A compressed air supply unit (1), wherein a piston pump assembly (2) for producing compressed air has a drive motor (10) and a cooling assembly (15); and the cooling assembly (15) has a hydraulic circuit (16), along which water is circulated by a first pump (21); the hydraulic circuit (16) having a heat exchanger (28), a number of work branches (22, 23, 24) parallel to one another upstream from the heat exchanger (28) and intersecting respective separate parts of the pump assembly (2), and an auxiliary branch (29) which bypasses the first pump (21) and has a second pump (30) for circulating water, when necessary, along the work branches (22, 23, 24) when the first pump (21) is idle.
COMPRESSED AIR SUPPLY UNIT

TECHNICAL FIELD

The present invention relates to a compressed air supply unit.

More specifically, the present invention relates to a compressed air supply unit of the type comprising a piston pump assembly for producing compressed air; a pump assembly drive motor; and a pump assembly cooling assembly.

BACKGROUND ART

In known compressed air supply units of the above type, the cooling assembly is normally an air type comprising a fan, which is located to the side of the pump assembly, is powered by the pump assembly drive motor by means of a belt drive, and directs a current of air over the pump assembly.

Air cooling assemblies of the above type perform perfectly well when working with relatively low-power supply units, but no so well over and above a given power, and, above all, are unsuitable for use with soundproofed pump assemblies, normally housed inside acoustically insulated housings. In which case, the cooling air inlets and outlets necessarily formed through the housing walls limit the degree of soundproofing achievable.
US 2751144 describes a compressed air supply unit featuring a liquid cooling circuit.

DISCLOSURE OF INVENTION

It is an object of the present invention to provide a compressed air supply unit designed to eliminate the above drawbacks.

According to the present invention, there is provided a compressed air supply unit as claimed in Claim 1 and preferably in any one of the Claims depending directly or indirectly on Claim 1.

BRIEF DESCRIPTION OF THE DRAWING

A preferred, non-limiting embodiment of the invention will now be described by way of example with reference to the attached drawing showing a schematic, partly exploded view.

BEST MODE FOR CARRYING OUT THE INVENTION

Number 1 in the attached drawing indicates as a whole a soundproofed compressed air supply unit, which comprises a pump assembly 2, in turn comprising a base 3 fitted at the bottom with a lubricating oil sump 4, and traversed by a crankshaft 5 fitted, at the end projecting from base 3, with a pulley 6 forming part of a belt drive 7 connecting crankshaft 5 to a pulley 8 fitted to the output shaft 9 of an electric motor 10.

Over base 3, pump assembly 2 comprises a cylinder 11, which houses, in known manner, at least one known
piston (not shown) connected to crankshaft 5 by a connecting rod (not shown), and is closed by a head 12 having an inlet (not shown) for air to be compressed, and an outlet communicating in known manner with a manifold 13 connected to head 12 and for post-cooling the compressed air issuing from pump assembly 2 along an outflow conduit 14.

Unit 1 also comprises a cooling assembly 15 comprising an endless cooling water circuit 16; and preferably a soundproofed casing 17 for soundproofing unit 1.

Circuit 16 comprises a delivery branch 18, which extends between two two-way valves 19 and 20 and through a centrifugal pump 21, the rotor of which is fitted to an end portion of crankshaft 5 projecting from base 3 at the opposite end to that supporting pulley 6. Circuit 16 also comprises three work branches 22, 23, 24 arranged parallel as of valve 20, and of which branch 22, located in an intermediate position between branches 23 and 24, extends through head 12; branch 23 bypasses head 12 and extends along post-cooling manifold 13; and branch 24 extends through oil sump 4.

Downstream from pump assembly 2, circuit 16 comprises a return branch 25, which in use receives hot water from branches 22, 23 and 24, has a branch line 26 connecting return line 25 to an expansion vessel 27, and
extends, downstream from branch line 26, through a heat exchanger 28 before reaching an inlet of valve 19.

Finally, circuit 16 comprises an auxiliary branch 29, which extends between valves 19 and 20, parallel to delivery branch 18, and through an auxiliary centrifugal pump 30, which is preferably an electric pump activated automatically to cool pump assembly 2 completely when electric motor 10 is turned off.

When off, centrifugal pump 30 acts as a valve closing auxiliary branch 29, so, in a variation not shown, valves 19 and 20 may obviously be eliminated.

As will be clear from the above description, water cooling assembly 15 of unit 1 provides for fast, effective cooling of large amounts of heat, and for maintaining pump assembly 2 below a given temperature, regardless of power output.

As shown in the drawing, casing 17 preferably houses pump assembly 2 equipped with post-cooling manifold 13, and centrifugal pump 21, while electric motor 10, auxiliary centrifugal pump 30, heat exchanger 28, branch line 26, and expansion vessel 27 are preferably located outside casing 17.

This arrangement drastically reduces the area and number of openings formed through the walls of casing 17, and more specifically to two inlet and outlet openings 31 for auxiliary branch 29; one opening 32 for
an outside-air feed conduit 33 outside head 12; one opening 34 for compressed air outflow conduit 14; and two inlet and outlet openings 35 for return branch 25. And all these openings can be sized to permit substantially airtight insertion of the relative conduits, and so prevent escape of the sound waves generated by pump assembly 2.

The embodiment shown has another two openings for the two branches of the belt of drive 7. In a variation not shown, these two openings are eliminated, and crankshaft 5 is extended, at the pulley 6 end, to project through an opening in casing 17, and support pulley 6 outside casing 17. This solution enables the whole of drive 7 to be kept outside casing 17, thus simplifying replacement of the belt, and prolonging the working life of the belt by keeping it at ambient temperature, which is definitely lower than the temperature inside casing 17.

In actual use, when activated, electric motor 10 rotates crankshaft 5 by means of drive 7 to draw outside air along feed conduit 33 and feed compressed air along outflow conduit 14. At the same time, electric motor 10 drives centrifugal pump 21 by means of crankshaft 5. Since valves 19 and 20 cut off communication between delivery branch 18 and auxiliary branch 29 when electric motor 10 is activated, activation of centrifugal pump
21 feeds cold water to work branches 22, 23, 24, thus cooling head 12, the post-cooling manifold 13, and the lubricant in sump 4, and heating the water, which is cooled as it flows through heat exchanger 28, before flowing back to the inlet of centrifugal pump 21.

When electric motor 10 is turned off and water ceases circulating along endless circuit 16, the whole of pump assembly 2 remains at a relatively high temperature, at times high enough to dry the lubricant in cylinder 11 and damage the known valve assemblies (not shown) in head 12. To prevent this, when electric motor 10 is turned off, a central control unit 36 switches valves 19 and 20, if provided, to disconnect return branch 25 from delivery branch 18 and connect return branch 25 to auxiliary branch 29, and activates auxiliary centrifugal pump 30 for a given length of time, to keep the cooling water circulating along work branches 22, 23, 24 and through heat exchanger 28.
CLAIMS

1) A compressed air supply unit, the unit (1) comprising a piston pump assembly (2) for producing compressed air; a motor (10) for driving the pump assembly (2); a soundproofed casing (17) housing the pump assembly (2); and a cooling assembly (15) for cooling the pump assembly (2); the unit being characterized in that the cooling assembly (15) comprises a hydraulic circuit (16), and a first pump (21) for pumping fluid along the hydraulic circuit (16), which comprises a heat exchanger (28), a number of work branches (22, 23, 24) parallel to one another upstream from the heat exchanger (28) to cool respective separate parts of the pump assembly (2), and an auxiliary branch (29) which bypasses the first pump (21) and has a second pump (30) for pumping fluid, when necessary, along said work branches (22, 23, 24) when the first pump (21) is idle; the soundproofed casing (17) housing the first pump (21) and the work branches (22, 23, 24) of said hydraulic circuit (16); and the second pump (30), the auxiliary branch (29), and the heat exchanger (28) being located outside the soundproofed casing (17).

2) A unit as claimed in Claim 1, wherein the pump assembly (2) comprises a base (3) fitted with a...
lubricating fluid sump (4); a shaft (5) fitted through
the base (3) and connected angularly to the motor (10);
and a head (12) having a first conduit (33) supplying
air to be compressed, and a second conduit (14)
supplying compressed air; a first and second (22, 24) of
the work branches (22, 23, 24) extending through the
head (12) and the sump (4) respectively.

3) A unit as claimed in Claim 2, and comprising a
post-cooling manifold (13) housing part of the second
conduit (14); a third (23) of the work branches (22, 23,
24) extending along the post-cooling manifold (13).

4) A unit as claimed in one of the foregoing
Claims, wherein the hydraulic circuit (16) comprises an
expansion vessel (27).

5) A unit as claimed in one of Claims 2 to 4,
wherein the first pump (21) is connected angularly to
said shaft (5) so as to be powered by said motor (10).

6) A unit as claimed in one of Claims 2 to 5,
wherein the second pump (30) is a motor-driven pump.

7) A unit as claimed in one of the foregoing
Claims, wherein the hydraulic circuit (16) comprises a
delivery branch (18) extending through the first pump
(21); and a return branch (25); the auxiliary branch
(29) being parallel to the delivery branch (18).

8) A unit as claimed in Claim 7, wherein each end
of the delivery branch (18) is connected to a
corresponding end of the return branch (25) and to a corresponding end of the auxiliary branch (29) by a respective two-way valve (19; 20).
INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2011/055651

A. CLASSIFICATION OF SUBJECT MATTER
INV. F04B35/04
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X Further documents are listed in the continuation of Box C. X See patent family annex.

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Date of the actual completion of the international search
28 February 2012

Date of mailing of the international search report
07/03/2012

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Authorized officer
Olona Laglera, C
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