A body defining a cylindrical passage receives a wire rope to be cleaned. An annular orifice extends about the wall of the passage and cooperates with a supply chamber for supplying pressurized fluid to the orifice. A duct between the chamber and the orifice directs fluid against the rope and is angled at more than 45° with respect to the axis of the passage.
The invention relates to a tool for cleaning or treating wire rope as the rope moves. The tool may be used for cleaning the rope or applying a protective coating of a liquid chemical or oil. Particular application is found in the treatment of wire rope used for suspending or withdrawing instruments in a bore hole of a gas or oil well. In such application, particularly in off-shore drilling, the rope, as it is withdrawn at speed, carries with it mud and water and perhaps corrosive chemicals. If the rope is not cleaned as it is withdrawn the materials carried by it foul the surrounding area. Furthermore, the rope wears and corrodes relatively rapidly. Also, water carried by the rope may freeze and cause serious icing of sleeves, rollers, wheels and the like. Devices used hitherto for cleaning the rope having included resilient wiper bushes or rollers through which the rope is drawn and which wipe the rope clean. However, such devices are not effective in penetrating the lay of the rope strands and cleaning is therefore usually incomplete.

In other fields of application, such as in the manufacture of wire filaments, devices have been proposed in which air is blown on to the traveling strand in an annular jet for drying purposes. However, the treatment of rope, as distinct from a filamentary strand, presents particular problems. For example, in order to penetrate the lay of the rope strands it is important to have a small clearance between the rope and the annular jet and with such a small clearance the uneven surface of the rope is liable to wear the tool and in particular to spoil the orifice which defines the annular jet.

It is an object of the invention to provide a tool for cleaning or treating wire rope of the annular jet kind which is capable of cleaning rope effectively and yet has acceptable wear properties. Thus, the invention provides a tool for cleaning or treating wire rope having a body defining a cylindrical passage along which passes with small clearance, the wire rope to be cleaned or treated; an annular orifice extending around the wall of the passage; a supply chamber in the body for supplying pressurised fluid to the orifice; and an annular duct coupling the supply chamber to the orifice for conveying the fluid, the duct being inclined, at least at the orifice end, towards the end of the passage at which the rope enters, the angle between the axis of the passage and the duct being greater than 45°. Preferably the angle is about 60°.

I have found that in practice there is a danger in treating wire rope with fluid from an orifice directed against the direction of travel of the rope, namely that the rope tends to rub against the active rim of the orifice and soon peels it over to such an extent as to feather the fluid flow. If the angle is made greater than 45° (and obviously less than 90°) this effect is suitably alleviated. For cleaning purposes the fluid will usually be air, although special cleaning fluids may be used. Because of the inclination of the annular duct the air from the orifice and the material suspended in it are directed out of the said entry end of the passage. This end may be open to atmosphere, either directly or by way of exhaust ports, and it may be necessary to provide a shroud around the tool body to contain the spray. Preferably, however, the said end of the passage opens into a cross-bore in the body and the air and suspended substances are withdrawn from the cross-bore by way of tubes whereby mud and water may be returned to the bore-hole.

When the rope has been cleaned it may be desirable to coat it with a protective film, perhaps of oil. The tool of the present invention may be used for such a purpose and the protective liquid may be ejected directly from the orifice or may be carried in atomised form in air blown from the orifice, in which case the supply chamber may be filled with spray under pressure from an atomiser unit. Conveniently, two tools may be arranged in series, the first using air to clean the rope and the second applying a protective film to the rope.

The invention will further be described with reference to the accompanying drawings, of which:

FIG. 1 is a cross-sectional view of a tool embodying the invention;
FIG. 2 is a cross-sectional view of part of another tool embodying the invention;
FIG. 3 is a cross-section plan view of the tool of FIG. 2 taken in III — III;
FIG. 4 is a perspective view of the tool of FIGS. 2 and 3; and
FIG. 5 is a schematic diagram showing the use of tools in accordance with the invention.

Referring to FIG. 1 the tool comprises a body 1 of non-ferrous metal provided with a cylindrical passage 2 through which wire rope to be cleaned is passed. Usually the body is supported with the axis of the passage vertical and the rope is passed upward therethrough. The diameter of at least a portion of the passage depends upon the gauge of the rope to be treated and for a rope of nominal gauge three-fourths inch a passage diameter of three-fourths inch is satisfactory, there being in practice a small clearance. An annular supply chamber 3 surrounds the passage 2 and is provided with two inlet ports 4 whereby compressed air or liquid under pressure may be supplied.

A downwardly inclined annular duct 5 extends from the supply chamber 3 and terminates in an annular orifice 6 extending around the wall of the referred to portion of the passage. The duct is defined by the space between two closely adjacent frusto-conical portions of the body and the width of the duct is 0.020 inch. This gives an orifice 6 of width some 0.023 inch because the inclination of the duct is 60° to the axis of the passage. These dimensions are found suitable for cleaning rope with the use of compressed air from the orifice. An air pressure of about 125 p.s.i. in the supply chamber 3 is adequate to blow mud and water from a rope as it withdraws measuring instruments from a bore hole. The speed of withdrawal may be as high as 2,000 ft. per minute.

Because of the inclination of the duct 5 and the proximity of the orifice to the lower end of the passage, the exhaust air carrying the mud and water passes out from the lower end of the passage. In order to contain this spray there is provided a cylindrical shroud 7.

Referring now to FIGS. 2 and 3 there is shown a preferred embodiment of the tool. In this embodiment the tool body is moulded in nylon and has replaceable nylon wear bushes 8 and 9 at the entry and exit ends respectively. In FIG. 2 the rope is shown at 10 and passes downwardly through the tool. The annular duct 5 is defined at one side by the body and at the other side by the bush 9. As in the FIG. 1 embodiment the duct makes an angle of 60° with the axis of passage 2 and...
there is defined an annular chamber 3 for receiving pressurized fluid through suitable inlet ports 4. The body is provided with a cross-bore 11. The lower end of the passage 2 is flared at 12 into the cross-bore and above the cross-bore there is a lead-in passage 13 through which the rope passes. Two exhaust tubes 14 (FIG. 3) are formed at the ends of the cross-bore and carry the exhaust spray away, conveniently leading it back down the bore hole.

The tool of FIG. 1 is made in unitary form and its use requires that the end of the rope be threaded through it. This is not always convenient and the tool of FIGS. 2 to 4 has a modification in which the tool is split on a vertical plane, the two parts being clamped together in use. The tool is formed in two similar halves hinged together by hinge pins 15 and 16 coupled by brass links 17. Two captive bolts 18 have wing nuts whereby the halves of the assembly are held together. Serious damage may be caused if the rope has a broken link or when this reaches the restriction presented by the tool. Under these circumstances quick release of the tool may be effected by withdrawal of the hinge pin 16, which is a snatch pin having a snatch chain attached. A spring clip 19 prevents accidental withdrawal.

FIG. 4 is a perspective view of the tool of FIGS. 2 and 3. For convenience, FIG. 4 shows a minor modification in which wear bush 8 is omitted.

Referring now to FIG. 5 there is shown schematically a rope-treating arrangement using two tools 20 and 21 of the kind shown in FIGS. 2 to 4. The tools are mounted immediately above the deck of an oil-drilling platform and the wire rope 10 passes through the tools as it is withdrawn from the bore-hole. The first tool 20 receives compressed air at a pressure of some 125 p.s.i. from a feed pipe 22 which is supplied from a compressor (not shown). As the rope passes upwardly through the tool 20 the annular jet of compressed air cleans it and carries off water and mud down the exhaust tubes 23 which lead back to the bore-hole.

After being cleaned by the tool 20 the rope passes through tool 21 which applies a protective film of oil to the rope. As oil mist is supplied to the tool by feed pipe 24, the mist being generated by a conventional spray head 25 receiving compressed air from the compressor and oil from a container 26. The oil mist is directed on to the rope from the annular jet and excess oil is carried back down the exhaust tubes 27 to be returned to the container 26.

The invention is not restricted to the details of the foregoing description of embodiments thereof made with reference to the accompanying drawings. For example, the particular dimensions of the passage, orifice and duct are not limiting. The angle of inclination of the duct may be different provided it is between 45° and 90° and the pressure of the air supply may be different. It is envisaged, for example, that air may be supplied at pressures up to 500 p.s.i. or so. With such pressures the air can cause the rope to "bird-cage," namely to open out the lay locally by a longitudinally compressive action. This is particularly useful when it is important to clean within the rope, as when the rope constitutes a cable, for example, including electrical leads for connection to the instruments.

The tool may be made of material other than non-ferrous metal or nylon and in particular may be made of polyurethane, or hard rubber composition. Even if a unitary tool of the kind shown in FIG. 1 is required it will be convenient to mould the halves as for the split form and then bond the halves together with adhesive or by high frequency capacitive welding.

The two halves of the split form of the tool may be held together by hose-type clamps instead of nuts and bolts.

I claim:
1. A tool for cleaning or treating wire rope comprising:
   a. a body defining a cylindrical passage along which passes the wire rope to be cleaned or treated;
   b. the diameter of at least a portion of the passage corresponding to the nominal gauge of the rope with only a small clearance substantially less than the gauge of the rope;
   c. a supply chamber in the body for supplying pressurized fluid;
   d. an annular duct terminating in an annular orifice extending around said portion of the passage coupling the supply chamber to the orifice for conveying the fluid;
   e. the duct being defined by the space between the portions of the body with closely spaced frusto-conical surfaces so as to be inclined at the orifice end towards the end of the passage at which the rope enters, the angle defining the inclination between the axis of the passage and the duct being greater than 45° and less than 90°;
   f. said body being split in a plane containing the axis of the passage to define two similar body halves;
   g. removable means holding the body halves in their assembled relationship; and,
   h. means attached to the removable means to enable the body halves to be quickly separated in the event the rope should become blocked in said portion of said body where only said small clearance is provided.

2. A tool as claimed in claim 1, in which said removable means includes hinge means having a removable snatch pin.

3. A tool as claimed in claim 1 wherein the angle of inclination of the duct with respect to the axis of the passage is substantially 60°.

4. A tool as claimed in claim 1 wherein the one of said frusto-conical portions which includes the acute angled rim of the orifice is part of a removable wear bush in the body.

5. A tool as claimed in claim 1 wherein the width of the duct is substantially 0.020 inch.

6. A tool as claimed in claim 1 wherein the entry end of the passage is flared outwardly away from the orifice.

7. A tool as claimed in claim 1 wherein the passage terminates at the entry end in a cross-bore from which air-suspended material is carried away.

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