

Nov. 25, 1952

N. C. Krontiris
STEAM ACTUATED WATER PROPULSION SYSTEM
WITH ROTATING BOILER HEATER

2,618,924

Filed May 9, 1950

2 SHEETS—SHEET 1

FIG. 1

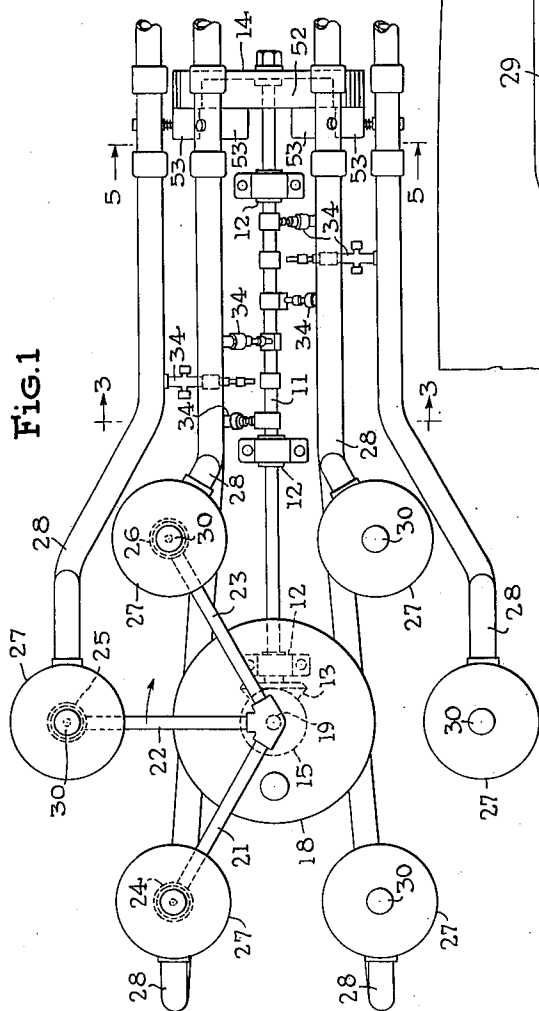


FIG. 2

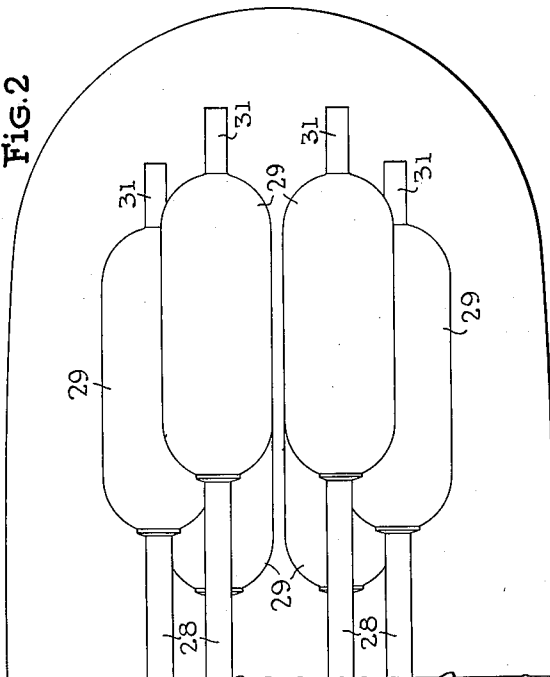
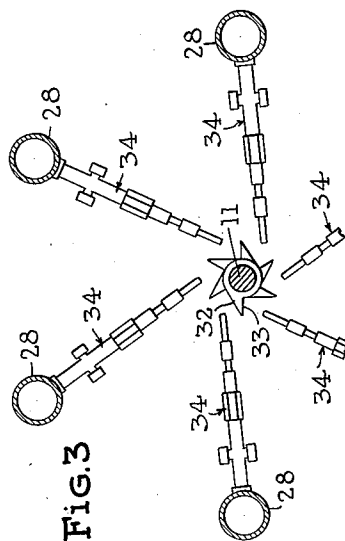


FIG. 3



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2 SHEETS—SHEET 2

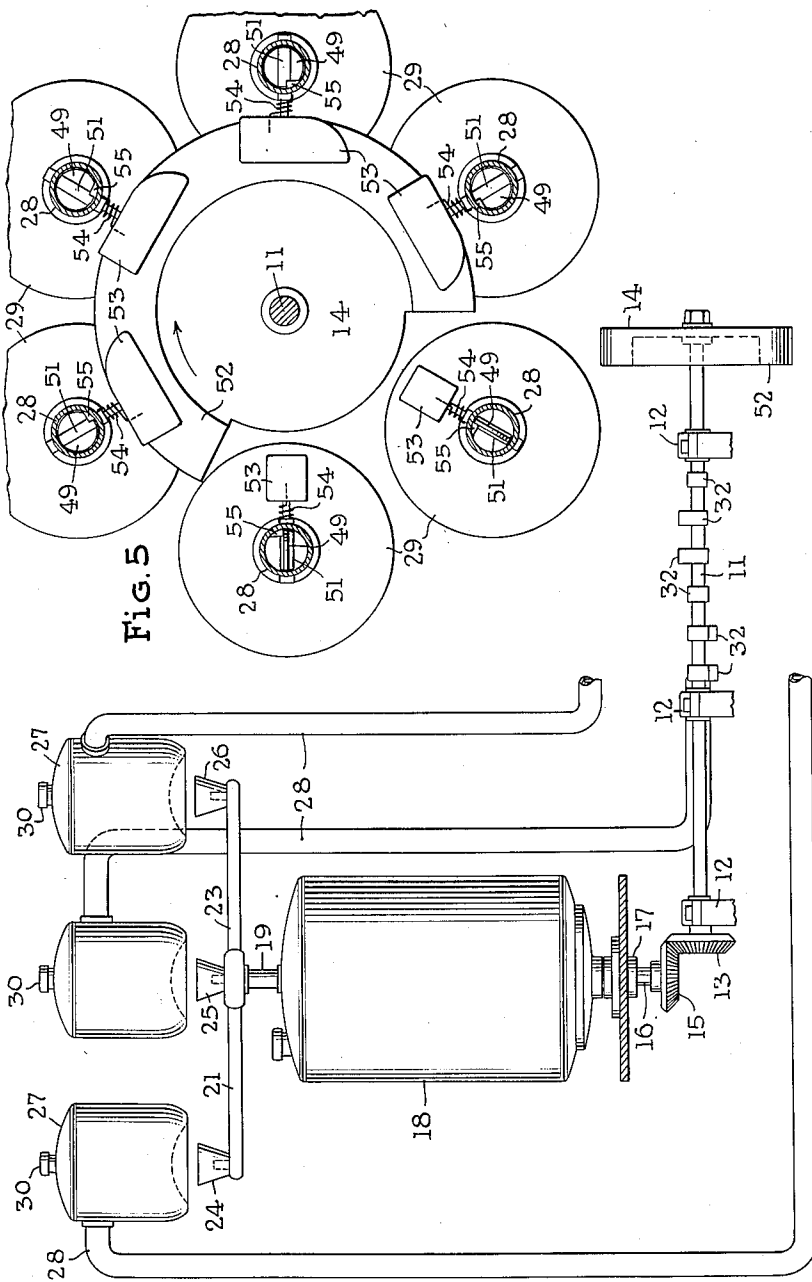


Fig. 5

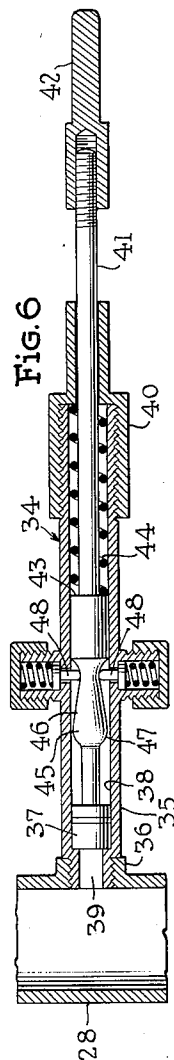


Fig. 6

Fig. 4

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UNITED STATES PATENT OFFICE

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STEAM ACTUATED WATER PROPULSION
SYSTEM WITH ROTATING BOILER
HEATER

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7 Claims. (Cl. 60—35.5)

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This invention relates to power plants of the reaction type. Particularly it relates to power plants of that type for use as propulsion units for marine vessels.

According to this invention a plurality of jet units are employed. Each of these jet units comprises a vapor generator and a jet conduit. The operation of the jet units is so timed that a substantially continuous propulsion force is attained, notwithstanding the fact that the action of each unit is intermittent.

The timed operation of the jet units results from the use of a heat source which is effective to heat the generators individually and serially. A pressure actuated motor is associated with each of the jet conduits and is actuated by the pressure developed in the heated generator. Upon actuation it serves to open a valve in the corresponding jet tube, suspend the heating of that generator and render the heat source effective to heat the next vapor generator in the series.

The use of valves to control the flow of fluid through the jet conduits permits the use of vapor at greatly increased temperature and pressure.

A preferred embodiment of the invention will be described by reference to the accompanying drawings in which:

Fig. 1 is a fragmentary plan view of a propulsion unit embodying the invention.

Fig. 2 is a fragmentary plan view of the displacement volumes.

Fig. 3 is a sectional view taken on line 33 of Fig. 1, certain parts being broken away.

Fig. 4 is a fragmentary side elevation partly in section showing a part of the propulsion unit embodying the invention.

Fig. 5 is a sectional view taken on line 5—5 of Fig. 1. Certain parts are broken away.

Fig. 6 is a sectional view showing one of the pressure actuated motors.

A drive shaft 11 is journaled in the bearings 12. The shaft 11 carries a bevel gear 13 at one end and a cam 14 at the other end. The bevel gear 13 meshes with a second bevel gear 15 which is mounted on a stub shaft 16 journaled in the bearing 17. The gears 13 and 15 have a 1:1 ratio. A fuel tank 18 having a vertical axis corresponding to the axis of the stub shaft 16 is connected to the upper end of the stub shaft 16. A fuel line 19, also on said axis, leads from tank 18. Radial fuel lines 21, 22 and 23 lead from the line 19 to main burner 24 and preheating burners 25 and 26 respectively. A plurality of steam generators 27 are arranged in circular series about an axis aligned with the axis of the stub shaft 16 and are

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adapted to be successively preheated and heated by the burners 24, 25 and 26.

In the illustrated unit six generators are shown and are spaced at 60° to each other. A larger or smaller number of generators might be used. The angular spacing would be a corresponding fraction of 360°. The generators 27 are cylindrical chambers which are closed except for the conduits 28 which serve to carry the steam expelled from the generator and the reflux of water thereto. Each generator 27 is provided with a normally closed air vent 30.

The conduits 28 connect near their outer ends with the water retention or displacement volumes 29 (see Fig. 2). Each of the volumes 29 (which can also be inclined according to the practical use) has a jet outlet 31. These outlets are horizontal and are parallel with one another. These outlets, as is the entire propulsion unit, are beneath the light water line of the vessel and are therefore submerged at all times.

Intermediate portions of the jet conduits 28 are arranged parallel with the shaft 11 and in circular series around it. A plurality of arms 32 are carried by the shaft 11. The arms 32 are axially spaced and their radially disposed thrust faces 33 have a uniform angular spacing, as is clearly shown in Fig. 3. Pressure energized motor means 34 are disposed between each of jet conduits 28 and corresponding thrust faces 33 (see Figs. 1 and 3). The motor means 34 are shown in detail in Fig. 6.

A cylindrical housing 35 is secured to the boss 36 on a corresponding jet conduit 28. A piston 37 is reciprocable in cylindrical bore 38 formed in the housing 35 and defines therein a working space 39 which is in direct communication with the interior of the conduit 28. A piston rod 41 extends outward of the bushing 35 through the packing nut 40. Adjustably secured on the outer end of the rod 41 is a contacting member 42. A shoulder 43 is formed on the rod 41 and serves as a seat for the spring 44 which biases the piston 37 toward the position shown in Fig. 6. An enlarged portion 45 is provided between the shoulder 43 and the piston 37. This portion 45 has reversely inclined surfaces 46 and 47. Spring pressed piston stops 48 extend radially inward through the housing 35.

A valve 49 is disposed in each of the conduits 28 between the corresponding motor 34 and displacement volumes 29. This valve 49 may be any type of balanced valve, such as the butterfly valve shown in the drawings. The valve 49 is carried by a shaft 51 which is radially disposed

relatively to the shaft and on a diameter of the corresponding conduit 28. The valves 49 lie in a plane perpendicular to the axis of shaft 11. The cam 14 has an annular rim 52 which subtends a portion of its periphery and serves as a track for the cam followers 53 through that portion. A spring 54 biases the cam followers against this track. In that portion of the cam where the rim is cut away, the spring 54 biases the valves to an open position. A stop 55 prevents movement of valves 49 past the full open position.

The multiple jet units as used aboard ship are located below the light water line of the ship. Assuming the generators 27 are empty the shaft 11 may be turned by hand thus causing the cam to permit each of the valves 49 to open serially and permitting the water to flow into tubes 28 and generators 27. The generators 27 are provided with air vents 30, to permit the air to be displaced during the filling operation.

After the generators are filled, the air vents 30 are closed and the burners 24, 25 and 26 are positioned in proper relation under the generators 27 and are lighted. The generator 27 over the primary burner 24 is heated until steam of the desired pressure is developed. During this interval the preheating burners 25 and 26 preheat the generators 27 associated therewith. When the desired steam temperature and pressure are attained, the piston 37 in the motor means 34 connected to the jet conduit from that generator will be moved outward against the bias of the spring 44.

As the piston moves outward it is also opposed slightly by the action of the stops 48 as they are urged outward by the sloping portion 46. This outward motion is accelerated when the stops act over the steeper reverse slope of the portion 47. The acceleration is effective as the member 42 engages the face 33 of the corresponding arm 32; the shaft 11 is thus quickly rotated through an angle of 60° as determined by the relative positions of the stops 48 and the piston 37. The burners 24, 25 and 26 are also moved through an angle of 60° to locate them under the next generators 27 in the series.

The generator 27, in which the desired pressure has been developed, is therefore no longer heated. The partial rotation of the shaft 11 moves the cam 14 through the same angle of 60°. This motion permits the valve 49 in the conduit 28 corresponding to the generator under pressure to open, as its cam follower 53 will no longer be riding on the cam track 52. At the same time another of the valves 49 will be closed. The opening of the valve 49 permits the steam in the generator 27 to escape forcing the water from the conduits 28 and the displacement volumes 29 through the jet exhaust 31.

The conduits 28 and volumes 29 are so dimensioned that the steam generated by the generator 27 will force substantially all the water from these spaces. After the water is expelled, the steam will start to condense in the relatively cool conduit 28 and the volume 29. The pressure in these spaces and in the generator is reduced and the water will re-enter the tubes past the valve 49 which is open and generators under the force of gravity. This recharging of the individual jet units preferably is permitted to occur during the expulsion cycle of the next succeeding jet unit. This permits a more rapid succession of power impulses.

The power plant may be conveniently con-

trolled by changing the burner settings with the result that the time for the generator to attain the desired temperature and pressure is increased or decreased.

It will be apparent that a plurality of these multiple jet units could be employed. Likewise it will be obvious that they could be located to drive the ship ahead or astern.

I claim:

1. A propulsion unit comprising a series of jet units, each jet unit comprising a vapor generator, a jet conduit leading therefrom, a cam operated valve in said conduit, and motor means actuated by the vapor pressure developed in the corresponding generator; heating means effective to energize said generators serially; a rotary cam to open and later to close said valves serially; a rotary member connected with said cam and said heating means; reaction elements one for each motor means carried by said rotary member, said motor means, when actuated, engaging a corresponding reaction element whereby said rotary member is turned through a predetermined angle, said angle being such that said cam is caused to open the valve in the conduit corresponding to the actuated motor and to close a second valve in said series and said heating means is caused to heat the next generator in said series.

2. The combination defined in claim 1 in which the jet units are N in number, the generators being arranged in circular series about a vertical axis, and portions of said conduits being arranged in circular series about said rotary member, the angular spacing between each of the generators in said circular series and between each of said portions of the conduits arranged in circular series being 1/Nth of 360° and in which each motor means when actuated turns said rotary member 1/Nth of 360°.

3. In a multiple unit jet motor the combination of a plurality of jet units, N in number, and each comprising a vapor generator and a jet conduit leading therefrom; cam operated valves, one controlling each of the N jet conduits; a rotary cam coactive with said valves effective to open and later to close said valves serially; rotary heating means connected to said cam effective to energize said generators serially; and motor means one for each unit each energized by development of pressure in a corresponding jet conduit each when energized serving to turn said cam 1/Nth of a revolution thereby opening the valve in the jet conduit corresponding to the energized motor and turning said heating means 1/Nth of a revolution whereby it becomes effective to energize the next generator in said series.

4. The combination defined in claim 3 in which said generators are arranged in circular series about an axis, said heating means comprising a primary burner; and a preheating burner, the said primary and preheating burners being movable in a circular path about said axis and spaced apart along said path by an arc equal to 1/Nth of 360°; a shaft whereby said burners are driven in said circular path, said shaft connected to said cam and adapted to be turned through 1/Nth of a revolution as said cam is turned 1/Nth of a revolution.

5. A propulsion unit comprising a series of jet units, each jet unit comprising a vapor generator, a jet conduit leading therefrom, a cam operated valve in said conduit, and motor means actuated by the vapor pressure developed in the corresponding generator, said motor means comprising a housing having a cylinder bore formed

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therein, a piston reciprocable in said bore, a spring biasing said piston against the pressure developed in said generator, and said piston having reversely inclined longitudinal surfaces; spring pressed means reacting against said surfaces and serving to first retard and then accelerate movement of said piston against the bias of said spring during actuation of said motor; heating means effective to energize said generators serially; a rotary cam arranged to open and later to close said valves serially; a rotary member connected with said cam and said heating means; reaction elements one for each motor means carried by said rotary member, said motor means, when actuated, engaging a corresponding reaction element whereby said rotary member is turned through a predetermined angle, said member when so turned causing said cam to open the valve in the conduit corresponding to the actuated motor to close a second valve in said series and causing said heating means to become effective to energize the next generator in said series.

6. A propulsion unit comprising a series of jet units, each jet unit comprising a vapor generator, a jet conduit leading therefrom, a cam operated valve in said conduit, and motor means actuated by the vapor pressure developed in the corresponding generator, said valves being of the balanced valve type; a cam follower arranged to operate each of said valves; spring means biasing said valves toward open position; a rotary cam coactive with said cam followers whereby said valves are opened and later closed serially; heating means effective to energize said generators successively; a rotary member connected

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with said cam and said heating means; reaction elements one for each motor means carried by said rotary member, said motor means, when actuated, engaging a corresponding reaction element whereby said rotary member is turned through a predetermined angle, said member when so turned causing said cam to open the valve in the conduit corresponding to the actuated motor to close a second valve in said series and causing said heating means to become effective to energize the next generator in said series.

7. In a multiple unit jet motor the combination of a plurality of jet units, N in number, and each comprising a vapor generator, a displacement tank and a jet conduit leading from said generator to said displacement tank, the relative volumes of said tank and said generator being such that the vapor generated in said generator will expel substantially all of the fluid therefrom during the expulsion portion of the cycle; cam operated valves, one controlling each of the N jet conduits; a rotary cam coactive with said valves and effective during each revolution to open and later to close said valves serially; motor means one for each unit each energized by development of pressure in a corresponding jet conduit each when energized serving to turn said cam 1/Nth of a rotation thereby opening the valve in the jet conduit corresponding to the energized motor; and rotary heating means connected to said cam and effective during each revolution of said cam to energize each of said generators serially.

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No references cited.