(No Model.)

P. HAENLEIN.

APPARATUS FOR PROPELLING VESSELS BY AIR OR GAS.

No. 374,247. Patented Dec. 6, 1887.

Fig. 1.

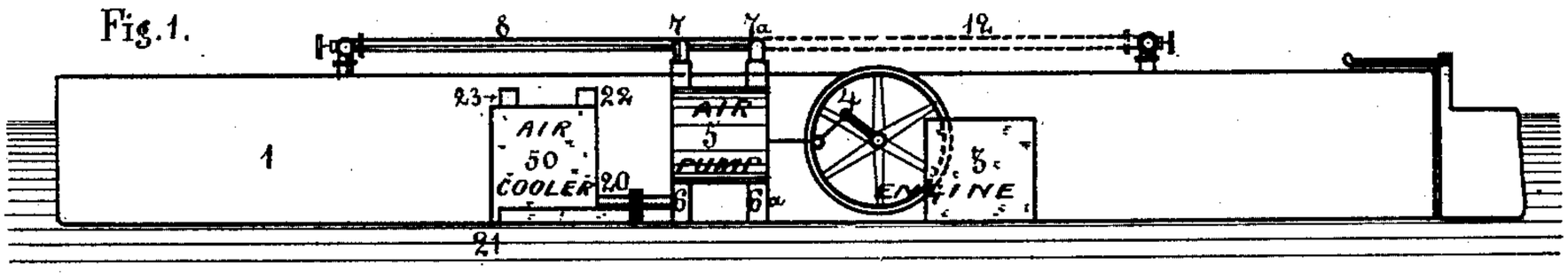


Fig. 2.

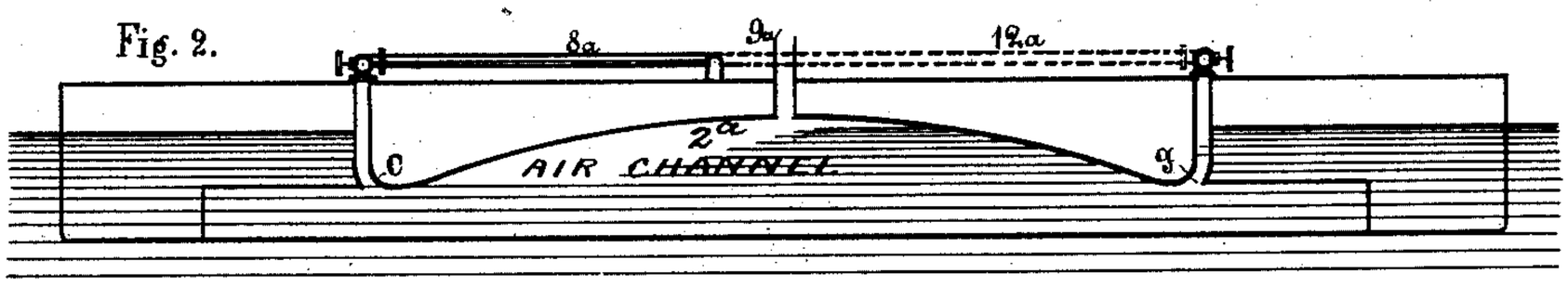


Fig. 3.

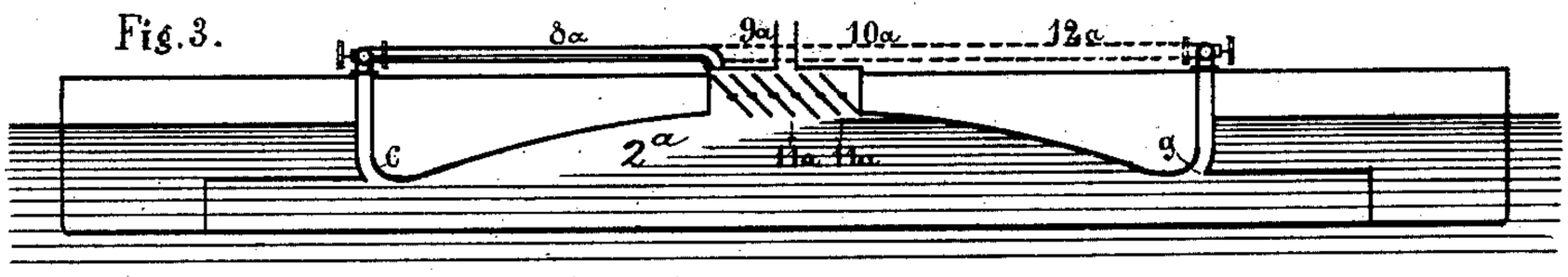


Fig. 4.

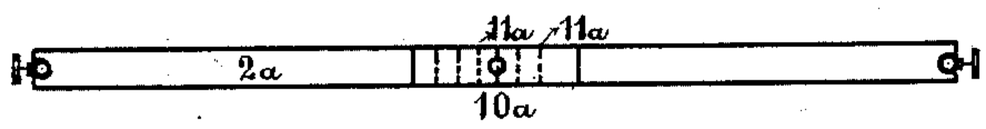


Fig. 5.

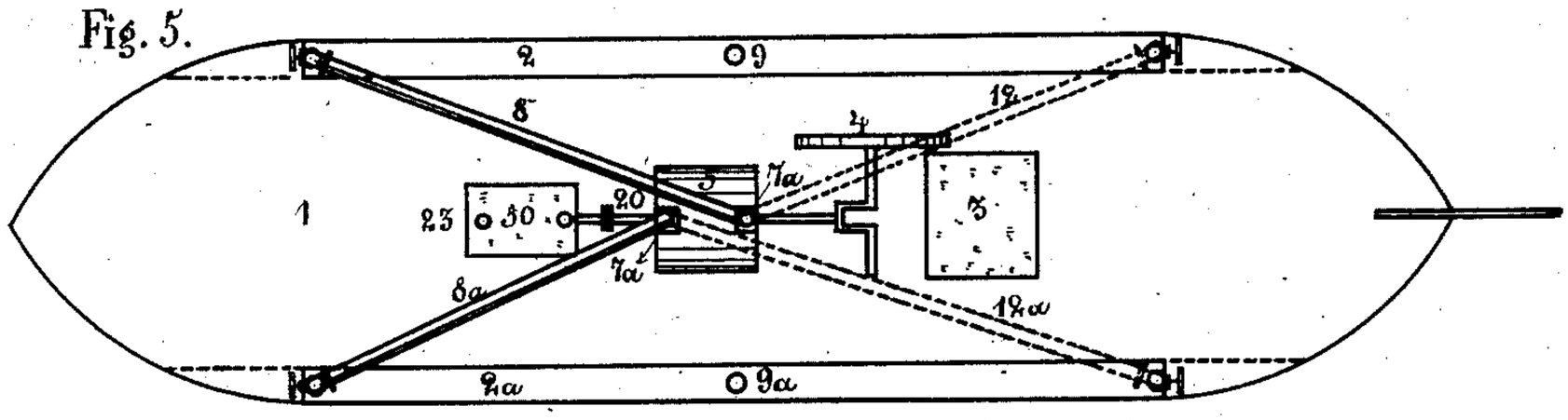


Fig. 6.

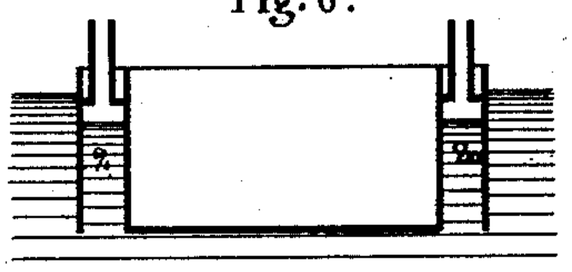


Fig. 8.

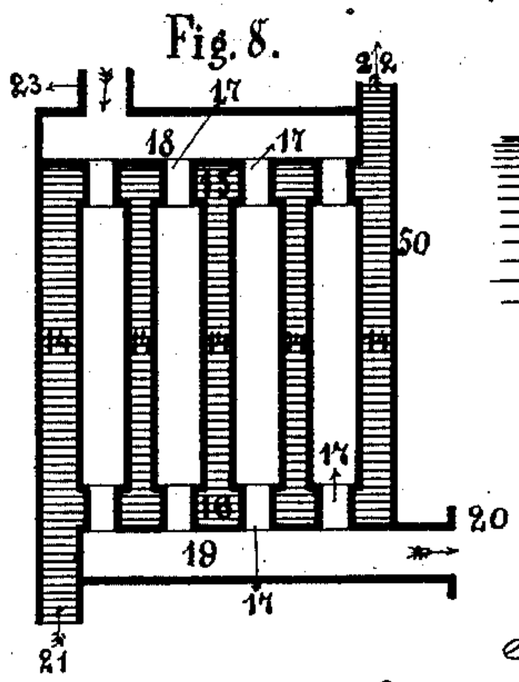
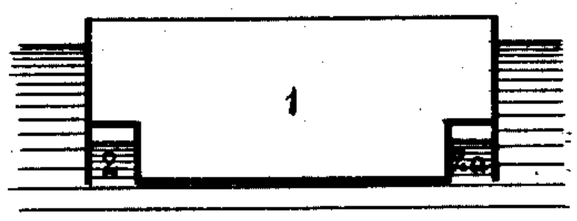


Fig. 7.



Witnesses:

W. D. Porter.

Frank Smith

Inventor.

Paul Haenlein.

by Herbert W. T. Jenner.

UNITED STATES PATENT OFFICE.

PAUL HAENLEIN, OF FRAUENFELD, THURGAU, SWITZERLAND.

APPARATUS FOR PROPELLING VESSELS BY AIR OR GAS.

SPECIFICATION forming part of Letters Patent No. 374,247, dated December 6, 1887.

Application filed June 30, 1887. Serial No. 242,976. (No model.) Patented in Germany November 5, 1886, No. 39,251, and in Belgium December 7, 1886, No. 75,519.

To all whom it may concern:

Be it known that I, PAUL HAENLEIN, a resident of the city of Frauenfeld, in the Canton of Thurgau, in Switzerland, and a subject of the Grand Duke of Hesse, have invented certain Improved Means and Apparatus for Propelling Vessels by Means of Compressed Air or Gases, of which the following is a specification.

Letters Patent have been obtained for this invention as follows: Germany, No. 39,251, dated November 5, 1886, and Belgium, No. 75,519, dated December 7, 1886.

This invention relates to means for propelling vessels by means of compressed air or gases, whereby the said air or gases are caused to act by pressure upon the water while passing through channels on each side of the vessel, as I will proceed to explain with reference to the accompanying drawings, in which—

Figure 1 shows a longitudinal section of the vessel; Fig. 2, a longitudinal section through one of the channels without guide-blades; Fig. 3, a longitudinal section through a channel with guide-blades; Fig. 4, a plan of one of these channels; Fig. 5, a plan of the vessel; Fig. 6, a cross-section of the vessel through the highest part of the channels; Fig. 7, a cross-section of the vessel at the lowest part of the channels; Fig. 8, a longitudinal section through the refrigerating apparatus, to an enlarged scale.

The vessel 1 has on each side a pressure-channel, 2 and 2^a, that do not project beyond the vessel and in which the jets of compressed air act.

3 is the motor-engine, which drives the fly-wheel shaft 4 of the double-acting air-compressing pump 5.

6 and 6^a are the suction-valves, and 7 and 7^a are the delivery-valves, of the air-pump from which the compressed air or gases are forced through pipes 8 and 8^a to the pressure-channels 2 and 2^a, in which the air enters at bottom through an opening *c* into the water. The compression of the air or gases may also be effected by a fan, or by the combustion of explosive compounds. On entering at *c* the compressed air rises upward toward the escape-nozzles 9 9^a, Fig. 2, and in acting against the water in the channel forces the same backward, thereby driving the vessel forward and eventually escaping through the nozzles into the open air. The sectional area of the nozzles is made so small that the air has to issue with a velocity corresponding to a head of water of about two and one-fourth inches, so that it issues from the water in a comparatively quiescent state; but in order to cause the air to issue in a perfectly quiet condition the pressure channels are provided with a box, 10^a, containing guide-blades 11^a, as shown at Figs. 3 and 4. The box 10^a is of the same width as the pressure-channel, and is opened at bottom, but closed on all sides and at top, where it is provided with a small nozzle, 9^a. The guide-blades 11^a are mounted on lateral pivots, so that they can be made to assume either the position shown on the drawings or the symetrically-opposite position. In passing through these guide-blades the air-jet issues in a perfectly quiet manner, so as to avoid all disturbance of the water, and consequently all loss of useful effect, the water remaining perfectly smooth in the channel.

In order to propel the vessel astern, the slide or valve of the opening *c* is closed and that at the opening *g* is opened, so that the compressed air will now pass through the pipes 12 12^a (shown in dotted lines) and enter the water at *g*, escaping through the guide-blades 11^a, which are now in the reversed position. If the compressed air is made to act in the forward direction on the one side and in the backward direction on the other side, the vessel will be turned in a very small radius.

Instead of using one and the same pressure-channel and guide-blade box for the forward and the backward motion, one or more separate pressure-channels, with their guide-blades arranged symmetrically relatively to the center line of the vessel, may be situated at the bows for the forward motion, and one or more others at the stern for the backward motion.

In order to avoid the loss of useful effect that would arise if the air were at a high temperature, owing to the refrigeration of the air as it enters the water, a refrigerating apparatus is employed—such as is shown at 50,

Fig. 8—for cooling the air in the first instance. This apparatus consists of thin copper pipes 14, fixed at top in the box 15 and at bottom in the box 16 for the circulation of cold water, while the air drawn into the upper chest, 18, passes through short tube 17 into the spaces between the water-tubes 14, and thence through other tubes, 17, into the lower air-chest, 19, the branch pipe 20 of which communicates directly with the suction-valves 6 6ª of the air-pump. The water enters the tubes 14 through the branch pipe 20 at bottom, and, rising in the tubes as it takes up heat from the air, issues at top through the branch pipe 22 again. Thus as the warm air entering through the pipe 23 at top is drawn downward through the apparatus by the pump it becomes effectually cooled by contact with the tubes 14, through which the water is passing in the contrary direction, and then enters the pump 5 through pipe 20 and valves 6 6ª. As the apparatus acts on the principle of reversed currents, a comparatively small extent of cooling surface is required for cooling the air.

Having now particularly described and ascertained the nature of this invention and in what manner the same is to be performed, I declare that what I claim, and desire to secure by Letters Patent of the United States, is—

1. The combination, with the hull of a vessel, of the two longitudinal curved pressure-channels 2 and 2ª, having air-escape openings 9 and 9ª at their highest points, an air-compressor, and pipes connecting the air-compressor with the lowest points of the said channels, substantially as set forth.

2. The combination, with the hull of a vessel, of the two longitudinal curved pressure channels 2 and 2ª, having air-escape openings 9 and 9ª at their highest points, the inclosed guide-blades located below the said escape-openings, an air-compressor, and pipes connecting the air-compressor with the lowest points of the said channel, substantially as set forth.

3. The combination, with the hull of a vessel, of the two longitudinal curved pressure-channels 2 and 2ª, having air-escape openings 9 and 9ª at their highest points, the air-compressor, pipes connecting the air-compressor with the lowest points of the said channels, and a refrigerator for cooling the air before it enters the compressor, substantially as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

PAUL HAENLEIN.

Witnesses:

E. KOLLBRUNNER,
Chancellor.

C. GAENSLI,
Registrator.