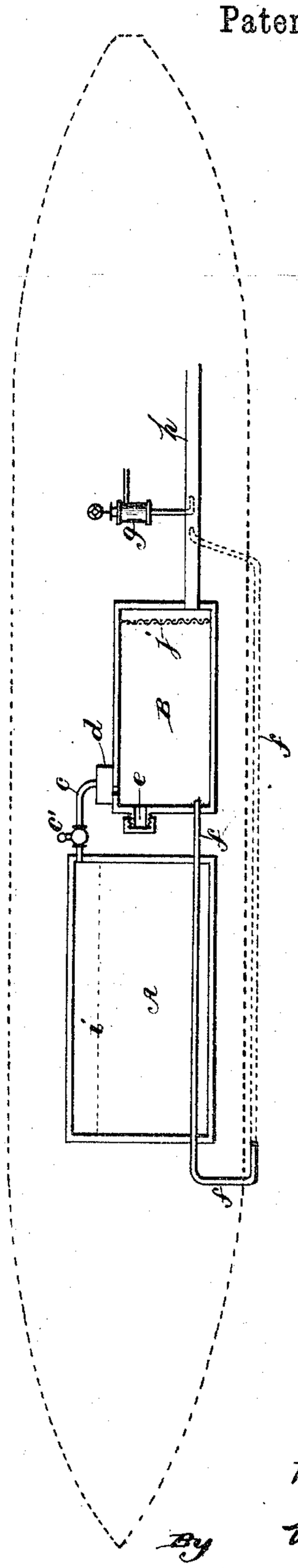
(No Model.)

W. F. JOHNSTON.

APPARATUS FOR PROPELLING TORPEDOES.

No. 254,021. Patented Feb. 21, 1882.



Witnesses.
Robert Everett.
E. A. Dick

Inventor.
Wilbur F. Johnston.
By W. Bailey & Co. Attys.

UNITED STATES PATENT OFFICE.

WILLBUR F. JOHNSTON, OF CLIFTON, NEW YORK.

APPARATUS FOR PROPELLING TORPEDOES.

SPECIFICATION forming part of Letters Patent No. 254,021, dated February 21, 1882.

Application filed August 9, 1881. (No model.)

To all whom it may concern:

Be it known that I, WILLBUR F. JOHNSTON, of Clifton, Staten Island, in the State of New York, have invented certain new and useful Improvements in the Method of and Apparatus for Propelling Torpedoes, and for other Purposes, of which the following is a specification.

It is my object in these improvements to impart to the fluid used as a motor for submerged torpedoes, which usually is a liquefiable gas, compressed to the extent of liquefaction, the heat needed to maintain it at such a temperature as will cause it to exert the best effect as a motor-fluid. The difficulty in this kind of apparatus, which when in use is submerged wholly, or almost wholly, is to furnish the heat to enable the gas to expand sufficiently to maintain the proper pressure. In some cases it has been proposed to employ as the heating agent a combustible; but as the chamber in which the combustible is contained is necessarily closed tight in some way against the entrance of water, it is difficult to obtain the requisite supply of oxygen to maintain combustion. Compressed air has been suggested in this connection as a supporter of combustion, but it is impracticable to store enough of this within the limits of the torpedo to suffice for the purpose. It has also been suggested to obtain the heat by means of the absorption of ammonia by a body of water surrounding the fluid-containing receptacle, and other means for the same purpose have also been suggested, all of them, however, being open to objection, either because they fail to supply the requisite heat or require too complicated, bulky, and expensive machinery or apparatus.

I have devised a method of obtaining and maintaining the requisite heat which is entirely simple and effective. It consists in supporting combustion in the combustion-chamber of the apparatus by means of a liquefiable combustion-supporting gas, compressed to the extent of liquefaction in a suitable receiver, and discharged in gaseous form therefrom under pressure into the combustion-chamber, so as to have contact with the ignited combustible therein. In this way I am enabled to store in small compass all the gas needed to promote and sustain proper combustion during the entire run of the torpedo, even should it be necessary for it to return to the starting-point, the full propelling power being kept up during the whole run.

The gas which I in practice use is nitrous-oxide gas, which at 32° Fahrenheit liquefies at pressure of fifty atmospheres, and at about 75° Fahrenheit gives a pressure of about one thousand pounds to the square inch. It is most effective as a supporter of combustion, and when liquefied has but little bulk. It is also admirably adapted to serve as a motor-fluid, so that I can use it for a twofold purpose—viz., both to drive the propelling-engine and to support combustion in the heating apparatus.

The preferred form of apparatus which I employ in carrying out my invention consists of a combustion-chamber containing carbon or other combustible matter, and a vessel containing liquefied nitrous-oxide gas, which communicates with said combustion-chamber by means of a valve or cock controlled pipe, through which the gas in determinate quantity is permitted at the proper time to pass from the receptacle into the chamber, so as to have contact with the ignited carbon or other combustible matter therein, the highly-heated gases evolved in the combustion-chamber being in whole or in part carried off through a suitable pipe or conduit which is conducted around or through the reservoir or tank containing the compressed motor-fluid, so as to heat the same to such a degree as to cause it to exert the proper pressure.

In using the nitrous-oxide gas, both as motor-fluid and as a supporter of combustion, I employ a portion only of the evolved gases to heat the liquefied gas, and from the combustion-chamber I conduct directly to the engine the main portion of the gases therein evolved, to which may also be added that portion which has been first used to heat the liquefied gas in the reservoir.

The nature of my improvements can, however, best be explained and understood by reference to the accompanying drawing, which represents in diagrammatic sectional side elevation an apparatus embodying the several fea-

tures of my invention. The dotted lines around the apparatus indicate the external case or shell of the torpedo. I have not deemed it necessary to represent the engine and the various other parts which go to make up the torpedo.

The apparatus represented in the drawing is one embracing such parts as are needed when the nitrous-oxide gas is used both as motor-fluid and to support combustion.

A is the closed vessel or receptacle, made usually of steel or wrought-iron, which contains the liquefied nitrous-oxide gas, the level of the liquid being indicated by the dotted line *i*.

B is the combustion-chamber containing the fuel, which usually is some form of carbon, preferably charcoal. Owing to the intense heat generated in this chamber, it should be protected in some way. I provide it for this purpose with a refractory lining or with a water-jacket, or with both.

From the upper part of the liquefied-gas reservoir A leads a small pipe, *c*, into the combustion-chamber.

In order to guard against any injurious or clogging action due to the cold usually produced at the point where the gas expands, I place directly on top of the chamber B a valve-chest, *d*, containing a slide-valve, preferably balanced, which controls the opening into the chamber and receives heat from the highly-heated shell of the chamber. If desired, this chest may be surrounded by a bath of mercury, which will still further gather heat from the chamber.

Chamber B is provided with an opening, *e*, through which the fuel is ignited, said opening being covered by a screw-cap, as shown, when the carbon is to be ignited by hand. When the carbon is ignited by friction primer or cap the opening should be covered by a stuffing-box, through which passes the actuating-rod, action being in this case simultaneous with the opening movement of the valve in valve-chest *d*.

From the lower part of the combustion chamber or box leads a pipe, *f*, which passes through the lower part of the gas cylinder or reservoir A, and through the pipe passes heated gas in sufficient quantity to furnish the amount of heat needed to evaporate the liquefied gas. By increasing the number of pipes any desired pressure can be maintained in the cylinder A. The pipe *f*, after passing through the gas-cylinder, can extend to the outside of the torpedo and open into the water, as indicated in full lines; or it may, as indicated in dotted lines, lead back into the main discharge-pipe *h*, (answering to the steam-pipe of an ordinary steam-engine,) which leads the motor-fluid from the chamber B to the propelling-engine. In the latter case it should preferably, in returning, pass outside of the boat or shell of the torpedo into the water, so that the gases passing through it may be cooled down enough to prevent them from burning the packing of the engine.

At *g*, I have indicated a small pump, which is to be actuated from the propeller-shaft or main shaft of the engine, and serves to inject water and oil in proper quantity into the motor gas-pipe *h*. By this means I not only cool the gas enough to prevent it from burning the parts of the engine, but I lubricate the engine, and at the same time increase the power by the addition of the steam into which the injected water is converted.

At *j*, in chamber B, is a screen designed to prevent charcoal from being blown by the gas into the pipe *h*.

Assuming the cylinder A and chamber B to be properly charged, the mode of operation is as follows: A valve or cock, *c'*, on pipe *c*, which serves to prevent all leakage when the boat is not in use, is first opened. The boat is then brought into position, and at the word of command the valve at *d* is opened and at the same time a friction-primer is ignited at *e*, preferably by the same mechanical device that opens the valve at *d*. I find it best to let the friction-primer ignite a slow-match of cotton or cotton cloth saturated with acetate of lead and dried. The fire started at *e* extends over the whole section of the carbon where the gas enters, and as it consumes burns everything before it toward the outlet-pipe *h*. The products of combustion, (in this case carbonic acid and nitrogen,) increased one-third in volume by the chemical action, and again expanded very much more by the high temperature, pass partly through the pipe *f*, supplying heat to the liquid gas in A, and partly through *h* directly to the engine. The gas passing through *f* may either be discharged into the water or be brought back, as indicated by dotted lines, into the pipe *h*. The pump *g* was put in operation as soon as the boat started and has again increased the volume of the gases passing to the engine by forming a large amount of steam in the pipe *h*. The gas which passes through pipe *f* heats the liquefied gas in A to the requisite degree, and the latter continuously passes in determinate quantity and at the desired pressure into the chamber B, where it supports combustion, uniting with the elements thereby evolved to form a motor-fluid, which is supplied to the engine. In this way the requisite pressure and power are maintained throughout the run of the torpedo, so that great speed can be secured.

The chamber B can be located at either end of the cylinder A. When placed in front of the latter it will be in proximity to the charge of explosive material carried in the bow of the torpedo; but the charge can readily be protected from the heat of the chamber, so that there will be no danger of explosion from this cause.

While I prefer to use the combustion-chamber as a part of the conduit by which the motor-fluid is conveyed from the reservoir A to the engine, yet it may be desirable under some

the pipe *c* would discharge into the combustion-chamber only the amount of gas needed to support combustion, while from the dome of the reservoir a separate pipe, which might pass through the combustion-chamber, if desired, would lead the motor-gas directly from the reservoir to the engine.

I have described what I believe to be on the whole the best form of apparatus now known to me for carrying my improvements into effect. It is manifest, however, that the construction and arrangement of the apparatus may be greatly varied without departure from my invention. I do not therefore restrict myself to the details herein described and illustrated; but

What I claim as of my own invention is—

1. The method of maintaining the combustion of the fuel employed to heat the liquefied gas used as a motor-fluid on submerged torpedoes, which consists in supplying the chamber containing the ignited combustible with gas drawn from a reservoir containing a liquefied gas—such as nitrous-oxide gas—which is a supporter of combustion, substantially as hereinbefore set forth.

2. The improvement in the art of producing a motor-fluid for submerged torpedoes and like purposes, which consists in conducting a liquefiable gas—such as nitrous-oxide gas—which is a supporter of combustion, on its way to the engine into and through a combustion-chamber containing ignited carbon or other fuel, substantially as and for the purposes hereinbefore set forth.

3. The method of increasing the volume of the motor-fluid by injecting water, or water and oil, into the gas after it is heated and before it passes into the engine, substantially as and for the purposes hereinbefore set forth.

4. The combination of a reservoir containing a liquefied gas—such as nitrous-oxide gas—which is a supporter of combustion, a combustion-chamber containing carbon or other suitable fuel, and pipes or connections, substantially as described, whereby the products of combustion from the chamber are caused to heat the liquefied gas in the reservoir, and the gas from said reservoir is conducted both to the chamber to serve as a supporter of combustion and to the engine to serve as a motor-fluid, substantially as hereinbefore set forth.

5. The method of obtaining a motor-fluid for driving the engines of submerged torpedoes and for similar purposes, consisting in acting upon ignited carbon or other fuel with a compressed liquefiable combustion-supporting gas, which unites with the combustible to form a highly-heated gaseous motor-fluid, substantially as and for the purposes hereinbefore set forth.

In testimony whereof I have hereunto set my hand this 29th day of July, A. D. 1881.

WILLBUR F. JOHNSTON.

Witnesses:
E. A. DICK,
N. C. LANE.