Sept. 10, 1968 G. WINFREY 3,400,538

HEAT ENGINE

Filed Oct. 28, 1966

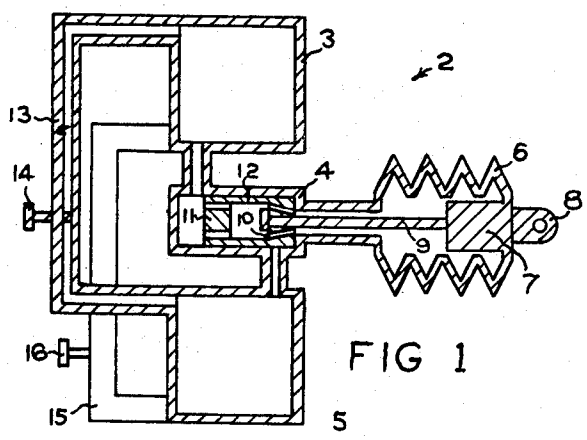

FIG 1

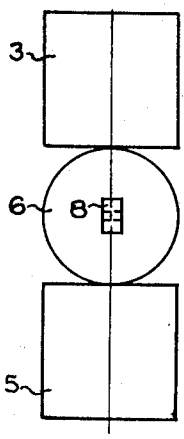

FIG 2

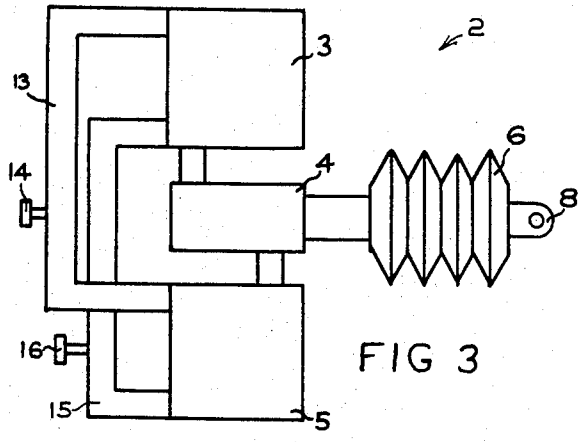

FIG 3

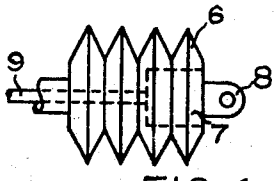

FIG 4

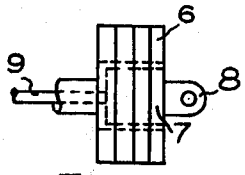

FIG 5

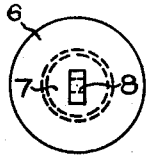

FIG 6

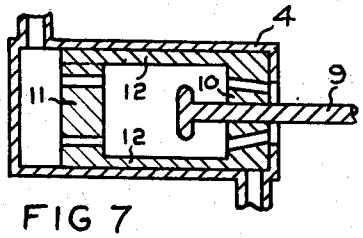

FIG 7

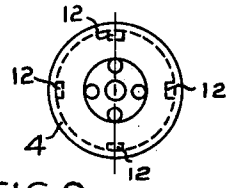

FIG 8

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HEAT ENGINE

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ABSTRACT OF THE DISCLOSURE

A steam engine situated between a boiler and a condenser. The steam engine including an expansion bellows. A member connected to the bellows which actuates a valving member and cyclically controlling the entrance of steam from the boiler to the bellows and the exit of steam from the bellows to the condenser.

This invention relates to engines and more particularly to a completely sealed heat engine which has vapor for a working media.

It is an object of the present invention to provide an engine which in a simple and efficient manner can use any one of many chemicals for a working media.

Another object of the present invention is to provide an engine which by sealing in the proper vapor can be made to run at any temperature difference or temperature level.

Another object of the present invention is to provide an engine which can be made to run as a single unit or with two or more units on a common crankshaft.

Another object of the present invention is to provide an expansion bellows which permits expansion and contraction largely restricted to axial movement with no objectional stress of the material of such a confinement element. As a still further refinement the bellows can be made to have a long axial movement, or stroke.

Another object of the present invention is to provide an engine which in some cases can be made largely of plastic, metal, or a variety of other material, depending upon the temperature and pressure at which it is designed to run.

Still another object of the present invention is to make an engine which is simple in construction, has few moving parts, and can utilize any heat source to produce power.

Still additional objects, benefits, and advantages of this invention will become evident from a study of the following detailed description taken in conjunction with the accompanying drawing, in which:

FIGURE 1 is a cross sectional view taken through the centerline of FIGURE 2.

FIGURE 2 is an end view of the engine shown in FIGURE 1.

FIGURE 3 is a side view of the engine shown in FIGURE 1.

FIGURE 4 is a side view of the engine's bellows expanded.

FIGURE 5 is a side view of the bellows shown in FIGURE 4 contracted.

FIGURE 6 is an end view of the bellows.

FIGURE 7 is a cross sectional view of the engine's valve assembly taken through the center of FIGURE 8.

FIGURE 8 is the end view of the valve assembly shown in FIGURE 7.

Referring now specifically to the drawing, an engine **2** made in accordance with the present invention is shown to include a condenser **3** which is located at the top of the engine and is piped with a hollow pipe to the rear of the valve box **4**. A boiler **5** which is located at the bottom of the engine and is piped with a hollow pipe to the front of the valve box **4**. An expansion bellows **6** which is pleated, and is so constructed that when contracted the pleats lie flat against one another while the core **7** fills

the remainder of the airspace within the bellows. An expansion bellows **6** which is piped with a hollow pipe to the front of the valve box **4**, and has a fitting **8** which can be connected to a connecting rod. A valve operating rod **9** with a flange on the end which is rigidly fastened to core **7** and has a slip fit through the front valve **10** in such a manner that the rod itself will not move the valves but the flange will. Valves **10** and **11** which are rigidly fastened together with bars **12** and have holes through them so gas can always pass lengthwise through the valve box **4**. A hollow pipe **13** which opens into the top of the boiler **5** and into the top of the condenser **3**. A hollow pipe **15** which opens into the bottom of the boiler **5** and into the bottom of the condenser **3**. Valves **14** and **16** which are located in the center of pipes **13** and **15**.

A boiler **5**, a condenser **3**, and a bellows **6** mounted to a valve assembly in such a manner that when the bellows is contracted it is sealed off from the condenser and has an opening into the boiler. The increased pressure will cause the bellows to expand. When expansion is complete the bellows **6** will be sealed off from the boiler **5** and will have an opening into the condenser **3** whereupon it will contract.

Pipes **13** and **15** are located so they can be use to drain condensed liquid from condenser **3** to boiler **5** by opening valves **14** and **16**. Thus the same vapor can be used over and over. It will be noticed that the entire interior of the engine is completely sealed off from the atmosphere and other environment.

An engine made in accordance with the present invention includes an expansion bellows **6** whose normal condition is a state of contraction, and when expanded has a definite spring action which tends to bring it to a contracted state.

The operation of this engine will now be readily understood. This engine can be made to operate under many conditions, but for simplicity sake assume the following conditions. (1) Water is introduced into the engine for a working media. (2) The boiler **5** is maintained at 100° C. (3) The condenser **3** is maintained at 20° C.

The vapor pressure in the boiler **5** will now be around 14 pounds per square inch, while the vapor pressure in the condenser **3** will be very slight. The engine itself will start operating when enough pressure is built up in the boiler **5** to expand the bellows **6**. The operating cycle being as follows.

(1) Pressure from the boiler **5** forces the bellows **6** to expand and when expansion is nearly complete the flange on the end of valve operating rod **9** will move valves **10** and **11** sealing the bellows **6** off from the boiler **5** and giving an opening between bellows **6** and condenser **3**. (2) Under the reduced pressure of the condenser **3** the spring action of the bellows **6** will cause it to contract, and when contraction is almost complete the flange on the end of valve operating rod **9** will move valves **10** and **11** sealing the bellows **6** off from the condenser **3** and giving an opening between bellows **6** and boiler **5**. The cycle is repeated.

The engine is started simply by heating the boiler, but if the boiler is hot the engine can be stopped by opening valve **14**, thus allowing the pressure to bypass the engine. The engine can be started again by closing valve **14**.

As the working media is evaporated from the boiler it is condensed in the condenser and may be returned to the boiler by opening valves **14** and **16**. Whereupon the force of gravity causes it to drain. If the condenser were lower than the boiler the media could be pumped through pipe **15**.

Since it is used over and over in this engine, the working media need not be water, and there are definite advantages in using other chemicals. For example ethyl alcohol will produce the same pressure at 78.5 C. that

water produces at 100° C. while carbon disulfide produces this pressure at only 46.2° C. Thus by choosing the proper chemical the engine can be made to operate at different temperature levels.

Another advantage of using other chemicals is that the temperature difference need not be so great. For example if NH_3 was used for a working media with the condenser at 20° C. and the boiler at 30° C., then the pressure difference between boiler and condenser would be over 42 pounds per square inch. Where with water the temperature would be raised from 20° C. to 100° C. to produce a pressure difference of 14 pounds per square inch.

So a temperature difference of 10° C. with NH_3 gives a greater pressure difference than a temperature difference of 80° C. does with water. It is easy to find a 10° temperature difference in our natural invironment.

Information on the vapor pressure of various chemicals is readily available.

If the condenser is under high pressure and the boiler is under still higher pressure this engine can be made to operate simply by mounting two units on a common crankshaft in such a manner that one unit is expanding while the other unit is contracting.

If it is designed to operate at moderate temperatures so that the heat does not deform the material and a chemical is used that does not deform the material then the bellows of this engine may be made of plastic or a variety of other material.

While this invention has been described with particular reference to the construction shown in the drawing and while various changes may be made in the detailed construction, it shall be understood that such changes shall be within the spirit and scope of the present invention as defined by the appended claim.

Having thus completely and fully described the invention, what is now claimed as new and desired to be protected by Letters Patent of the United States is:

1. An improved valve engine whose entire interior is completely sealed away from the atmosphere and other environment comprising in combination, a condenser which is connected to a valve box, a boiler which is connerted to said valve box, an expansion bellows which is used instead of the usual piston and cylinder combination and which is constructed with pleats in it which lie flat against one another when said bellows is contracted and which has a core which is designed not to guide said bellows but to establish the compression ratio of said bellows and having said bellows connected to said valve box, pipes connected to said condenser and said boiler and said pipes are equipped with valves and are used to move condensed liquid from said condenser to said boiler, a valve operating rod with a flange on one end of said rod and the other end of said rod fastened to said expansion bellows, movable slide valves in said valve box which are constructed so that gas can always flow from said bellows through the length of said valve box and which are moved by said flange on said valve operating rod at the proper time to seal and unseal said condenser and said boiler to and from said valve box in such a manner as to keep said expansion bellows continually expanding and contracting so long as there is a pressure difference between said boiler and said condenser, said flange moving through a provided space when the bellows is moving and valve movement is not desired.

References Cited

UNITED STATES PATENTS

1,056,736	3/1913	Carey	91—341
1,658,951	2/1928	Stitt	92—44 X
3,009,325	11/1961	Pirsh	60—95 X

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