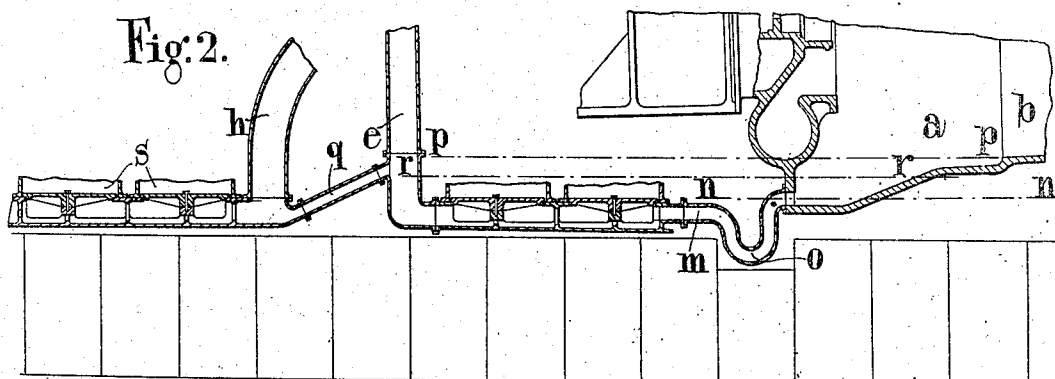
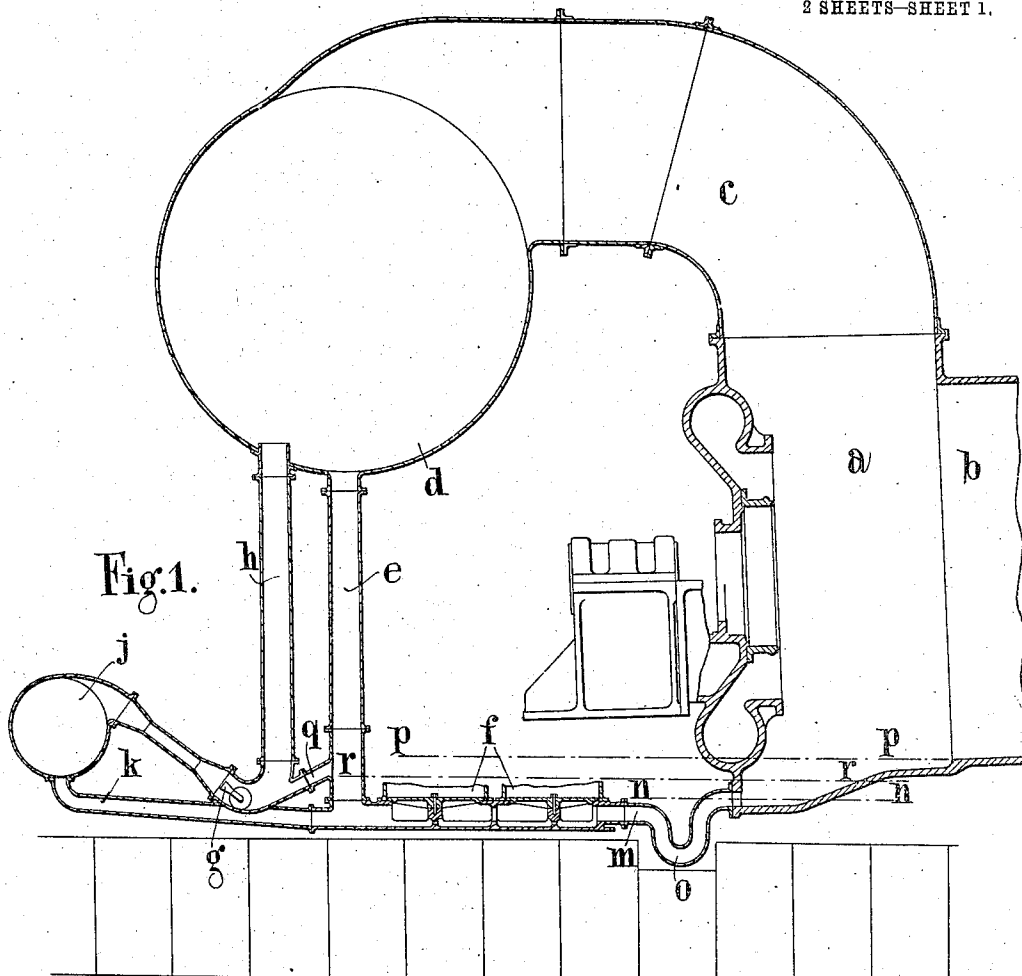


C. A. PARSONS & S. S. COOK.  
CONDENSING APPARATUS.  
APPLICATION FILED OCT. 21, 1911.

1,054,602.

Patented Feb. 25, 1913.

2 SHEETS—SHEET 1.



WITNESSES

H. L. Alden  
H. M. Barrett

INVENTORS

Charles A. Parsons  
BY Stanley S. Cook  
Spear, Middleton, Donovan & Spear  
ATTORNEYS

C. A. PARSONS & S. S. COOK.  
CONDENSING APPARATUS.  
APPLICATION FILED OCT. 21, 1911.

1,054,602.

Patented Feb. 25, 1913.

2 SHEETS—SHEET 2.

Fig.3.

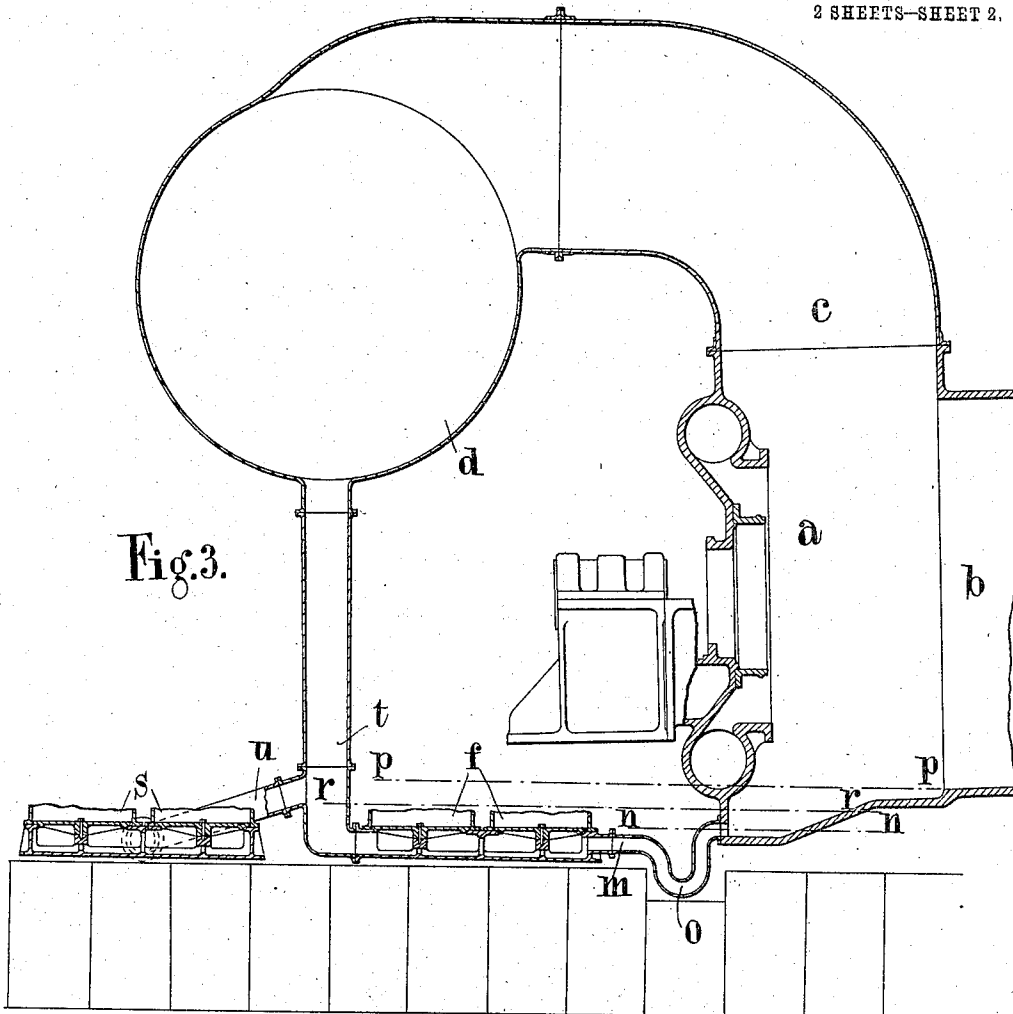
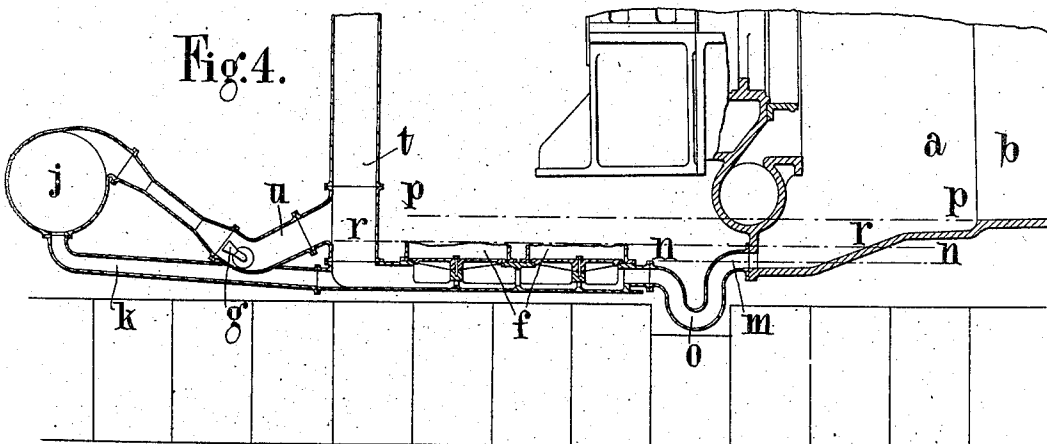


Fig.4.



WITNESSES

H. L. Alden  
H. M. Barrett

INVENTORS

BY Charles A. Parsons  
Stanley S. Cook  
Spear, Widdell & Donarson  
ATTORNEYS

# UNITED STATES PATENT OFFICE.

CHARLES ALGERNON PARSONS, OF NEWCASTLE-UPON-TYNE, AND STANLEY SMITH COOK, OF WALLSEND, ENGLAND; SAID COOK ASSIGNOR TO SAID PARSONS.

## CONDENSING APPARATUS.

1,054,602.

Specification of Letters Patent.

Patented Feb. 25, 1913.

Application filed October 21, 1911. Serial No. 656,067.

*To all whom it may concern:*

Be it known that we, CHARLES ALGERNON PARSONS, K. C. B., a subject of the King of Great Britain and Ireland, and residing at 5 Heaton Works, Newcastle-upon-Tyne, in the county of Northumberland, England, and STANLEY SMITH COOK, a subject of the King of Great Britain and Ireland, and residing at Turbinia Works, Wallsend, in the 10 county of Northumberland, England, have invented certain new and useful Improvements in Condensing Apparatus, of which the following is a specification.

This invention relates to improvements in 15 condensing plant of the type used for obtaining very high degrees of vacuum as in the exhaust chamber of turbines, steam engines and the like. Such condensing plants are usually provided with augmentor means 20 arranged to increase the vacuum produced in the main condenser by the wet air pumps or other ordinary means, the latter being placed at a lower level than the chamber to be exhausted so as to drain away any 25 fluid which may condense therein. For the sake of economy in space, this difference in levels has been reduced to as great an extent as is possible consequent upon proper drainage being obtained, but it is found that 30 under such conditions an increased degree of vacuum in the condenser and in the exhaust chamber causes the condensed fluid to rise to an undesirable height in the exhaust chamber by means of the drainage passages. 35 For instance in the case of a turbine this condensed fluid rises so as to come into contact with the blades.

The object of the present invention is to overcome this difficulty.

40 The invention consists for this purpose in providing a connection between the augmentor suction and the suction pipe of the ordinary exhausting means, to prevent the fluid rising to more than a predetermined 45 height above the inlet to the ordinary exhausting means.

The invention also consists, in the improved condensing plant as hereinafter described.

50 Referring now to the accompanying drawings Figure 1 is a sectional elevation of a vapor condensing plant arranged according to the present invention; Fig. 2 shows in sectional elevation a part of another 55 arrangement similar to that shown in Fig. 1;

Fig. 3 is a sectional elevation of another form of a condenser plant according to the present invention, while Fig. 4 is a part sectional elevation of another arrangement similar to that shown in Fig. 3.

One method of carrying the invention 60 into effect is shown as applied to a condensing plant illustrated in Fig. 1, in which the exhaust chamber, *a*, of the turbine, *b*, is connected by means of a pipe, *c*, to a condenser, 65 *d*, of any type, the water of condensation in the condenser, *d*, being withdrawn through a pipe, *e*, which leads to one or more wet air pumps, *f*, the foot valves only of which are shown. As is customary in condensing 70 plants for turbine machinery, the degree of vacuum in the main condenser, *d*, is further increased by any suitable means such as that shown, which comprises an ejector nozzle, *g*, the steam issuing from which entrains 75 vapor passing through the pipe, *h*, from the main condenser, *d*, the vapor being thereafter passed into an augmentor condenser, *j*, from whence it is sucked through a pipe, *k*, 80 by the wet air pumps, *f*.

In order to provide for the proper drainage of the exhaust chamber, *a*, of the turbine, *b*, the wet air pumps, *f*, are connected to the chamber, *a*, by a drainage pipe, *m*, 85 having a suitable water seal such as a pipe bend *o* for the purpose of preventing the vapor in the chamber, *a*, passing directly to the pumps, *f*, which are placed at a level indicated by the line *n, n*, which is slightly 90 lower than the level, *p, p*, of the turbine blades, the difference of level *n, p*, being utilized to cause the water of condensation formed in the turbine casing to flow down the pipe connection *m* leading to the wet air 95 pump suction pipe. In such an arrangement it has been found that an increased degree of vacuum produced in the main condenser *d* and turbine exhaust chamber, *a*, causes the water of condensation in the turbine exhaust chamber, *a*, to rise to an 100 undesirable height therein and even touch the rows of turbine blades, this being especially noticeable when the difference of levels, *n, p*, between the turbine and the pump inlet valves is made as small as possible 105 for the sake of economizing space. According to the present invention however this difficulty is overcome by placing a pipe connection, *q*, between the inlet pipe, *h*, of the augmentor, and the suction pipe, *e*, of 110

the wet air pumps, *f*, the connection to the pump suction pipe, *e*, being at the same level, *r, r*, as that to which it is deemed advisable to allow the water of condensation to rise within the exhaust chamber, *a*, of the turbine.

On account of the head of liquid in the conduit, *e*, being thus limited, an increased degree of vacuum in the chamber, *a*, causes the wet air pumps to operate at a lower pressure, such head being thus always capable of overcoming the resistance to opening of the wet air pump valves. If, however, the liquid in the conduit, *e*, overflows into the augmentor, *j*, the latter discharges less vapor while the discharged liquid is now at a temperature at which the liquid can be more readily handled by the wet air pumps. A high degree of vacuum is therefore maintained in the turbine chamber, *a*, without giving rise to the previous mentioned disadvantage.

Obviously this invention may be applied to other arrangements by which a high degree of vacuum is obtained. Thus instead of using a vacuum augmentor of the Parsons's type, one or more air pumps, *s*, as shown in Fig. 2 may be used for the purpose of increasing the vacuum in the main condenser, *d*. In such a case, however, the water and vapor discharged from the augmentor pumps, *s*, are passed directly to the atmosphere, boiler feeding pump or hot well, though the inlet side of the augmentor pumps, *s*, is connected to the suction pipe, *e*, of the wet air pumps, *f*, by a pipe connection, *g*, in the above described manner. Further, if desired, instead of providing two separate pipe connections, *e* and *h*, between the main condenser and pump suction pipe and augmentor respectively, both the water and vapor in the main condenser are conducted by a single pipe connection to the pump suction pipe, the augmentor then being connected to the single pipe connection at a point therein at the requisite height above the pump inlet valves. Such an arrangement is shown in Figs. 3 and 4 in which, *t* indicates the pipe connection conducting water and vapor to the inlet of the wet air pumps *f*. A pipe, *u*, branches from the pipe *t* to the vacuum augmentor means, which, in Fig. 3 are shown as dry air pumps, *s*, and in Fig. 4 as an ejector, *g*, and augmentor condenser, *j*. The height at which the pipes, *t* and *u* meet, is, as before, controlled by the maximum height, *r, r*, of condensation water to be permitted in the exhaust chamber, *a*, of the turbine.

When the augmentor consists of one or more dry air pumps as shown at, *s*, in Figs. 2 and 3, it is not necessary that the foot valves should be at the same level as those of the wet air pump, *f*, and if the former are higher than the latter by the distance

sufficient to give the head of liquid necessary to open the valves of the wet air pumps the arrangement then becomes one in which the suction spaces of the two pumps are common but the valves of the dry air pump or pumps, *s*, stand a prescribed distance above those of the other for the purpose described.

It will be seen that by this invention the level of the inlet valves of the wet air pump or pumps, *f* below the turbine, *b*, is reduced to a minimum and need therefore be made only sufficient to insure the proper drainage of the turbine exhaust chamber, *a*, since the water of condensation therein, cannot possibly rise to an undesirable height.

In ship installations especially, the reduction thus effected in the space occupied by the condensing plant, is of great importance.

Further, the invention is applicable to turbine installations having more than one low pressure turbine and also to steam engine or other installations where a high degree of vacuum is required.

It will be seen that the method of carrying the invention into effect is capable of many modifications in the structural details and arrangement of the plant without in any way departing from the spirit of the invention.

Having now described our invention what we claim as new and desire to secure by Letters Patent is:—

1. An apparatus for obtaining a high degree of vacuum, comprising in combination a motor, a condenser receiving the fluid discharged from said motor, exhausting means, a pipe connection between the condenser and the exhausting means, a drainage pipe connection from the motor to the exhausting means, and augmentor means having a connection to the connection between the condenser and exhausting means, said connection being made at the level to which condensed fluid is permitted to rise within the motor.

2. An apparatus for obtaining a high degree of vacuum, comprising in combination a motor, a condenser receiving the fluid discharged from the motor, exhausting means, a pipe connection between the condenser and the exhausting means, a drainage pipe connection from the motor to the exhausting means, augmentor means, a pipe connection between said augmentor means and the condenser and an overflow pipe connection between the latter connection and that between the condenser and exhausting means, said overflow connection being connected to the exhausting means pipe connection at the level to which condensed fluid is permitted to rise within the motor.

3. An apparatus for obtaining a high degree of vacuum, comprising in combination a motor, a condenser receiving the fluid dis-

charged from said motor, wet air pumps, a  
pipe connection between the condenser and  
said pumps, a drainage pipe connection from  
the motor to the wet air pumps, dry air  
5 pumps, a pipe connection between the con-  
denser and the dry air pumps and an over-  
flow pipe connection between the latter con-  
nection and that between the condenser and  
the wet air pumps, said overflow pipe con-  
10 nection being connected to the wet air pump

pipe connection at the level to which con-  
densed fluid is permitted to rise within the  
motor.

In testimony whereof, we affix our signa-  
tures in presence of two witnesses.

CHARLES ALGERNON PARSONS.

STANLEY SMITH COOK.

Witnesses:

W. H. PILMSUR,

FREDRICH GORDON HAY BEDFORD.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents,  
Washington, D. C."