July 9, 1968 G. C. WISWELL, JR 3,391,686

WET DIVING SUIT HEATING APPARATUS AND SYSTEM

Filed Aug. 16, 1966 2 Sheets-Sheet 1

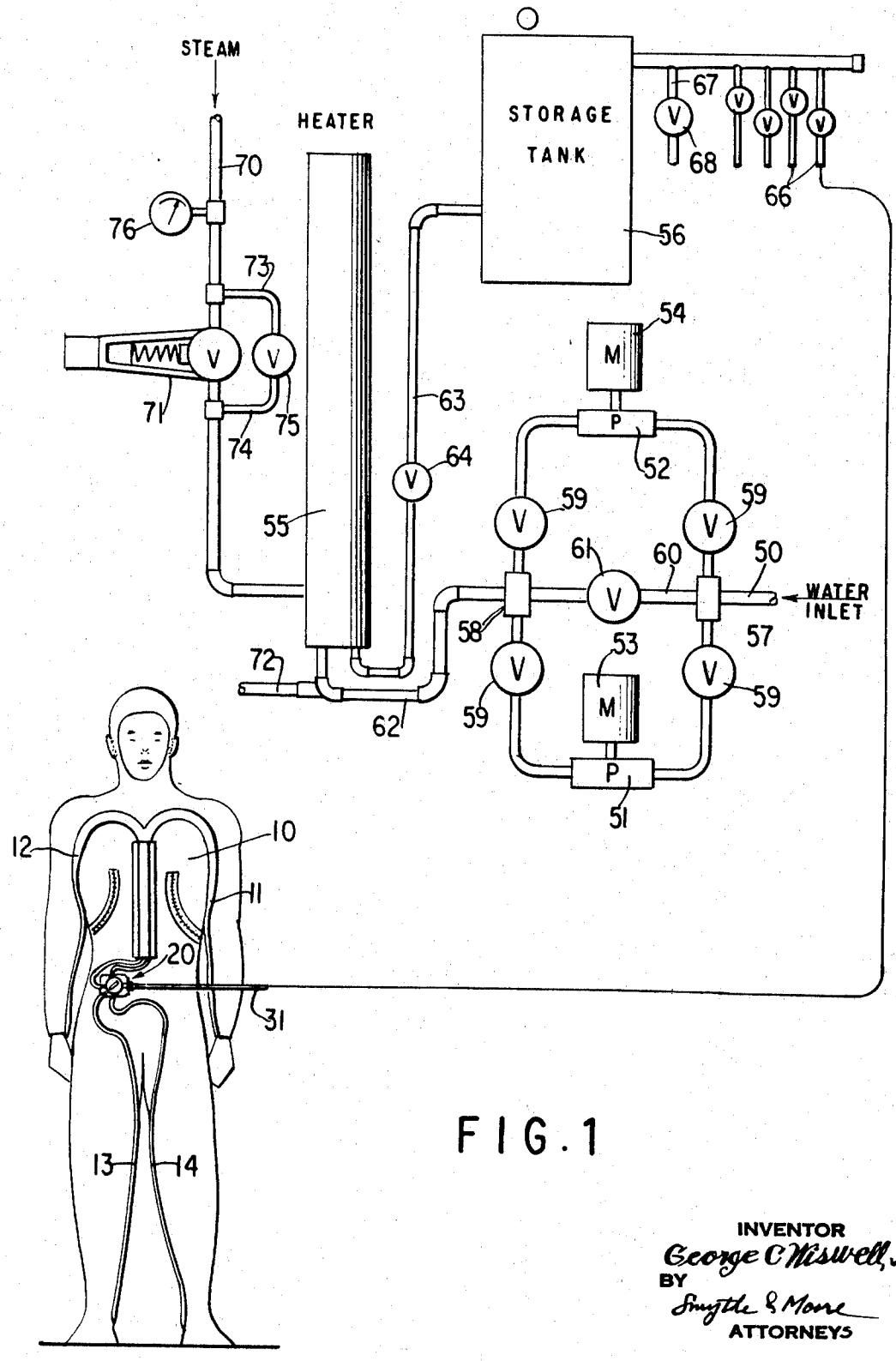


FIG. 1

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WET DIVING SUIT HEATING APPARATUS AND SYSTEM

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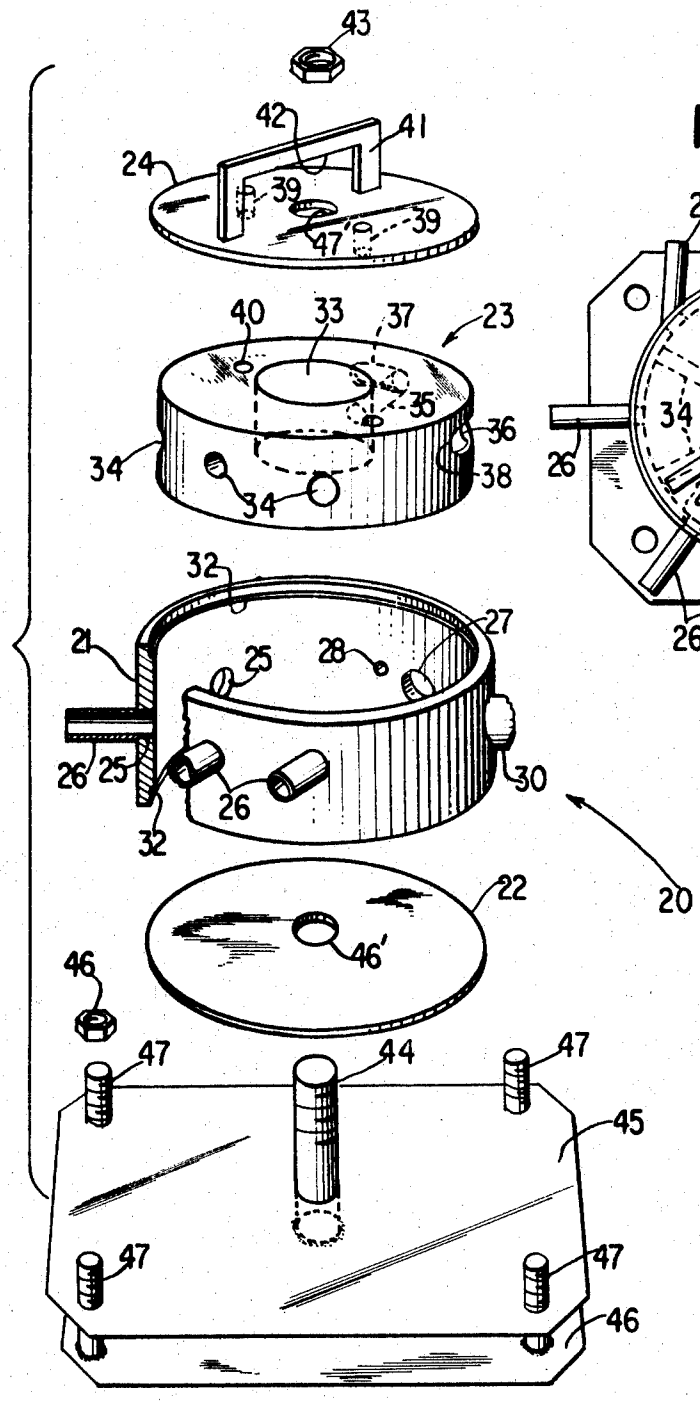


FIG. 2

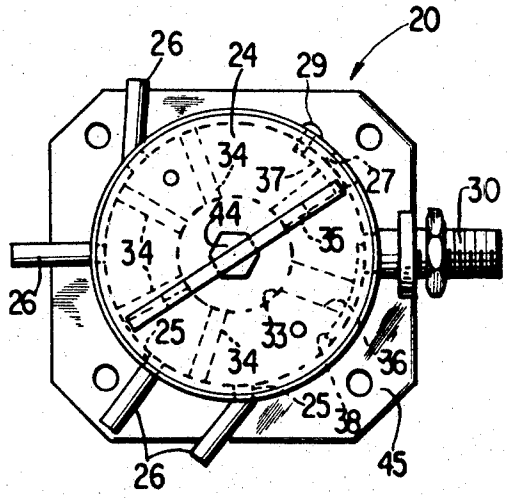


FIG. 3

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WET DIVING SUIT HEATING APPARATUS AND SYSTEM

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9 Claims. (Cl. 126—204)

ABSTRACT OF THE DISCLOSURE

An apparatus for controlling the introduction of heated fluid into and the circulation thereof through conduits in a diving suit including a circulating system having a control valve and manifold.

The present invention relates to heating apparatus and more particularly to a system and apparatus for heat a diving suit of the "wet suit" type.

The copending application Ser. No. 547,900, filed May 5, 1966, discloses a diving suit of the "wet suit" type in which flexible conduits forming a part of the suit extend upwardly over the chest and downwardly through each of the arms and legs to provide channels for the passage of heated water to warm the body of the wearer. One end of the conduits are connected to a manifold and a control valve while the ends terminating in the arms and legs are open to provide for discharge of the warm or heated water into the interior of the suit. The valve and manifold are adapted to receive a continuous supply of warm water, the valve controlling the amount of heated water flowing through the conduits thereby to control the heating effect, and excess water being discharged exteriorly of the suit.

One of the objects of the invention is to provide an improved apparatus for supplying heated water to a diving suit.

A further object of the invention is to provide heating and control apparatus which supplies a continuous substantially constant flow of heated water to a diving suit.

A further object is to provide apparatus for supplying heated water to a diving suit which is adapted to be mounted as a portable unit for transportation to the diving area.

A further object is to provide an improved unitary valve and manifold device for controlling the flow of heated water through a diving suit so as to prevent an undesirable sudden supply of heated water to a suit.

In one aspect of the invention, a pump driven by a motor forces water from a suitable supply such as a sea, lake or river through a heat exchanger and into a hot water storage tank. Heated water from the storage tank flows in a continuous substantially constant stream through a flexible hose or conduit to a control valve and manifold device mounted on a diving suit from which it is distributed to the conduits provided in the suit. The valve is carried on the exterior of the suit so as to be operable by the diver and provides for discharging excess water into the surrounding media exteriorly of the suit.

In a preferred aspect of the invention, the control valve and the manifold are combined into a single unitary device. Heat for the heat exchanger may be provided by steam or any other desired means. Steam may be provided, for example, by a relatively small portable boiler heated by kerosene, oil or the like. To assure a steady continuous flow of heated water to the suit, particularly at greater depths, a second pump may be connected in the supply line between the storage tank and the flexible hose or conduit, and a standby pump may also be connected in the cold water supply line in parallel with the first pump.

The above and other objects, advantages and features of the invention will be apparent from the following description taken in conjunction with the accompanying drawings which illustrate an exemplary embodiment of the invention.

In the drawings:

FIG. 1 is a schematic view of the heating and supply apparatus and illustrates it as being connected through a flexible hose or the like to a control valve carried on the exterior of a "wet suit" diving suit provided with warm water conduits;

FIG. 2 is a front elevational view of the control valve and manifold device carried on the diving suit of FIG. 1; and

FIG. 3 is an exploded view showing the valve and manifold parts in perspective.

Referring to the drawings, and more particularly to FIG. 1, there is shown a diver wearing a "wet suit" type of diving suit **10** having warm water conduits **11**, **12**, **13** and **14** all as more particularly illustrated and described in the aforesaid copending application Ser. No. 547,900. Mounted on the exterior of suit **10** in a position readily accessible to the diver, is a valve and manifold device designated generally by the reference numeral **20** and adapted to control the amount of heated water fed to the conduits **11**, **12**, **13** and **14** to control or adjust the heating effect of the warm flowing through the suit as also descibed in said copending application. While the control valve and manifold device **20** may comprise separate valve and manifold elements as shown in the copending application, the present invention preferably utilizes an improved unitary valve and manifold structure as more particularly shown in FIGS. 2 and 3.

Referring to FIGS. 2 and 3, the device **20** is shown as comprising a cylindrical shell or housing **21**, a bottom disc **22**, an inner member **23**, and a top disc **24**. The housing **21** and discs **22** and **24** are preferably made from a copper or other non-corrosive metallic alloy. The inner member **23** may be formed from a synthetic resin material, or other suitable material. The annular wall of the housing **21** is provided with a plurality of openings **25** into which discharge tubes **26** are fitted and secured by any desired means such as soldering or brazing, there being one such opening and one tube for each of the warm water conduits such as **11** to **14** provided in the suit **10**. The wall of housing **21** is also provided with a relatively larger opening **27** providing for the discharge of excess heated water, and with an adjacent threaded opening **28** adapted to receive a screw **29** (FIG. 2). An attachment nipple **30** adapted threadedly to receive a flexible supply hose or conduit **31** (FIG. 1) also fits into and is suitably secured to the housing **21**. Housing **21** is also provided at its upper and lower ends with an annular recessed shoulder **32** upon which the bottom and top discs **22** and **24** are adapted to flush fit.

The inner member **23** comprises an annular ring-like member adapted closely but rotatably to fit within the housing **21** between the discs **22** and **24** and provided with a central axially extending opening **33**. Transversely extending openings **34** adapted to register with the open-

ings 25 and tube 26 of housing 21, a transverse opening 35 adapted to register with the discharge opening 27, and a transverse opening 36 adapted to register with the inlet nipple 30 are molded or otherwise formed in the annular wall of member 23 and communicate with the central opening 33. The outer wall of member 23 is arcuately recessed adjacent the opening 35 as indicated at 37 in FIG. 3 to receive the end portion of screw 29 (FIG. 2) and limit rotation of the member 23 within housing 21 when the parts are assembled. The inlet opening 36 is also arcuately enlarged at the outer side of member 23, as indicated at 38 in FIG. 3, so as always to register with the nipple 30 within the limited rotation of member 23 as determined by screw 29 and recess or slot 37. The openings 34 and 35 are so positioned that when the member 23 is rotated in a clockwise direction as viewed in FIGS. 2 and 3 to its extreme position as limited by screw 29 and recess 37, all of the openings 34 and 25 are closed and opening 35 is in full registry with discharge opening 27. As member 23 is rotated in a counter-clockwise direction, openings 34 and 25 come more and more into registry and openings 35 and 27 out of registry until screw 29 reaches its other limit in recess 37, at which time there is full discharge through tubes 26 into conduits 11, 12, 13 and 14, and no discharge through opening 27. The inner member 23 thus constitutes both a valve and a distributor or manifold member.

To effect rotation of the inner valve and distributor member 23, the upper disc 24 is provided with a pair of downwardly projecting studs 39 or the like which are adapted to be received in axially extending holes 40 or the like drilled or otherwise formed in the member 23. The disc 24 is also provided with an upwardly extending handle or operating member 41 which is adapted to be grasped by a hand of the diver to rotate the disc 24 and member 23 thereby to adjust or control the flow of heated water into the suit. The operating member 41 is cut away as indicated at 42 in FIG. 3 to receive a nut 43 which threads on a bolt or stud 44 to hold the device in assembled condition. The bolt or stud 44 is soldered or securely attached to a copper or like non-corrosive plate 45 and extends upwardly through openings 46' and 47' provided in the discs 22 and 24.

The plate 45 together with a similar plate 46 provide for mounting the valve and distributor device 20 on the diving suit 10. The plate 46 is thus adapted to lie flat against an interior surface of the suit while the plate 45 lies flat against an exterior surface. Bolts 47 and nuts 48 serve securely to clamp the plates to the material of the suit and thus to support the device 20 on the outer side of the suit. The plates 45 and 46 are sufficiently thin and flexible as to bend with the contours of the suit 10 when the suit is worn by a diver.

Referring now to FIG. 1, the heating apparatus or system is shown as comprising an inlet pipe 50 adapted to supply water from a lake, river, sea or other source, a pair of pumps 51 and 52 driven by motors 53 and 54, a heat exchanger 55, a storage tank 56, the flexible hose or conduit 31, and the control device 20. Couplings 57 and 58 and valves 59 provide for use of either the pump 51 or pump 52. One of the pumps can normally serve as a standby pump in the event the other becomes clogged or otherwise disabled. Also, if more volume is needed than is the capacity of one of the pumps, the other can also be used in conjunction therewith. A pipe 60 normally closed by a valve 61 provides a bypass across the pumps. Also, such can be used to provide for recirculation of the pumped fluid. Power for the motors 53 and 54 may be supplied from storage batteries, a gasoline driven motor generator, or a shore connection, and the motors can be adapted to run at a constant speed to pump a substantially constant volume of water in a continuous stream. Of course, other types of motors or pumps can be used.

Suitable pipes and couplings, indicated generally by the reference numeral 62, connect the coupling 58 with the heat exchanger 55 and other pipes and couplings, indicated by numeral 63, connect the heat exchanger with the storage tank 56. A valve 64 can be connected in line 63. Heated water from the storage tank 56 is discharged through selected ones of cut-off valves to the various diving suits as needed, through pipes 66, each of which is adapted to be connected to the flexible hose 31. A bleed pipe 67 controlled by a shut-off valve 68 can provide for bleeding the tank 56 until it is filled with heated water. The tank 56 provides a reservoir of hot water in case of failure of one or both of the pumps 51 or 52 and during changeover from one to the other.

The water may be heated by any desired means during passage through the heater or heat exchanger 55. In the illustrated embodiment, steam is used as the heating medium. As above noted, the steam may be supplied by a relatively small, portable, kerosene or oil fired boiler (not shown) and is fed into the heater 55 through a pipe 70 and pressure regulating valve 71. The used steam or condensate is fed back to the boiler through a pipe 72. Pipes 73 and 74 and a valve 75 provide a bypass around valve 71, and a pressure gauge 76 is provided in the steam input line 70. It will be apparent, however, that an electric or other heating means may be used in place of steam. It will also be apparent that the entire heating and pumping apparatus may be mounted as a unit on a portable frame, truck, or other supporting structure for ready transportation to a diving area.

A very flexible and satisfactory heating apparatus and system for supplying and distributing heated water to a diving suit of the "wet suit" type has thus been provided. It will be further apparent, however, that various changes, alterations and modifications may be made in the illustrated and described structure without departing from the spirit of the invention, and it is intended to be limited only by the scope of the appended claims.

What is claimed is:

1. In an apparatus and system having means for supplying heated water to a diving suit of the "wet suit" type having a plurality of warm water conduits therein, said diving suit in combination with pumping means adapted to pump a continuous substantially constant volume of water, means for supplying water to said pumping means, a tank for receiving water from said pumping means, means for heating said water during passage to said tank, a valve and manifold means connected to said conduits, and means including a flexible conduit for supplying heated water from said tank to said valve and manifold means in a continuous steady stream, said valve and said manifold means controlling the amount of heated water introduced into said warm water conduits and water discharged exteriorly of said warm water conduits.

2. A combination as set forth in claim 1 in which said pumping means comprises a pair of pumps arranged in parallel.

3. A combination as set forth in claim 2 in which valve means provide for selectively using said pumps.

4. A combination as set forth in claim 1 in which said means for heating the water during passage to said tank comprises a heat exchanger.

5. A combination as set forth in claim 4 in which said heat exchanger is heated by steam.

6. A combination as set forth in claim 1 in which said valve and manifold means is carried on an exterior part of the diving suit in a position readily accessible to the diver.

7. A combination as set forth in claim 1 in which a valve and manifold means is combined into a unitary valve and distributor device.

8. A combination as set forth in claim 7 in which a manually operated rotary actuator provides for adjusting said valve.

9. A combination as set forth in claim 1 in which said pumping means and said heating means are mounted

as a unit on a portable supporting means adapted for ready transporttion to diving area.

References Cited

UNITED STATES PATENTS

1,896,953	2/1933	Hassell	219—39.6
2,110,022	3/1938	Kliesrath	5—334
2,260,134	10/1941	Ballman	165—46
2,693,088	11/1954	Green	2—2.1 X
2,885,189	5/1959	MacCracken	165—46
3,034,495	5/1962	Bernard	126—210
3,161,192	12/1964	McCormack	2—2.1 X
3,289,748	12/1966	Jennings	165—46

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