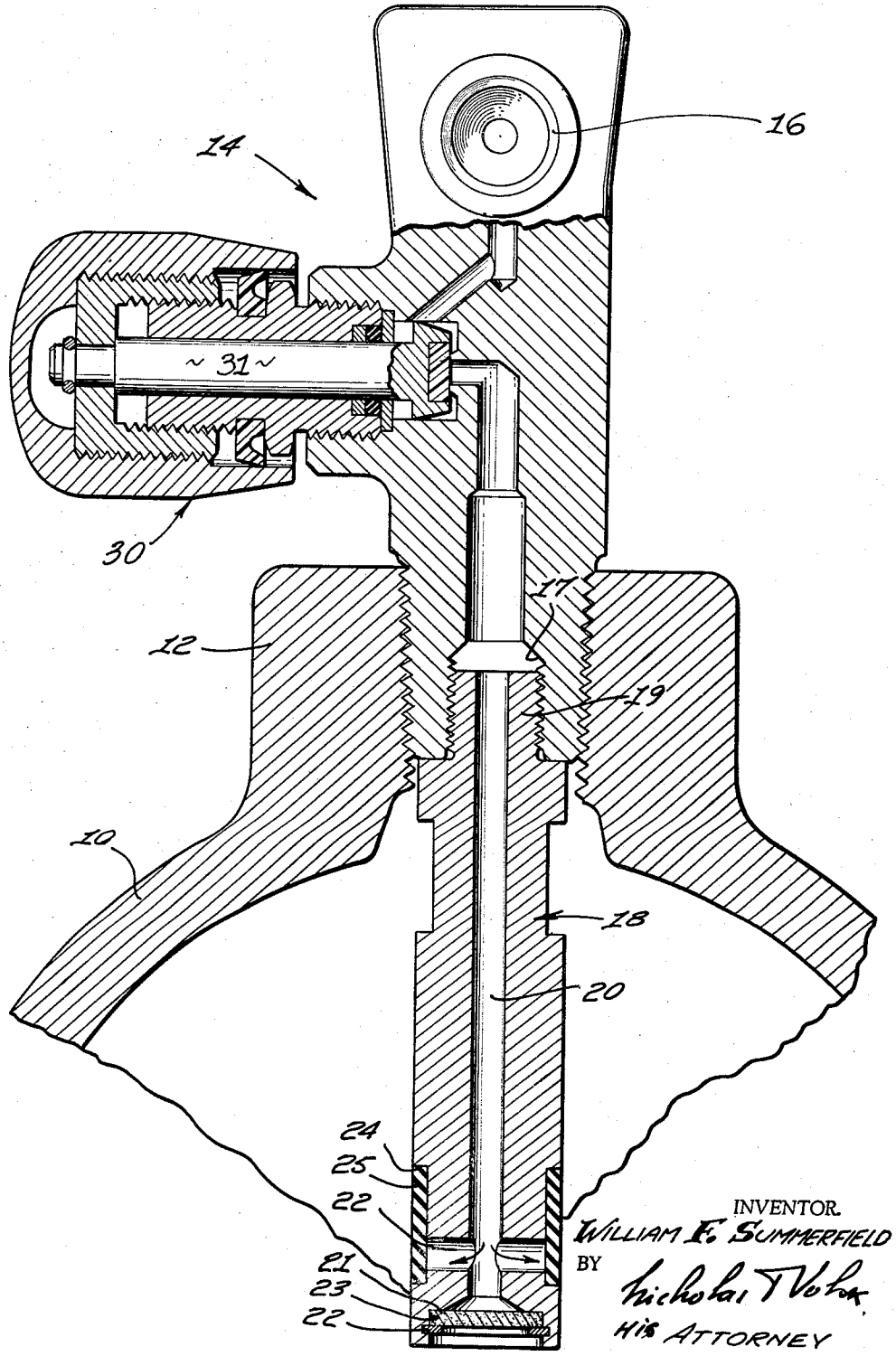
Sept. 15, 1964 W. F. SUMMERFIELD 3,148,965

DIP TUBE FOR GAS-FILLED CYLINDER

Filed July 2, 1962



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United States Patent Office 3,148,965 Patented Sept. 15, 1964

3,148,965

DIP TUBE FOR GAS-FILLED CYLINDER

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Filed July 2, 1962, Ser. No. 206,703
3 Claims. (Cl. 55—313)

This invention relates to "dip tubes" or "turbulence tubes" used in gas or air-filled cylinders of the type suitable for supplying air for self-contained underwater breathing apparatus, also known as SCUBA.

SCUBA cylinders are made of steel and air is pumped into such cylinders under a pressure of approximately 2250 pounds per square inch gauge. Cylinders of this type commonly develop rust spots along their inner surface and eventually some of this rust flakes off and remains in the cylinder until the latter is thoroughly cleaned. These loose rust particles can, under normal cylinder usage, find their way into the valve proper and travel into the pressure reduction regulator system, damaging valve seats beyond repair.

It is also possible that microscopic particles of rust will pass completely through the filter of the pressure reduction regulator found in conventional arrangements, and inbed themselves into the delicate valve seats of the pressure reduction regulator or pass through the regulator into the breathing quality air of the diver himself.

Air supplies of the above type are generally provided with the so-called dip tubes which are connected to the cylinder and of a shut-off valve or reserve valve and in this manner are suspended within the cylinder from such valve.

The function of the dip tube proper is to extend the high pressure inlet of the valve beyond the neck of the cylinder and in this manner prevent condensed water from entering the valve. The liquid water appears in the cylinder when it becomes condensed from "wet" air used in filling the cylinder or due to carelessness.

This invention provides "dip tubes" fitted with a special type of filter and one-way valve for eliminating water and any solid particles that would not otherwise be in suspension in the ambient atmosphere from entering the valve and regulator system. The disclosed dip tube employing a special one-way blow-by valve and filter assembly, greatly reduces the chance of rust or dirt particles damaging the cylinder valve seat or passing into the pressure reduction regulator, or, in extreme cases, into the mouth of the user of such SCUBA apparatus.

The compressed air, after it leaves the cylinder and passes through the reserve valve, pressure reducing valves, and pressure regulator, is used for breathing purposes and it should be as pure as possible. Also, the entire apparatus between the cylinder and the mouthpiece of a diver should be free of contaminants and water particles to prevent clogging.

It is therefore an object of this invention to provide a dip tube for gas-filled cylinders, the tube being provided with a filter and a blow-by valve.

It is an additional object of this invention to provide a dip tube of the above type with a filter and a blow-by valve which becomes eliminated and taken out of the breathing or gas supply circuit altogether in case the filter becomes clogged, thus eliminating the danger of suddenly losing the air supply while diving.

Referring to the drawings, the only figure illustrates a sectional view of the dip tube, the upper portion of the cylinder and a portion of the reserve valve connected to the cylinder and to the dip tube.

A cylinder **10** is provided with a threaded neck **12** to receive a shut-off valve **14** having a knob **30** and a stem **31**. Valve **14** is provided with an output port **16** normally connected to a pressure regulator or regulators.

The lower portion of the cylinder valve is provided with a threaded opening **17** and the dip tube **18** is connected to valve **14** with its upper threaded end **19**. The central portion of the tube is provided with a bore **20**, which terminates at its lower, or inner, end in a circular seat **23** for a sintered metal filter **21** which is fastened to the tube by means of an expansion ring **22**. The filter is composed of sintered bronze particles, such as grade 40, coated with nickel. Filters of this type are especially suitable for this use because they provide a high degree of filtration and are moisture, corrosion and shock resistant.

Just above the filter seat **23** there is provided an additional transverse bore **22** which provides two openings in the tube. The tube is also provided with a circular recess **24** which acts as a seat for a blow-by valve sleeve **25** which is made of a suitable elastic material. Sleeve **25**, in its natural state, has a smaller inner diameter than the diameter of recess **24**, and, therefore, sleeve **25** tightly grips the tube and prevents the air from flowing into the air supply system through bores **22** and **20** through this blow-by valve during the normal use of SCUBA equipment. The valve may open, however, when the cylinder **10** is filled with air. If the rate of flow during the filling cycle is sufficiently high to create an appreciable pressure differential across the filter disc **21**, the elastic sleeve **25** will expand and allow air to flow through bores **22** and **20** and thus avoid possible rupture of the filter disc **21**. During the air-filling cycle, the air that flows through the filter also cleans the filter by dislodging particles caught in it and returning them to the tank.

The blow-by valve **22—25** also performs an additional function. If, because of some unforeseen malfunction the filter fails to supply air to the breathing apparatus by becoming clogged, the pressure in the bores **20** and **22** drops to a sufficiently low value so as to create a rupturing pressure differential across the elastic band **25** with the result that band **25** becomes ruptured at one or both ends of bore **22** and air is then supplied to the breathing apparatus through bore **22** and then bore **20**. The filter, then, is bypassed altogether.

Therefore, the blow-by valve **25—22** acts first as a well-known one-way check valve during the air filling cycle, but it also acts as a safety device during the breathing cycle should the filter fail to function properly because of clogging.

The length of the tube is made so as to remove the filter and the intake portion of the tube sufficiently from the neck **12** of the cylinder so that even when there is a considerable amount of condensed water in the cylinder it does not reach the filter end of the tube regardless of the attitude (position) of the cylinder. The overall length of the tube is in the order of three inches.

What I claim as new is:

1. A dip tube for a gas-filled cylinder used in underwater breathing apparatus, said dip tube including a hollow tube having a central duct and an outer end having means for fastening said tube to said cylinder and an inner end projecting into said cylinder, said inner end and said central duct terminating in a filter seat, a sintered metal filter mounted within said seat and a blow-by and frangible safety valve between said inner and outer ends of said tube for by-passing said filter when gas is pumped into said cylinder and for supplying gas from said cylinder in case of failure of said filter, said blow-by and safety valve comprising a cross bore piercing said tube and going through said central duct, and an elastomeric band strapped around said tube and over said cross bore, said band being pierced by gas pressure within said cylinder should said filter fail to pass gas from said cylinder into said tube.

2. A dip tube for a gas filled cylinder, said dip tube

comprising an elongated tube having a first central bore and first and second ends, said first end having means for connecting said dip tube to the outlet end of said cylinder, said second end having a seat, a filter mounted within said seat, said filter closing off said first central bore at the second end of said tube, a transverse second bore intersecting said first bore above said filter and said second end, and an elastomeric band surrounding said tube at said second bore for closing off said second bore, said second bore and said band acting as a blow-by and safety valve for said dip tube, said second bore and said blow-by valve by-passing said filter when gas is pumped into said cylinder and when said filter fails to supply gas from said cylinder.

3. A self-contained underwater breathing apparatus including a gas-filled cylinder providing breathing atmosphere for a diver, said cylinder having valve means and a dip tube having first and second ends, said first end being the outer end attached to said valve means, the improvement in said dip tube comprising a filter mounted at and within the second inner end of said dip tube, said second inner end projecting into said cylinder, and a blow-by and safety valve between said first and second ends of said dip tube, said blow-by and safety valve comprising a cross-bore piercing said tube and an elastomeric band stretched over said tube and said cross-bore to by-pass said filter when said filter is being filled with said gas, said band being pierceable by gas pressure at the cross-bore if said filter becomes plugged up during use of said apparatus.

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