Aug. 20, 1968 D. W. SAMUELS 3,397,659

NEEDLE COOLING DEVICE

Filed July 20, 1966

FIG. 1.

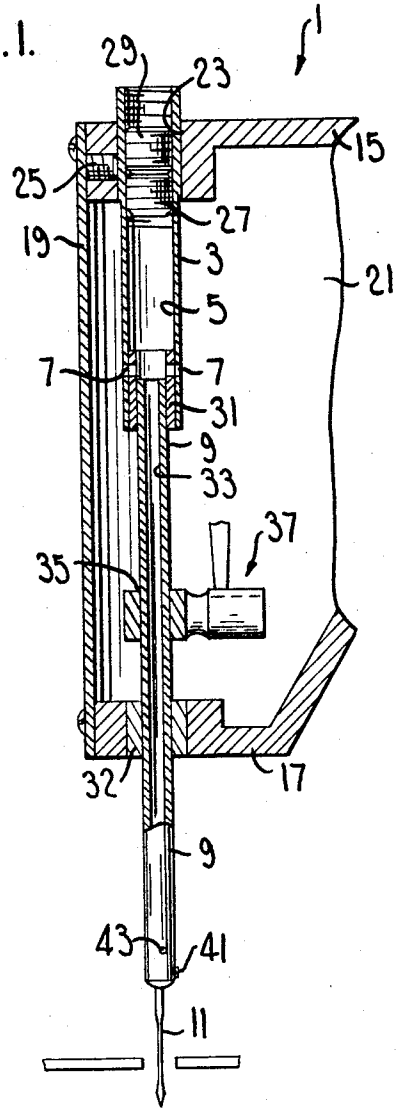


FIG. 2.

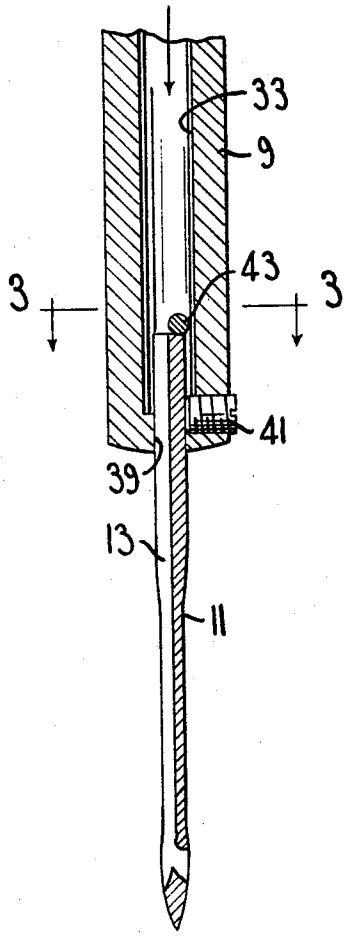
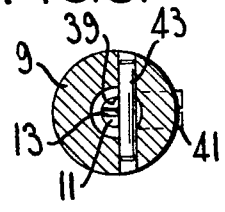


FIG. 3.



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NEEDLE COOLING DEVICE

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ABSTRACT OF THE DISCLOSURE

A device for cooling the needle of a sewing machine with blasts of air on upstrokes of the needle, comprising a hollow needle bar functioning as a plunger within a cylinder vertically adjustable for accommodation to needle strokes of various models of sewing machines to which the device may be easily attached, the cylinder having an adjustable plug threaded therein for making the length of the cylinder chamber substantially equal to the length of the needle stroke.

The invention is particularly concerned with a type of needle cooling device adapted for attachment to existing sewing machines, without modification of the machines, having a tubular needle bar which functions as a plunger reciprocating in a cylinder for pumping air through the bar to the needle for cooling the needle. Among the several objects of the invention may be noted the provision of a device of this class which is adapted for attachment to various models of existing sewing machines, as to which the stroke of the needle bar may vary widely, and which is adapted for maximum delivery of air in relation to the length of the stroke of the needle bar; the provision of such a device in which, in effect, the length of the pumping chamber in the cylinder is adjustable in relation to the length of the stroke of the needle bar for the purpose of making the length of the chamber substantially equal to the stroke of the needle bar (whatever the stroke may be as regards the machine in which the cooling device is installed) for maximum evacuation of air from the chamber on an upstroke of the needle bar, thus providing for maximum delivery of air; the provision of such a device which is easy to install and adjust; and the provision of such a device for utilization of a needle having a longitudinal groove with a simplified arrangement for backing up the needle at the lower end of the needle bar without interfering with flow of air through the needle bar to the groove in the needle. Other objects and features will be in part apparent and in part pointed out hereinafter.

The invention accordingly comprises the constructions hereinafter described, the scope of the invention being indicated in the following claims.

In the accompanying drawings, in which one of various possible embodiments of the invention is illustrated,

FIG. 1 is a fragmentary view, partly in section, showing a needle cooling device of this invention installed in a sewing machine;

FIG. 2 is an enlarged fragmentary section showing mounting of a needle at the lower end of the needle bar; and

FIG. 3 is a section on line 3—3 of FIG. 2.

Corresponding reference characters indicate corresponding parts throughout the several views of the drawings.

Referring to the drawings, a device of this invention

for cooling the needle of a sewing machine is shown mounted in the head portion 1 of the sewing machine. The device generally comprises a cylinder 3 which is adjustably mounted in head 1 and defines an air pumping chamber 5 having lateral inlet ports 7 adjacent its lower end. A tubular needle bar 9 is adapted to reciprocate vertically in the cylinder 3 between the lower limit shown in FIG. 1 where ports 7 are unblocked and an upper limit where the upper end of the needle bar is above ports 7. The upper end of cylinder 3 is closed so that upward movement of the needle bar 9 forces air from the chamber 5 through the needle bar for discharge from its lower end. Thus the needle bar acts as a pump plunger. A needle 11 held in the lower end of the needle bar has a groove 13 which communicates with the passage in the needle bar so that air discharged downwardly through the needle bar travels along the needle 11 for cooling it.

The sewing machine head 1 has a top 15 and a bottom 17. A face plate 19 mounted on the left end of head 1 closes off a space 21 between top 15 and bottom 17 of the head. The head 1 conventionally has a hole 23 is top 15 for a needle bar guide and a set screw 25 for holding the guide in place. In installing the cooling device of this invention, the needle bar guide is removed and cylinder 3 is inserted in hole 23 and held by the set screw. The upper end of cylinder 3 is internally threaded and receives a threaded plug 27 which is vertically adjustable in the cylinder. Plug 27 determines the upper end of pumping chamber 5 and is adjustable in the cylinder to adjust the length of the pumping chamber to correspond substantially to the stroke of the needle bar 9. Plug 27 is held in its adjusted position by a locking screw 29 threaded in the upper end of cylinder 3 and bearing against the top of plug 27.

Mounted in the lower end portion of cylinder 3 is a bushing 31 in which the needle bar 9 has a sliding fit. The lateral inlet ports 7 extend through cylinder 3 and through bushing 31. The sliding fit between the needle bar 9 and the bushing is sufficiently close that when the bushing is raised from its FIG. 1 position it effectively blocks off inlet ports 7. The needle bar also has a sliding fit in a bushing 32 in the bottom 17 of the sewing machine head. The passage through the tubular needle bar is designated 33. This passage communicates at the upper end of the needle bar with the pump chamber 5. Passage 33 is as small in diameter as practical relative to the outside diameter of the needle bar so that a maximum amount of air may be pumped from chamber 5 on each upstroke of the needle bar.

The needle bar is clamped at 35 to a mechanism generally designated 37 which constitutes part of the sewing machine and which functions to reciprocate the needle bar vertically through a stroke in which its upper end moves from the lower limit shown in FIG. 1 to an upper limit closely adjacent to the lower end of plug 27 as explained more fully hereinafter. The length of the stroke of the mechanism 37 is different for various models of conventional sewing machines. However, the device of the invention can be installed in various sewing machine models due to the fact that chamber 5 is adjustable in length by raising and lowering the plug 27 in the cylinder. The manner in which the device is adjusted for various strokes of the needle bar is explained later.

The mounting of needle 11 in the lower end of the needle bar 9 is best illustrated in FIGS. 2 and 3. A hole 39 in the lower end of the needle bar is adapted to receive the upper end of the needle to place needle groove 13 in

communication with passage **33**. A set screw **41** threaded in a tapped lateral hole **42** in the needle bar adjacent its lower end engages needle **11** and holds it in position in the needle bar. A pin **43** extending across the needle bar above set screw **41** adjacent the lower end of the needle bar backs up the needle without interfering with the flow of air through passage **33** to the groove in the needle. Needle **11** is inserted into the needle bar until its upper end contacts the pin **43**.

To install the cooling device of this invention in a sewing machine, face plate **19** is removed and set screw **25** is loosened. Then the conventional needle bar guide and needle bar of the sewing machine are removed. Cylinder **3** is inserted through hole **23** until its upper end is substantially flush with the top **15** of the sewing machine head. The cylinder is arranged so that one of the inlet ports **7** in the chamber **5** is at the left side as illustrated in FIG. 1 so that it is clearly visible to the person installing the device in the sewing machine. Set screw **25** is then tightened just enough to hold the cylinder in place. The needle bar **9** is then inserted downwardly through cylinder **3** and through the bushing **32** in the bottom of the head. The needle **11** is inserted upwardly through hole **39** in the needle bar to the point where the upper end of the needle engages the pin **43**. Needle **11** is rotated until its groove **13** is at the left when the set screw opening is at the right. Then the set screw **41** is tightened against needle **11** to hold it in place. The needle bar is adjusted vertically to time the needle to the hook of the sewing machine, and then clamped at **35** to the reciprocating mechanism **37**. The needle bar is then manually moved to the lower limit of its stroke. Set screw **25** is loosened and the cylinder **3** is vertically adjusted until the inlet ports **7** are just above the upper end of the needle bar as shown in FIG. 1. This adjustment is easy to make by sighting through the inlet port **7** at the left as shown in FIG. 1. Then set screw **25** is tightened firmly to lock the cylinder in place. The needle bar is manually moved to the upper limit of its stroke. Plug **27** is then screwed into the cylinder until the plug contacts the top of the needle bar, then backed off about half a turn, thereby adjusting the length of the pumping chamber to correspond substantially to the stroke of the needle bar. Screw **29** is then tightened against plug **27** to lock the plug in its adjusted position, face plate **19** is then reinstalled, and the device is ready for operation.

Operation of the needle cooling device of the invention is as follows:

On operation of the sewing machine, the needle bar is reciprocated up and down in cylinder **3**. When the needle bar is at the lower limit of its stroke (FIG. 1), ports **7** are uncovered for entry of air to pumping chamber **5**. Upon upward movement of the needle bar a short distance, it closes off the ports **7** so that air in chamber **5** becomes trapped and cannot be discharged except through the passage **33** in the needle bar. The needle bar continues to move upwardly until its upper end is closely adjacent the bottom of plug **27**, thereby sweeping through substantially the entire pumping chamber. Because the needle bar moves substantially entirely through the pumping chamber and because the passage **33** through it is small relative to the outside diameter of the needle bar, substantially all of the air in the pumping chamber is forced out of the pumping chamber through the passage **33** during the upward stroke of the needle bar. Air from chamber **5** passes downwardly through passage **33** and is discharged through groove **13** in the needle. Thus, a strong blast of high-pressure air is blown along the needle on each upstroke of the needle bar. When the upper end of the needle bar clears ports **7** on a downstroke, air can enter the pumping chamber **5** to be discharged across the needle during the next upward stroke of the needle bar.

The device of this invention can be installed in various sewing machines without modification of the machine. The length of the stroke of the needle bar may vary widely as required for the individual machine due to the provision of the plug **27** which permits varying of the length of the chamber **5** for various strokes of the needle bar. Also, because cylinder **3** is vertically adjustable and can be fixed in various adjusted positions by set screw **25**, the device can be used on sewing machine models requiring a higher or lower positioning of the needle bar for a given locus of stroke.

With chamber **5** adjustable in length in relation to the length of stroke of the needle bar to make the length of the chamber substantially equal to the stroke of the needle bar irrespective of the needle bar stroke, maximum evacuation of air from the chamber may be achieved on an upstroke of the needle bar, thus providing for maximum delivery of air to the needle providing improved cooling of the needle. The small diameter of the passage **33** in the needle bar also assists in achieving maximum delivery of air at the highest possible pressure.

Without provision for adjustment of the length of chamber **5** to correspond substantially to the stroke of the needle bar, there might be considerable dead space above the upper end of the needle bar when at its upper limit of travel. With a relatively small bore in the needle bar, and at the high speed of reciprocation of the needle bar, such dead space would materially reduce the pumping of air due to inability of air quickly to exit from chamber **5** through the needle bar, with the result that reciprocation of the needle bar would result in compression and expansion of air on the dead space with reduced evacuation of air. This condition cannot be corrected by making the bore in the needle bar larger, since this would reduce the displacement of the needle bar. The construction of the present invention is such as to enable elimination of dead space in the pumping chamber (except such as to avoid bumping of the upper end of the needle bar against the upper end of the chamber), thus achieving maximum evacuation of air via a relatively small diameter bore in the needle bar.

The use of the pin **43** provides a simplified mode of backing the needle without interfering with the flow of air downwardly through passage **33** into the groove **13** in the needle.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As various changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. In combination with a sewing machine, a device for cooling the needle of the sewing machine comprising a cylinder mounted in vertical position in the sewing machine in the line of needle travel including means for vertically adjusting the position of the cylinder, said cylinder defining an air pumping chamber and having an open upper end and a lateral air inlet port adjacent its lower end, a needle bar extending into the cylinder through its lower end and having a sliding fit in the cylinder, said needle bar being tubular to provide an air passage therethrough, said sewing machine including needle bar reciprocating mechanism connected to said needle bar for reciprocating the bar through a stroke, said vertical adjustment of said cylinder positioning the air inlet port immediately above the upper end of the needle bar when the latter is at the lower limit of its stroke, means for closing the open end of said cylinder and defining the upper end of said pumping chamber, said cylinder closing means being adjustable in the cylinder for adjusting the length of said pumping chamber to correspond substantially to the stroke of the needle bar, a longitudinally grooved needle and means at the lower end of the needle bar for mount-

ing said longitudinally grooved needle with the upper end of the needle received in the lower end of the needle bar, said needle bar acting as a pump plunger and adapted, on each upstroke thereof, to pump air from said chamber down through the air passage in the needle bar to the groove in the needle, said means for mounting said needle comprising a pin extending across the passage in said needle bar for backing up the needle and limiting insertion of the needle into said needle bar.

2. A device as set forth in claim 1 wherein said closing means comprises a plug threaded in the upper end of the cylinder.

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