby declare the nature of this invention to be as follows:—

This invention relates to apparatus for separating oil and air, and recovering the oil, from water containing considerable quantities of these substances, the said apparatus being more particularly applicable to water discharged by the bilge pumps of vessels or to boiler feed water coming from condensers.

The invention has for its object to recover the lubricating oil from the water and to obtain water as far as possible freed from oil so that the water discharged by bilge pumps for instance cannot destroy the paint of vessels.

According to my invention I provide a closed chamber or receptacle in the pipe delivering the water, mixed with oil and air in such a manner that the water enters the said receptacle at its upper end and flows out from the same through the bottom. It will be obvious therefore that, as soon as equality of inflow and outflow is established, the chamber contains a column of water of a certain height and above the same a layer of compressed air. An oil pipe passes through the top or cover of the receptacle and extends into the liquid, the said pipe being provided at its inlet with a valve, which is connected with a float.

When this float is dipping into water, its buoyancy suffices to keep the valve closed, whilst when the float is dipping into oil it becomes sufficiently immersed to open the valve. The oil is then forced into the oil pipe by the compressed air and continues to be blown out until the level of the oil has sunk to the level of the opening into the oil pipe, when air begins to escape. The consequent rise in the level of the liquid, resulting from the diminution of air pressure has for its effect to cause the float to be raised again and to close the valve of the oil pipe.

In order to provide a float with as large a volume as possible I advantageously employ an annular float arranged so as to surround the lower end of the oil pipe. The form of valve best suited to this float is a tubular slide valve, corresponding ports or apertures being formed in the pipe and slide. In some cases, however, it is difficult to keep such a slide tight, for instance when there is a high pressure in the receptacle in consequence of the delivery pipes of the bilge pumps opening below the level of the sea, and I therefore advantageously arrange an ordinary conical valve at the top end of the oil pipe, the said conical valve being connected with the tubular slide valve by means of a downwardly extending stem.

To promote the rise of oil drops in the water and to accelerate the formation of a sufficiently thick layer of oil, I arrange a conical diaphragm below the float, the said diaphragm having one or more apertures provided with oil baffles and a cylindrical head or cap, which surrounds the float.

To prevent the liquid contained in the receptacle from being stirred up by the inflowing water, whereby the separation of the oil would be hindered, I provide a tube or sleeve arranged concentrically around the end of the admission pipe and extending to a certain depth into the water.

The above mentioned cylindrical head is provided at its lower end with a sieve bottom, below which a steam coil for heating purposes is advantageously arranged.

[*Price* 8*d*.]

The vessel for collecting the oil flowing out from the apparatus may with advantage, be arranged within the receptacle. It is in this case made annular so as to surround the cylindrical head of the conical diaphragm, and its exhaust pipe extends outwardly through the side of the receptacle, and passes to a filter.

In the lower portion of the receptacle are arranged one or more cross partitions so as to prevent the water from directly passing from the inlet to the outlet.

Dated the 11th day of January 1896.

G. F. REDFERN & Co.,
4, South Street, Finsbury, London, Agents for the Applicant.

COMPLETE SPECIFICATION.

Apparatus for Separating Oil and Air from Water and Recovering the Oil.

I, HEINRICH HINTERBERGER, of Pola, in the Province of Istria, in the Empire of Austria, Engineer in the Imperial and Royal Austro-Hungarian Navy, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to apparatus for separating oil and air, and recovering the oil, from water containing considerable quantities of these substances, the said apparatus being more particularly applicable to water discharged by the bilge pumps of vessels or to boiler feed water coming from condensers. It is however, applicable in general to all cases, where it is desired to separate from each other two liquids of different specific gravity.

As regards bilge water and feed water, the invention has for its object to recover the lubricating oil from the water and to obtain water as far as possible freed from oil so that the water for instance discharged by bilge pumps, cannot destroy the paint of vessels.

According to my invention I provide a closed chamber or receptacle in the pipe delivering the water mixed with oil and air, in such a manner that the water enters the said receptacle at its upper end and flows out from the same through the bottom. It will be obvious therefore that, as soon as equality of inflow and outflow is established, the chamber will contain a column of water of a certain height and above the same a layer of compressed air. An oil pipe passes through the top or cover of the receptacle and extends into the liquid the said pipe being closed by a valve, which is connected with a float.

When this float is dipping into water, its buoyancy suffices to keep the valve closed, whilst when the float is dipping into oil, it becomes sufficiently immersed to open the valve. In some cases, I prefer to have the valve kept closed by spring pressure and only opened by the sinking float. The oil is then forced into the oil pipe by the compressed air and continues to be blown out until the level of the oil has sunk to the level of the opening into the oil pipe, when air begins to escape.

The consequent rise in the level of the liquid, resulting from the diminution of air pressure, has for its effect to cause the float to be raised again and to close the valve of the oil pipe, or to allow the spring to close it.

In order to provide a float with as large a volume as possible, I advantageously employ an annular float arranged so as to surround the lower end of the oil pipe. The valve is by preference a conical valve arranged at the top end of the oil pipe and having its stem extended downwards through the said pipe, below the bottom end of which it is connected with the float. When springs are provided

for closing the valve, the valve stem is not rigidly connected with the float, but is adapted to be carried along by the float as it sinks.

To promote the rise of oil drops in the water and to accelerate the formation of a sufficiently thick layer of oil, I arrange a conical diaphragm below the float, the said diaphragm being provided with a hole, from which a pipe extends downwards for establishing the necessary communication between both compartments of the receptacle. The central portion of the diaphragm is made up into a cylindrical head or cap, which surrounds the float.

To prevent the liquid contained in the receptacle from being stirred up by the inflowing water, whereby the separation of the oil would be hindered, the admission pipe is extended downward nearly to the bottom of the receptacle and is surrounded by a concentric sleeve, which reaches from the diaphragm nearly to the head of the receptacle.

The above mentioned cylindrical head is provided at its lower end with a sieve bottom, below which a steam coil for heating purposes is advantageously arranged.

The vessel for collecting the oil, flowing out from the apparatus may, with advantage, be arranged within the receptacle. It is in this case made annular so as to surround the cylindrical head of the conical diaphragm, and its exhaust pipe extends outwardly through the side of the receptacle, and passes to a filter.

In the lower portion of the receptacle are arranged one or more cross partitions so as to prevent the water from directly passing from the inlet to the outlet.

In order to enable my invention to be fully understood, I will describe how it can be carried into practice by reference to the accompanying drawings, in which :—

Figure 1 is a sectional elevation of an oil separator embodying my invention, and having its valve kept closed by spring pressure.

Figure 2 is a top side view of the oil separator, the head or cover being removed.

Figure 3 is a diagram of a different arrangement of the oil pipe and valve, which is kept closed by the buoyancy of the float.

The sheet iron receptacle a is hermetically closed, and has the top end of its admission pipe b connected to the delivery pipe of a bilge pump, while a pipe opening into the sea is bolted to the boss c near the bottom of the receptacle. It will be readily understood that the water flowing in through the pipe b flows out at c, at first with less velocity than it enters and that in consequence thereof the receptacle a will gradually fill with water above which the air will be compressed. After a given time, the pressure exerted by the column of water within the receptacle and by the compressed air will cause the same volume of water to flow out as that flowing in.

Into a hole in the cover or head of the receptacle a, is inserted the oil pipe d, which extends sufficiently far downward to admit of the lower end of the valve stem, hereinafter described, being guided inside the pipe. Above the top end of the oil pipe d, the valve chamber f is bolted to the head of the receptacle and from the valve chamber extends a horizontal pipe f^1 for the eduction of oil. Round the oil pipe d which has inlet holes d^1 at the level, where the oil is expected to accumulate, is arranged the annular float g provided with transverse tubes g^1 through which the layer of oil inside the float communicates with the layer of oil outside. The stem h^1 of the conical valve h extends downwards within the oil pipe d, in the lower end of which it is guided by a bushing d^2. Below the said bushing the valve stem h^1 passes through a guide hole in a cross g^2 secured in the float g and below the said cross, a nut h^2 is secured to the valve stem h^1. The valve h is kept closed by a spiral spring h^3 bearing against a collar on the valve stem, and it is opened by the float g directly the same sinks down in consequence of a layer of oil having collected on the surface of the liquid. The float then opens the valve by its cross g^2 bearing against the nut h^2. The cross g^3 at the top of the float forms a guide for the float along the oil pipe.

For oil separators on board ship, I prefer to use a spring for keeping the valve

closed, as the float is subject to almost incessant oscillations. In stationary apparatus, however, the buoyancy of the float dipping into water may be utilized for closing the valve, as illustrated by the diagram Figure 3.

The apparatus, thus far described constitutes the most simple form of my oil separator the other parts hereinafter described and shewn in the drawing constitute additional improvements in the same. Of these improvements I will first describe the special arrangement of the oil reservoir.

The oil forced out by the compressed air through the valve h passes through the pipe f^1, and the three way cock f^2 into the annular oil reservoir j whence it flows into the filter k the purified oil issues through the cock k^1. The three-way cock f^2 allows of conducting the oil into another vessel in case the reservoir j should be already full and the filtration goes on too slowly. From Figure 2 it will be seen that the said oil reservoir j has an opening j^1 in its top side for the escape of the air displaced by the oil. Another improvement consists in the conical diaphragm m with its cylindrical head m^1 closely surrounding the float g. The conical diaphragm m directs the oil drops upwards and by the small sectional area of the head m^1, a more rapid increase of the thickness of the layer of oil is insured. The holes m^2 in the walls of the head m^1, connect the air spaces of the head m^1, and receptacle a, so that no difference of pressure can arise. The head m^1 is closed at its lower end by a sieve-like bottom m^3, below which there is arranged a steam coil n. The sieve-like bottom m^3 retains solid impurities and the steam coil n gives more fluidity to the oil in cases when the bilge water is very cold; before passing out, the steam coil n also encircles the lower end of the admission pipe b.

By the pipe m^4 the space above the diaphragm is connected with the space below the same, so that water is permitted to enter the annular clearance round the oil reservoir j and thereby to compress the air therein.

The admission pipe b is perforated with a number of holes b^1 allowing the air carried along by the water to escape, and the jacket b^2 surrounding the pipe b and resting on the diaphragm m is intended to prevent the oil from splashing about.

In order to prevent the water from passing directly from the inlet to the outlet, diaphragms o, o, are inserted in the lower compartment of the receptacle a.

The seat of the valve h is formed in a second valve p, kept closed by a spiral spring p^1 over which a protecting cap p^2 is screwed. The valve h is merely formed by the conical end of the valve stem h^1 adapted to carry the valve p along by means of a collar. The oil and air enter the large valve p through the lower radial bores and stream out through the upper bores.

It will be seen from the above description that, as the small valve h is kept closed by spring pressure, a certain force is required to open it, and this force can only be created by a layer of oil of a certain thickness, as it is not desirable that there should be a continuous opening and closing of the valve. The larger valve p, in that case, only opens when large volumes of oil are to be discharged and cause the float g to descend a comparatively long distance. The dotted lines X, X and Y, Y indicate the levels to which the float is immersed in oil and sea water respectively. By the described arrangement of the valve, the escape of air on the discharge of small quantities of oil is avoided.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. In apparatus for separating air and oil from water flowing under pressure in a conduit, such apparatus being characterized by a closed receptacle (a) interposed in the conduit, an oil pipe (d) extending through the top side of the receptacle into the liquid and opening at the level where the layer of oil must form, a valve (h) closing the oil pipe, and a float (g) adapted to open the valve when the float is immersed in oil, substantially as set forth.

2. In an apparatus of the kind claimed in the 1st claiming clause, an annular float (a) surrounding the oil pipe (d), substantially as set forth.

3. In an apparatus of the kind claimed in the first claiming clause a conical diaphragm (m) arranged below the float (g) and having a cylindrical head (m^1) which surrounds the float, substantially as set forth.

4. In an apparatus of the kind claimed in the first claiming clause, an admission pipe (b) passing through the top side or cover of the receptacle (a) and extending nearly to the bottom, the said pipe having holes (b^1) and being surrounded by a jacket (b^2), substantially as set forth.

5. In an apparatus of the kind claimed in the first claiming clause, an annular oil reservoir (j) so enclosed in the receptacle as to surround the float, substantially as set forth.

6. In an apparatus of the kind claimed in the first claiming clause, a valve (h) arranged at the top of the oil pipe (d) and having its stem (h^1) extending down through the oil pipe for connection with the float, substantially as set forth.

7. In an apparatus of the kind claimed in the first claiming clause, vertical diaphragms or partitions (o) in the bottom part of the receptacle, which prevent the water from passing directly to the outlet orifice, substantially as set forth.

8. The improved apparatus for separating oil and air from water and for recovering the oil, hereinbefore described and illustrated in the accompanying drawing.

Dated this 11th day of November 1896.

G. F. REDFERN & Co.,
4, South Street, Finsbury, London, Agents for the Applicant.

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HINTERBERGER'S COMPLETE SPECIFICATION.

(1 SHEET)

Fig. 1.

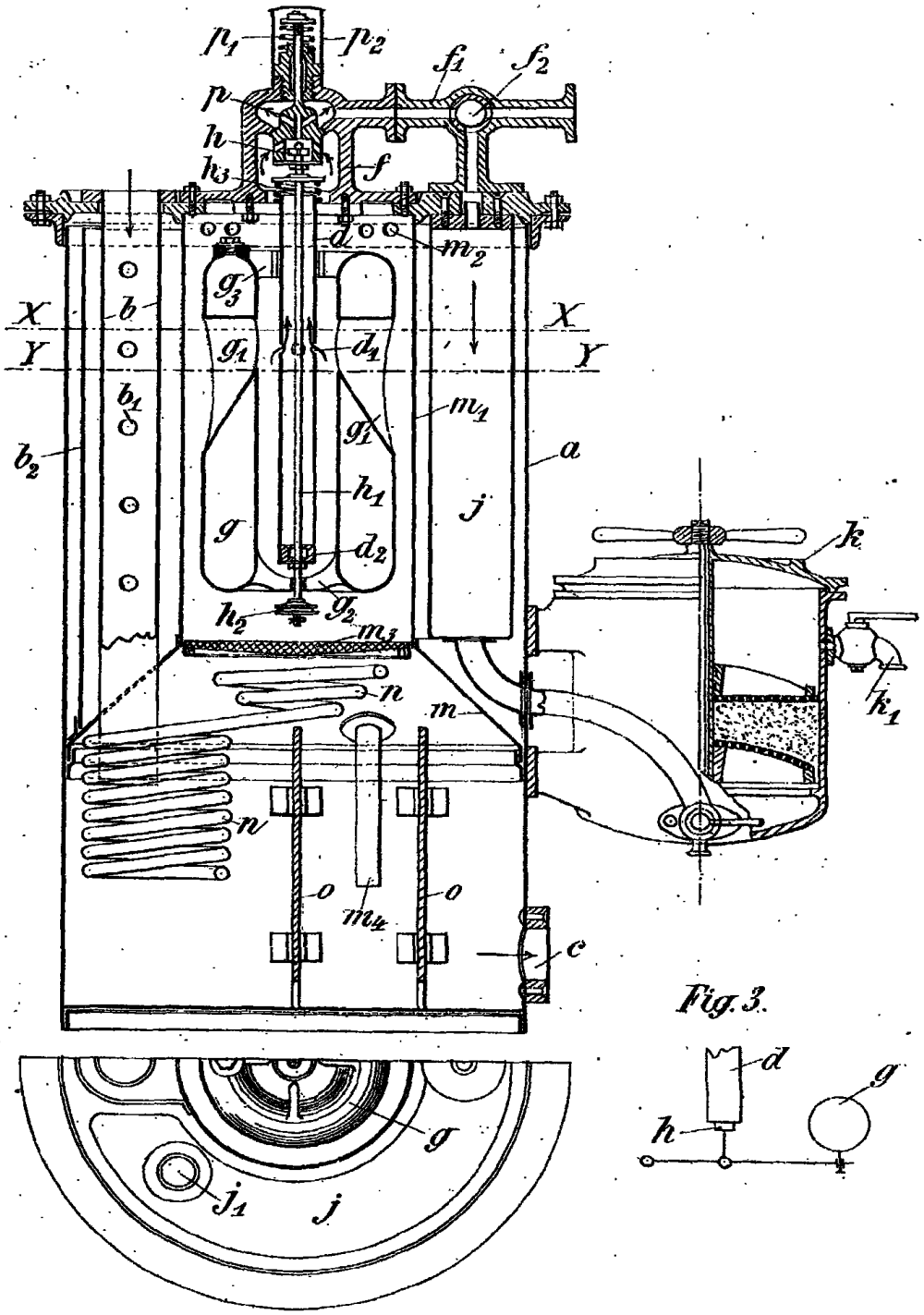

Fig 2.

Fig. 3.

[This Drawing is a reproduction of the Original on a reduced scale]

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