

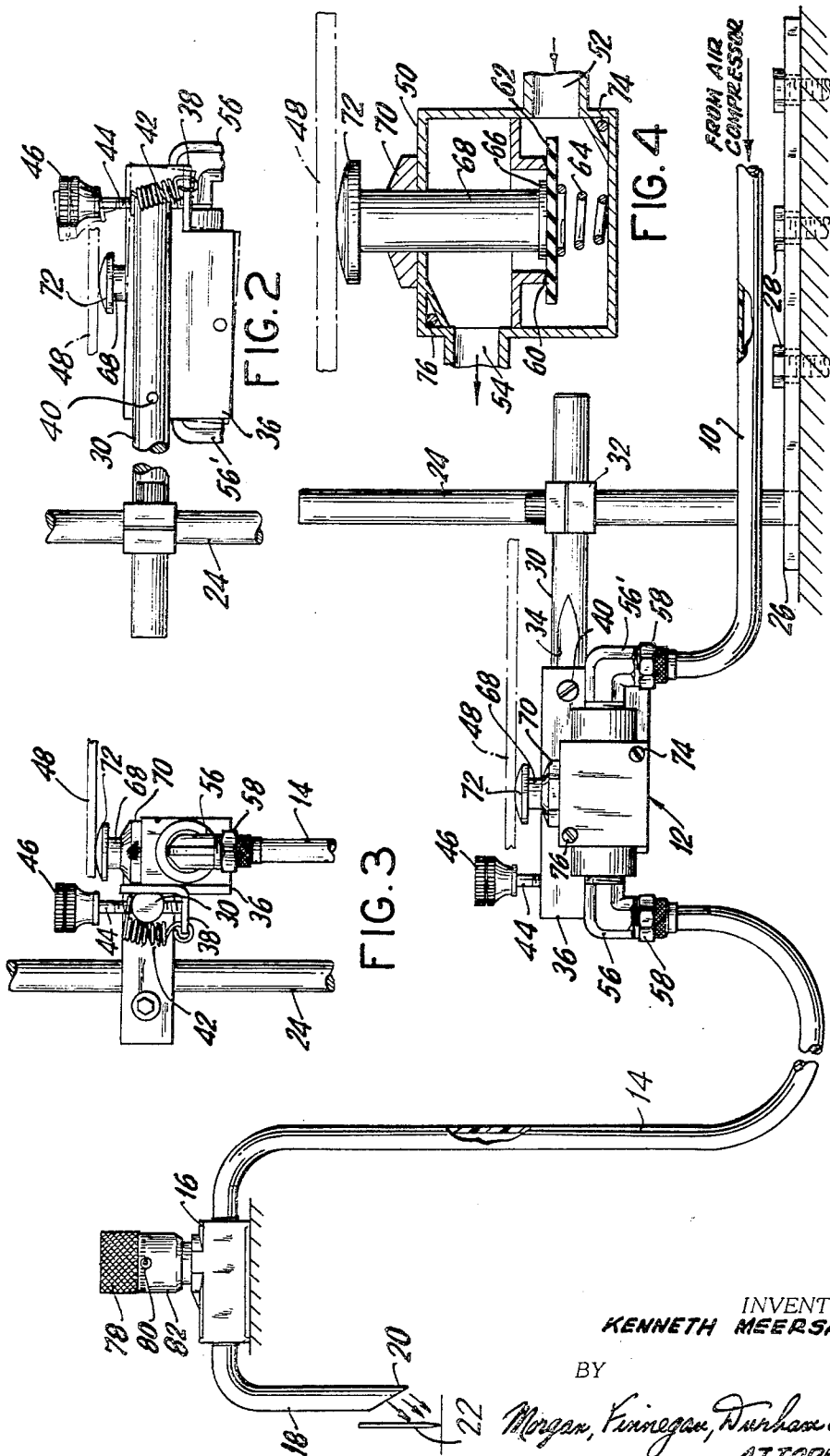
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COOLING SYSTEM FOR A SEWING MACHINE NEEDLE

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1

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COOLING SYSTEM FOR A SEWING MACHINE NEEDLE

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6 Claims

ABSTRACT OF THE DISCLOSURE

A system for automatically cooling a sewing machine needle or other high speed tool which becomes heated by friction when in use which operates in response to actuation of the sewing machine needle. The system comprises an on-off control valve located upstream from the needle or tool and downstream from a source of compressed air, an adjustment valve located between the control valve and the needle or tool, a treadle for actuating the control valve and controlling the sewing machine motor or drive for the tool, a plunger in the control valve operable by the treadle, and spring biased mounting means for the control valve to permit movement of the treadle after the control valve is opened to thereby operate the needle.

BACKGROUND OF THE INVENTION

This invention relates to a system for cooling a high speed tool during its operation on a workpiece, and more particularly, to a compressed air cooling system for cooling a sewing machine needle which tends to become heated during use. Although the cooling system of the invention is adapted for use in many industrial operations, it will be described here in the environment of industrial sewing machines where the advantages of the invention may be readily demonstrated.

The operating speeds of sewing machines, particularly industrial sewing machines, are to a great extent limited by the heat developed as a result of the friction encountered by the needle as it passes through the fabric being stitched. The higher the operating speed, the hotter the needle tends to become. The heating of a needle during use may cause warping or breakage of the needle, and may also adversely affect the fabric being sewn. For example, fabrics made from various synthetic, as well as natural fibers, may be scorched when contacted by the hot sewing needle, or the needle may burn the sewing thread. A hot needle may also skip resulting in defective stitches. It will, therefore, be appreciated that a hot sewing machine needle may be lead to machine down time resulting in a costly loss of productivity.

It has also been observed that a hot sewing machine needle will remove dye from a dark colored fabric. In those instances where a dark colored fabric is being stitched to a lighter colored fabric, the hot needle will deposit the dark colored dye on the lighter colored fabric, thereby emphasizing the needle holes and rendering the stitching unsightly.

To avoid the disadvantages and harmful effects of a hot sewing machine needle, the practice has developed of operating sewing machines below their most efficient speeds, and well below the higher operating speeds easily attained by the machines. In this way, the tendency of the needle to become sufficiently hot to cause any of the foregoing problems is either reduced or minimized.

Cooling systems of the type heretofore known for sewing machine needles are generally complex and usually rely on a compressor operated or controlled by the sewing machine motor. According to those known systems,

2

movement of the sewing machine treadle will serve to energize the sewing machine motor which, in turn, will drive the compressor of the cooling system. In many instances the cooling systems are operated by treadles which are separate from the treadles used to energize the sewing machine motor. These known systems are either cumbersome and expensive to install and maintain, and require the operator to perform an additional function in order to activate the cooling system.

SUMMARY OF INVENTION

It is an object of this invention to provide a cooling system for a sewing machine needle that is simple in construction and operation, and which does not interfere with the normal treadle control of the sewing machine motor.

Another object of the invention is to provide a cooling system in which a control valve is so disposed with respect to the treadle of the sewing machine that movement of the treadle for energizing the sewing machine motor will simultaneously open the valve, permitting the cooling air to be directed to the sewing machine needle.

It is yet another object of the present invention to provide a cooling system for a sewing machine needle in which a control valve for the cooling system is so disposed with respect to sewing machine treadle such that movement of the treadle is not impaired.

Another object of this invention is to provide a needle cooling system adapted for use with existing sewing machines which operate in response to the needle actuating treadle.

Additional objects and advantages of the invention will be set forth in the description which follows and in part will be obvious from the description, the objects and advantages being realized and obtained by means of the instrumentalities particularly pointed out in the appended claims.

Briefly described, the present invention may be generally characterized as a cooling system for a sewing machine needle or other high speed tool which tends to become heated during use, comprising a control valve having a plunger and adapted to be connected to a source of compressed air, means for delivering and directing the compressed air from the control valve to the sewing machine needle, a treadle for moving the plunger to open the control valve, and spring biased support means for the control valve to permit further movement of the treadle after the control valve has been opened.

An advantage of the cooling system of this invention is that it may be utilized without operation of additional control mechanisms by the sewing machine operator, since a single treadle serves to activate the cooling system and the sewing machine motor. In this way, the operator's hands are free to manipulate the work pieces being acted upon, and yet readily able to initiate the motor and the cooling system. The cooling system of the present invention may be incorporated into an existing sewing machine structure or attached thereto without interfering with the existing control mechanisms normally found on such apparatus.

It has been found that the cooling of the needle, in accordance with the present invention, permits high speed sewing machines to operate at their normally rated speeds because the heat normally built up on the needle is properly and adequately dissipated by the cooling system. Accordingly, much higher speeds may be used.

The invention consists of the novel parts, steps, constructions and improvements shown and described.

The accompanying drawings which are incorporated in and constitute a part of this specification illustrate an embodiment of the invention and together with the de-

scription serve to explain the principles of the invention.

Of the drawings:

FIG. 1 illustrates the cooling system in accordance with the present invention.

FIG. 2 is a rear elevation of the control valve of FIG. 1.

FIG. 3 is a side elevation of the control valve of FIG. 1.

FIG. 4 is a view, partly in section, of the control valve of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The cooling system of the present invention is illustrated generally in FIGURE 1 and includes a flexible conduit 10 adapted to be connected to any suitable conventional and convenient source of compressed air (not shown). Since most places having sewing machines also have convenient sources of compressed air the system of the present invention can easily be incorporated into existing sewing machines. Conduit 10 communicates with the inlet of an on-off control valve generally indicated as 12 downstream of the source of compressed air. Conduit 14 communicates with the outlet of valve 12 and the inlet of a manually adjustable valve generally indicated as 16. The outlet of valve 16 communicates with a conduit 18, and a nozzle 20 is connected therewith for subjecting a needle 22 to forced air for cooling purposes. Needle 22 is shown in isolation without the remainder of the sewing machine structure in order to simplify the description of the present invention, and nozzle 22 is shown schematically and may be of any conventional configuration in order to cool needle 22 equally on all sides.

The cooling system in accordance with this invention can be incorporated into an existing sewing machine or built into a new sewing machine. As embodied, the support means for valve 12, FIGS. 1-3, comprises an upright cylindrical support member 24 which may be secured to a transverse member 26 that is affixed to the floor or other convenient structure by bolts 28 in order to provide a firm base.

In accordance with this invention means are provided for pivotally mounting the valve with respect to the supporting structure. As embodied, this means includes a cylindrical stationary member 30 which extends transversely to member 24 and is attached thereto by a clamp 32. Member 30 has a flat surface 34 extending longitudinally along one side thereof for abutment of a planar back-up plate 36 for supporting valve 12 that is basically rectangular in shape with a portion of one side folded so as to form a flange 38 extending transversely to the planar surface of back-up plate 36.

Back-up plate 36 is secured to member 30 at one end by a bolt 40 that extends through an aperture in back-up plate 36 to threadedly engage a threaded bore extending through member 30 at surface 34, and a suitable washer is inserted on bolt 40 between back-up plate 36 and surface 34 to permit pivoted movement of back-up plate 36 about bolt 40. The flanged end 38 of back-up plate 36 is connected with member 30 by a spring 42 that is hooked through an aperture in flange 38 and wound around an adjustment bolt 44 that threadedly engages and extends through a threaded bore in the end of member 30 so that spring 42 abuts the top of member 30. The threaded bore is aligned so that its axis is transverse to flange 38 and parallel to surface 34 thereby permitting the end of bolt 44 to abut flange 38 under the tension of spring 42. A knob 46 is attached to the top of bolt 44 to permit manual adjustment thereof.

In accordance with this invention the needle actuating treadle actuates the cooling system before actuating the needle.

A sectional view of valve 12 is shown in FIG. 4 in cooperation with a treadle 48. Valve 12 includes a casing

50 having an inlet 52 and an outlet 54 which are adapted to be connected to conduit 10 and conduit 14, respectively, by suitable connecting elements such as the elbow pipes 56 and 56' and nut-sealing apparatus 58 shown in FIGS. 1 and 3. Inlet 52 communicates with outlet 54 through an annular valve seat 60 which is attached to the side walls of casing 50. An annular valve member 62 is made of resilient material to sealably cooperate with valve seat 60 to control the flow of air through valve 12. A coil spring 64 is mounted in compression between valve member 62 and the bottom wall of casing 50, and a backing plate 66 is secured to the top of valve member 62. A plunger 68 is attached to plate 66 and extends through the upper wall of casing 50 and a sealing ring and stop 70. Plunger 68 has a head 72 attached thereto having a flat top portion for abutment with treadle 48 and a flat annular lower portion adapted to abut stop 70 to limit the downward movement of plunger 68. Valve 12 is secured to back-up plate 36 by two screws 74 and 76 which extend through opposite corners of casing 50 and threadedly engage a back-up plate 36. A second valve means is provided in accordance with this invention for controlling the amount of air directed to the needle.

Valve 16 is manually adjustable by rotating a knob 78 which may be connected with a circular vane within valve 16. Rotation of knob 78 may be controlled by locating two stops 80 one quarter of a revolution from each other in a stationary cylindrical housing 82 so that the vane may be rotated from a fully open position to a fully closed position. When knob 78 is rotated against one stop 80, the circular vane will seat against an annular valve seat in valve 16 to define a fully closed position; and, when knob 78 is rotated to abut the other stop 80, the circular vane will present a minimum resistance to flow and define a fully opened position. By rotating knob 78 to an intermediate position between stops 80, the amount of air to which needle 22 is subjected can be controlled, and to aid in the setting of head 78, a pointer may be provided thereon and housing 82 may have micrometer calibrations disposed thereon. It is clear that any conventional manually adjustable valve may be used to perform the function of valve 16 and the foregoing description is for exemplary purposes.

In operation, treadle 48 is operated by the sewing machine operator's foot and controls the sewing machine motor through apparatus and circuitry not shown as well as on-off control valve 12. Spring 42 is much stronger than valve spring 64; and, thus when treadle 48 is pressed down, this pressure is transmitted to plunger 68 through head 72 and plunger 68 will be depressed before back-up plate 36 is moved. Once plunger 68 has been moved downward so that head 72 abuts stop 70, spring 64 will be compressed and valve 12 will be fully open, and any further downward movement of treadle 48 will cause back-up plate 36 to pivot about bolt 40 and spring 42 to be elongated as shown in phantom in FIG. 2. Consequently, upon commencing operation of the sewing machine, valve 12 is opened to permit compressed air to flow therethrough and through adjustment valve 16 to cool needle 22 without limiting the treadle control of the sewing machine motor. That is, the cooling system of the present invention does not inhibit freedom of movement of the motor control treadle, and the required length of movement of the motor control treadle to provide proper motor control is not limited by the addition of the treadle controlled on-off control valve of the cooling system of the present invention.

Upon cessation of operation of the sewing machine by decreasing the pressure on treadle 48, spring 42 will cause back-up plate 36 to return to its normal position with flange 38 abutting adjustment bolt 44, and any further decrease in pressure on treadle 48 after back-up plate 36 returns to its normal position will cause plunger 68 to move upward under the force of spring 64 to close valve 12.

5

Knob 46 is provided for adjustment of the tension of spring 42 to assure the opening of valve 12 prior to pivotal movement of back-up plate 36 and further to adjust treadle tension to provide easy and accurate operation thereof. By rotating knob 78 of valve 16, as previously described, the amount of air discharged from nozzle 20 can be adjusted, and after setting valve 16 for the desired force of air the cooling system can be conveniently and fully controlled by treadle 48.

The supporting structure for the control valve support apparatus may be altered to suit the requirements of various applications. For instance, member 24 could be a leg of a sewing machine or member 30 could be directly attached to the sewing machine at one or both ends. Similarly, valves 12 and 16 may be of any conventional valve structure that will provide the relative functions necessitated by the cooling system of the present invention.

The cooling system of the present invention can be easily incorporated into existing sewing machines due to its simplicity, independence from the operation of other components of the sewing machines, and compatibility with the existing treadle control of the sewing machines.

Inasmuch as the present invention is subject to many variations, modifications and changes in detail, it is intended that all matter in the foregoing description or shown in the drawing be interpreted as illustrative and not in a limiting sense.

What is claimed is:

- 1. A cooling system for a sewing machine needle comprising:
 - control valve means having a plunger and a casing forming an inlet adapted to be connected to a source of compressed air and an outlet;
 - means communicating with said outlet to deliver compressed air to the sewing machine needle;
 - a movable treadle;
 - means for transmitting movement of said treadle to said plunger to open said control valve means; and
 - spring biased support means for said control valve means to permit further movement of said treadle after said control valve means has been opened in response to movement of said treadle, said spring biased support means including
 - valve support means having a first side and a second side, a stationary member, means attaching said first side of said valve support means to said stationary member and a spring having a first end connected with said second side of said

6

valve support means and a second end connected with said stationary member whereby said spring permits movement of said treadle after said control valve means is opened.

2. The invention as recited in claim 1 wherein said control valve means includes a bias spring for normally biasing said control valve means closed, said bias spring being weaker than said spring in said spring biased support means whereby said bias spring will be overcome to open said control valve means in response to movement of said treadle before said valve support means moves in response to movement of said treadle.

3. The invention as recited in claim 1 wherein said valve support means has a flange on said second side, said stationary member has an adjustable bolt inserted there-through and said spring biases said bolt and said flange to a normally abutting relationship whereby the tension on said spring may be controlled by said adjustable bolt.

4. The invention as recited in claim 1 wherein said control valve means includes a valve seat disposed between said inlet and said outlet, a valve member adapted to sealably engage said valve seat, a spring mounted between said casing and said valve member to normally bias said valve member into engagement with said valve seat, means connecting said plunger to said valve member and means in said casing for permitting said plunger to extend therethrough.

5. The invention as recited in claim 4 wherein said treadle movement transmitting means includes a head attached to said plunger and said casing has stop means mounted thereon to limit movement of said plunger due to abutment of said stop means and said head.

6. The invention as recited in claim 5 wherein said means communicating with said outlet includes a manually adjustable valve for controlling the amount of air delivered to the sewing machine needle.

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