July 15, 1947. C. F. RUBEL 2,423,996

SEWING MACHINE

Filed March 7, 1942 3 Sheets-Sheet 1

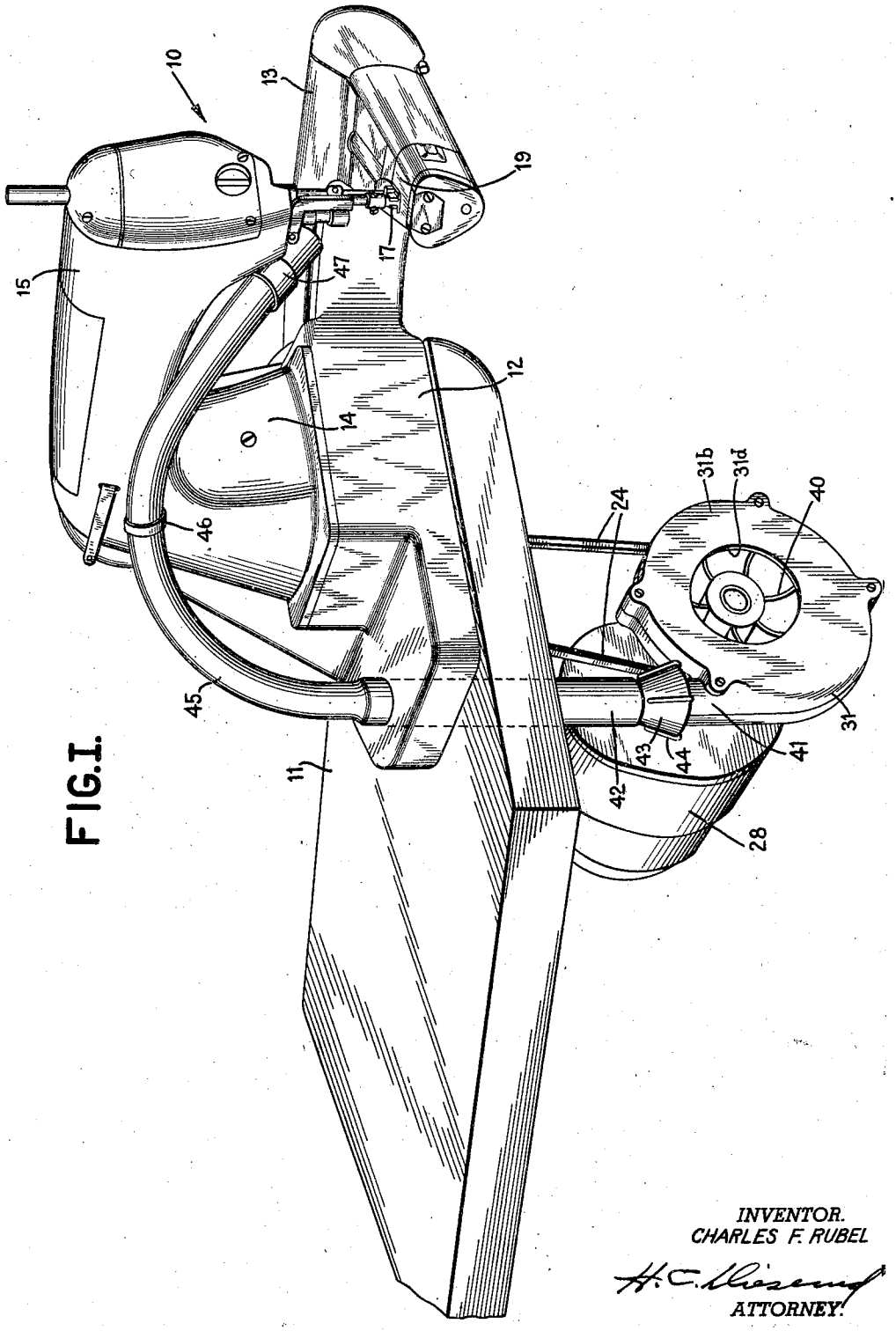


FIG. I.

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SEWING MACHINE

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FIG. III.

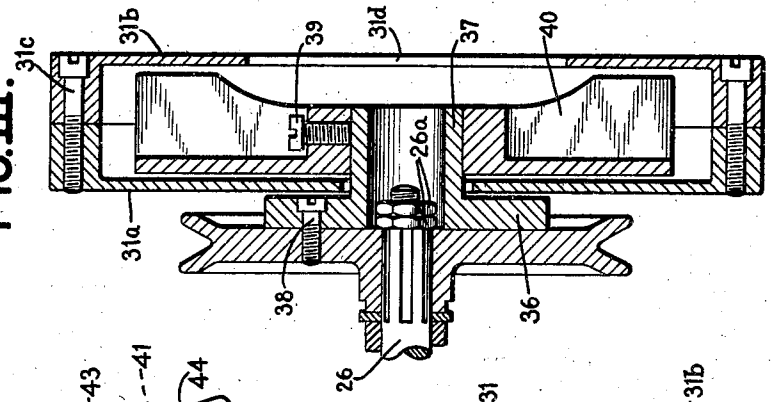
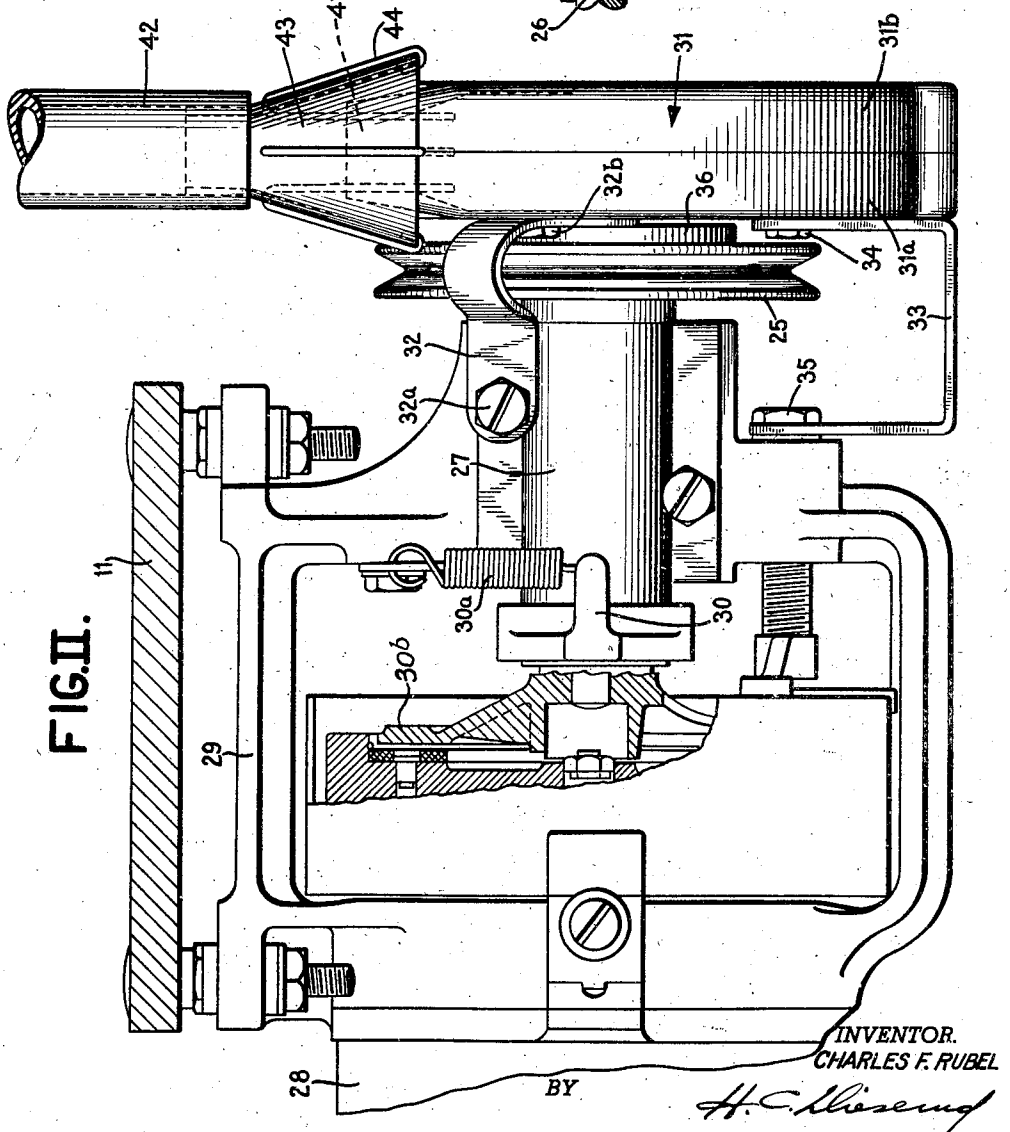


FIG. II.



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SEWING MACHINE

Filed March 7, 1942 3 Sheets-Sheet 3

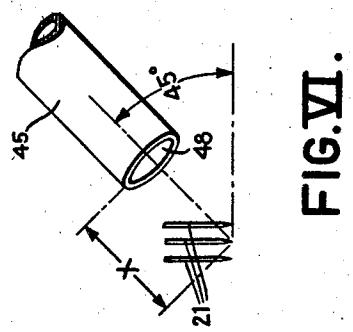


FIG. VI.

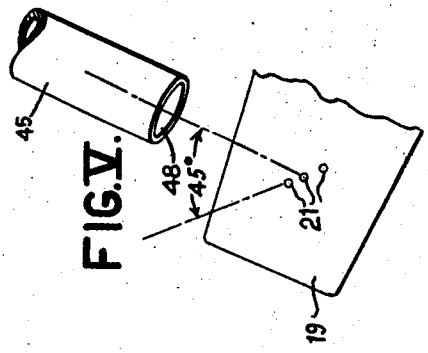


FIG. V.

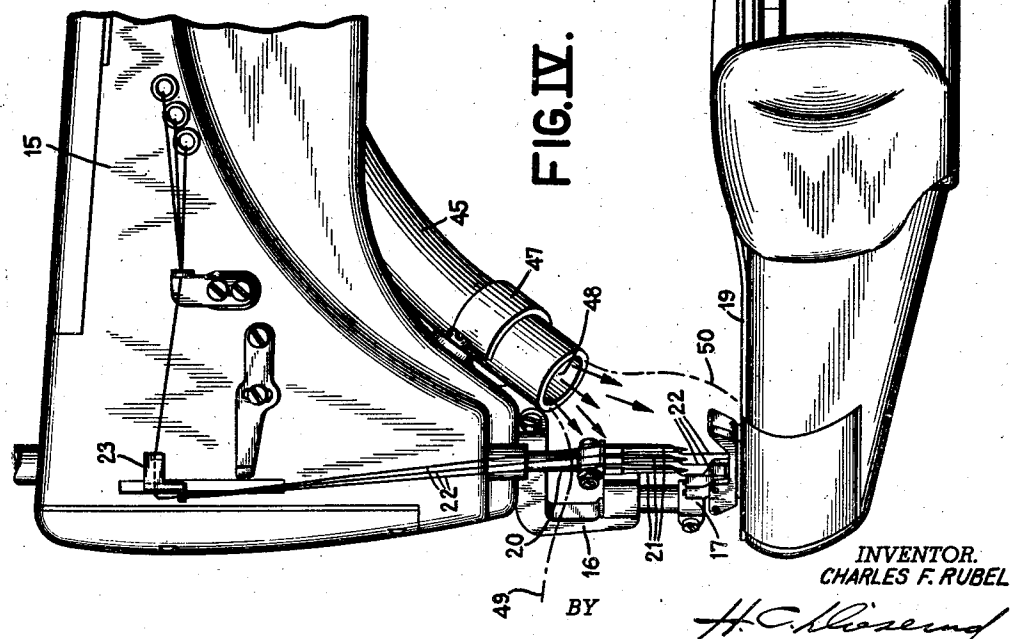


FIG. IV.

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Patented July 15, 1947

2,423,996

UNITED STATES PATENT OFFICE

2,423,996

SEWING MACHINE

Charles F. Rubel, Chicago, Ill., assignor to Union Special Machine Company, Chicago, Ill., a corporation of Illinois

Application March 7, 1942, Serial No. 433,740

2 Claims. (Cl. 112—218)

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This invention relates to sewing machines and more particularly to an improved combination and method of operating the same, by which greater speeds of operation may be attained than have heretofore been possible.

In the used of certain types of sewing machines, especially those employed in operations upon heavy and tough materials, as in the manufacture of overalls, uniforms, army shirts and the like, a limitation upon the speed of operation is imposed by the tendency of the needles to become overheated. This has two principal evil consequences, i. e., excessive breakage of the needles or injury thereto in other respects and excessive breakage of the needle thread. In either case there is not only wastage of material but also loss of valuable operating time required to insert a new needle or to re-thread the old. Heretofore it has been considered necessary to employ either chromium-plated or nickel-plated needles in order to reduce the friction of the fabric thereon, but it has been found that plain steel needles may be used effectively in accordance with the present invention. Plain steel needles are rougher than the plated ones and hence, in general, will generate more heat due to friction in passing through the cloth. As a result the speed of operation must ordinarily be reduced, in substituting plain steel needles for the plated ones, in order to avoid excessive breakage of needles and thread. When the present invention is employed, however, the former speed of operation may not only be maintained but it may be increased in spite of the change of needles. With the present scarcity of chromium and nickel, due to the war emergency, this improved operation made possible by the invention, even with plain steel needles, is of vital importance. The benefit of increased speed is, of course, derived regardless of the character of the needles employed, since needle and thread breakages are encountered with all types of needles when the machines are operated at excessive speeds. But a double benefit is derived when plain steel needles are used, by way of rendering the critical materials, chromium and nickel, available for other more urgent uses without impairing, and in fact increasing, the operating efficiency of sewing machines, when equipped with the invention.

An important object of the present invention has been to provide effective, simple and efficient means for cooling the needles of a sewing machine so that its speed of operation, and hence its output, may be increased without danger of

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needle and thread breakage and without danger of spoiling the needles through drawing their temper and the like, and with consequent damage to the goods being stitched.

One difficulty of providing adequate cooling of the needles, particularly in a multiple-needle machine, is the limited power available for the production of the cooling action. It is impracticable, for example, to provide a compressor driven by the motor of a sewing machine since a compressor will add too great a load to the driving motor, which in attaining the high speed operation made possible by the cooling of the needles is required to operate at substantially its maximum load. Moreover, in compressing air, heat is imparted to it so that some provision is necessary for the cooling of the air if it is to be used for needle-cooling purposes. It is impracticable, moreover, to provide a common air-line from a special compressor unit to supply cooling air to a number of sewing machines. In any installation of this character it will be found that adequate cooling may be provided for a few machines close to the source of supply of the cooling air but machines further along the line cannot be adequately supplied without prohibitively expensive provisions.

Heretofore various suggestions have been made for the cooling of the needles of a sewing machine but the cooling action has usually been incidental to the performance of some other function, such as the elimination of lint or the like from the work surface and whatever cooling action there may have been has been secondary and wholly inadequate for the purposes of the present invention. Prior suggestions concerned specifically with the cooling of a needle have involved the use of a restricted nozzle for directing a high velocity jet of air against the needle. This method of producing a cooling action has been unsatisfactory, particularly for the cooling of the needles of a multiple-needle machine. Too much power has been required to develop the necessary high velocity flow for adequate cooling of all of the needles. Moreover, it is substantially impossible in a construction of this character to provide uniform cooling of the multiple needles.

It has been discovered, in accordance with the present invention, that the uniform cooling of a plurality of needles may be effectively produced without blowing a high velocity jet of air against each needle. Effective cooling, capable of increasing the speed of operation of a multiple-needle machine from 10% to as much as 50% over its permissible speed without cooling may

be produced by directing a relatively low velocity stream of air over a relatively large area through which the needles operate. It has been found, for example, that a machine having three needles spaced across a width of about ¾ of an inch may be effectively cooled for the purposes indicated, and to substantially the same extent, by a stream of air discharged uniformly and continuously during the operation of the machine at a rate of anywhere between 20 and 55 feet per second from a nozzle about ¾ of an inch in diameter. Thus in forming a seam 30 inches long in a four ply strip of blue denim, it was found that plain steel needles were heated to a dark straw temper color when operated at a speed of 3200 R. P. M. with no cooling air employed. However, the machine could be operated at a speed of about 3800 R. P. M. under the same conditions and with the same effect upon the needles when cooling air was blown from a ¾" nozzle over a relatively wide area around the needles at velocities ranging between 20 and 55 feet/sec. This was an increase in speed of nearly 20%. Reasonably satisfactory results, i. e., about 10% increase in permissible speed, may be obtained with air velocities as low as 10 feet/sec., while at velocities above 55 feet/sec., up to say 100 feet/sec., somewhat greater improvement results than in the range first mentioned.

An important feature of the invention is that air in sufficient quantity and at velocities up to at least 65 feet/sec., may be provided by a simple blower of such diameter and construction as to place substantially no additional burden upon the motor which operates the machine. For example, a simple blower having an impeller of about six inches diameter and revolving at a speed of 3450 R. P. M. will have a blade tip speed of 90 feet/sec. Allowing for a 20%, or even greater, slippage of the air past the impeller blades it will be seen that the desired air velocities are readily obtainable. The width and form of the impeller blades should, of course, be such as to insure an adequate supply of air under the conditions mentioned to cause a continuous stream to issue from the ¾" jet at the velocity desired. In this connection, moreover, it is desirable that the connections from the blower to the jet be such that a minimum of resistance will be developed to the flow of the air, so that the development and delivery of the air stream is substantially noiseless. No attempt should be made to increase the velocity of flow by any substantial reduction in the cross sectional area of these connections at any point. In this way a relatively high blower efficiency is maintained and little additional load is placed upon the operating motor of the machine. Furthermore, the necessity of employing a multi-stage blower is avoided and the diameter of the blower may thus be held within desirable limits. The latter is an important consideration, since the centrifugal forces acting at the required high speeds are relatively great and would necessitate an objectionably heavy rotor structure if the diameter were greatly increased. If the rotor is required to be of relatively heavy construction, its inertia will interfere with quick starting and stopping of the machine and will also require more power for its operation.

In the operation of the machine under the preferred conditions mentioned, the needles reciprocating at high speeds, say between 4000 and 5000 R. P. M., are constantly traveling through an ever changing atmosphere of cooling air throughout the time that the various portions of the needle are exposed at the entrant side of the work, i. e., above the work supporting surface. A sufficiently good heat exchange appears to be provided at the relative speeds of movement of the needle and air, under these conditions, to produce a highly effective cooling action even though the actual velocity of the air is not high.

Another important aspect of the invention is the elimination or substantial reduction of thread scorching. When the needle temperature is permitted to rise unchecked, at high speeds of operation, serious injury is likely to be done to the thread, especially during the interim between the formation of successive seams. It is apt to be weakened by the scorching action of the needle and sometimes to such an extent that it breaks at frequent intervals in the course of seam formation. Such thread breakage is apparently due not only to the actual weakening of the thread by the scorching but also to the tendency of the thread to stick and develop greater resistance to movement through the eye of the needle when the latter becomes overheated. The thread breakage difficulty is particularly pronounced when the machine is stopped abruptly after the formation of a relatively long seam. The accumulated heat of the operation leaves the needle at an objectionably high temperature and a bad burning action takes place at the point on the thread which remains in the eye of the needle as the machine comes to rest. Apparently the scorching action takes an appreciable period of time and therefore is not so serious when the thread is constantly shifting through the needle eye during operation of the machine. But sufficient time for an objectionable burning action is allowed when the machine is stopped, as between successive seaming operations.

By reducing the temperature of the needle between 50 and 100° F., or more, through the use of the cooling blast, the deleterious thread scorching action of the needle may be very much reduced if not altogether eliminated. Complete elimination of the scorching action at a particular speed of operation of the machine requires a somewhat higher velocity of flow of the cooling air than is required to prevent injury to the needles themselves. This is particularly the case when the air blast is discontinued upon the stopping of the machine. Under this condition the heat retained by the needle, even though it is cooled while in operation, is sufficient to burn the thread to a certain extent. It is therefore desirable, for maximum protection of the thread, to provide a continuous cooling blast so long as the driving motor of the machine is in operation. However, substantial benefit from the standpoint of thread protection is obtained when the air blast is directed against or around the needles only so long as the machine is in operation, particularly if the cooling stream has a velocity in the neighborhood of 70 feet/sec., or more.

Other objects, features and advantages of the invention will appear from the detailed description of an illustrative form of apparatus embodying, and capable of performing in accordance with, the invention, which will now be given in conjunction with the accompanying drawings, in which:

Fig. I is a perspective view of a sewing machine of the feed-off-the-arm type, supported by a table top, embodying the improvement of the present invention.

Fig. II is an enlarged view, in side elevation of the blower and driving means therefor, forming a part of the invention.

Fig. III is a vertical, transverse, central section through the blower.

Fig. IV is a detail view in elevation, showing a portion of the end of the overhanging arm of the sewing machine and the associated devices.

Fig. V is a schematic view, in plan, illustrating the relative positions of the work supporting arm and the nozzle for delivering the blast of cooling air, and

Fig. VI is a schematic view, in elevation, illustrating the relative positions of the needles and the nozzle for delivering the blast of cooling air.

Referring now to the drawings, there is shown in Fig. I an illustrative form of sewing machine 10, to which the invention has been applied. This sewing machine is suitably mounted upon a table 11. The machine may be of any appropriate construction, the form illustrated being of the type more fully disclosed in the pending application of Norman V. Christensen, Ser. No. 405,539, filed August 5, 1941. It includes a base portion 12 from which extends, laterally, an integral work supporting arm 13. A vertical standard 14 secured to the base 12 has integrally connected therewith at its top a laterally extending, overhanging arm 15 carrying at its free end a needle head which overlies the free end of the work supporting arm 13. At the needle head end of the arm 15, there is mounted, for vertical movement, presser means 16 carrying presser foot 17 at its lower end, said means being urged downwardly by a spring, not shown. The presser foot urges the work against a throat-plate carried by the work supporting surface 19 of the arm 13. Beneath the throat-plate suitable work-feeding devices, of the type disclosed in said Christensen application, are provided. Also mounted in the needle head is a vertically reciprocable needle bar 20 which carries at its lower end a series of needles 21, three such needles being shown in Fig. IV. The invention is particularly applicable to such a multiple-needle machine. Any suitable means, such as those disclosed in said pending Christensen application, may be provided for reciprocating the needle bar in the operation of the machine. Simultaneously therewith suitable complemental stitch-forming means, such as disclosed in said Christensen application, are operated beneath the work supporting surface, thus producing a seam or plurality of lines of stitching of appropriate character. The needle threads 22 entering into these lines of stitching are fed from suitable sources of supply, not shown, and are led over or through appropriate guides and then to and through the eyes of the needles 21. In their travel from the sources of supply to the needles, the threads are passed through suitable take-up means, such as an arm 23, secured to the needle bar and hence operated upon each cycle of operation of the machine to take up the slack in the thread at the desired times. Due to the operation of the take-up 23 and the reciprocation of the needle bar 20, as well as the action of the complementary stitch forming devices and the general advance of the thread in seam formation, a more or less constant sliding of the needle threads through the eyes of the needles takes place during the operation of the machine.

Power for driving the various operating devices of the machine, including the needle bar 20, the complementary stitch-forming devices, and the work feeding devices, is supplied by means of a belt 24, which at its upper end is connected with a suitable driving wheel or pulley on the machine. The power so delivered to the machine is carried to the operating devices by appropriate gearing and shafts, such as disclosed in said pending Christensen application. The belt 24 is driven by a pulley 25 splined to a shaft 26 forming part of a transmitter unit 27, of any suitable construction, including a driving motor 28. The transmitter unit may, for example, be of the type disclosed in the patent to Peets et al No. 2,004,055, granted June 4, 1935. A pair of nuts 26a may be provided for retaining the pulley on the shaft 26. The transmitter unit is suitably suspended beneath the table 11 by means of a bracket 29. The transmitter unit may be controlled in a well known manner by an arm 30 connected in any suitable way with a foot treadle (not shown). This construction is such that upon rocking the foot treadle and the arm 30 against the action of a spring 30a, a friction clutch member 30b secured to the shaft 26 and forming part of the unit is shifted toward the left (Fig. II) to connect the motor 28 with the shaft 26 to drive the pulley 25.

Alined with the shaft 26 is a blower having a casing or housing 31 supported from the transmitter frame and the supporting bracket 29. For this purpose a bracket 32, secured to the transmitter frame by a screw 32a and having a portion curved over the periphery of the pulley 25, has its opposite end secured by a screw 32b to the blower casing 31. Another bracket 33, preferably of U-shape, attached to the blower casing by means of a screw 34, or the like, and attached to the transmitter frame by means of a screw 35, assists in retaining the blower rigidly in place. As illustrated in Fig. III, the blower housing is preferably formed in two sections, 31a and 31b, which are secured together by means of screws 31c.

The impeller of the blower may be connected directly with the pulley 25, to be driven whenever the latter is operated. This may be accomplished by connecting the flange 36 of a sleeve or hub 37 to the outer vertical side wall of the pulley by means of a number of screws 38. The sleeve or hub 37 is axially alined with the shaft 26 and extends through a central opening in the wall of the inner section 31a of the blower housing. Within the housing there is secured to the sleeve 37, by means of a screw 39, a multiple-vaned impeller 40 of any suitable construction. The vanes of the impeller are of such length and shape as to develop the desired volume and velocity within the ranges noted above. In the operation of the impeller air will be drawn into the housing 31 through the opening 31d in its outer wall and will be discharged through an outlet 41 at the periphery of the housing. If desired, the outlet 41 may be connected directly with a tube 42 forming part of the conduit for delivering the cooling air to a point adjacent the needles. However, it has been found desirable, for minimizing the noise, as far as possible, to provide an intermediate funnel member 43 between the outlet 41 and tube 42. This funnel is preferably carried by the outlet 41 by means of a number of spring clips 44, portions of which are passed through apertures in the conical wall of the funnel member and are then extended

parallel with the axis of the member to provide fingers adapted to frictionally engage the inner periphery of the outlet 41. As best shown in Fig. II, the arrangement is such that a space or passage is provided between the outlet 41 and the inner wall of the funnel member. Tube 42 is connected with the small end of the funnel and for this purpose may simply be frictionally held by a reduced cylindrical extension of the funnel. The tube passes upwardly through an aperture in the table 11 and then through a portion of the base 12 of the sewing machine and is connected with an extension of the conduit, which may be in the form of a flexible hose 45, extending to a point adjacent the needle head of the machine. The hose 45 may be integral with the tube 42 and in that event the latter portion of the conduit may be stiffened by the insertion of a metal or plastic member in the hose. A clamp or strap 46 serves to attach the hose to the side of the vertical standard while a strap 47 fastens the forward end of the hose to the underside of the needle head.

The conduit is preferably of the same inside diameter throughout its length and adjacent the discharge end is directed in such a way as to cause a broad stream of the cooling air to be blown across the entire region through which the needles 21 operate when they are above the work support. If desired, a nozzle may be provided at the end of the conduit but in any case the outlet opening 48 should be of relatively large cross-sectional area and adapted to deliver the stream of cooling air completely across the width of the multiple needles. Moreover, as indicated, the stream should have substantial depth so that the needles will be subjected to the cooling action throughout their movement above the work support. It has been found desirable, as indicated in Fig. V, to so direct the discharge end of the conduit 45 that in plan the air stream is projected at an angle of about 45° to the vertical plane of the multiple needles. This angle may be reduced, if desired, to about 30° or it may be increased to 90°, in which case a slightly more even distribution of the air around all of the needles is provided. However, the preferred arrangement disclosed provides satisfactory distribution and at the same time so positions the discharge end of the conduit as not to interfere with the manipulation of the material being stitched. It also directs the air in such a way as not to discommode the operator. As shown in Fig. VI, the elevational disposition of the discharge end of the conduit is preferably such that its axis is approximately 45° to the horizontal. The distance X, Fig. VI, from the end of the conduit to the point at which the center needle enters and emerges from the work support may conveniently be about 1 to 3 inches. When the discharge end of the conduit is positioned as indicated with the distance X about 2 inches, the limits of the zone in which a substantial flow of air occurs are indicated, by the broken lines 49 and 50 in Fig. IV. The stream has some tendency to fan out as it leaves the conduit and it is also deflected to some extent upon striking the work supporting surface, thus providing a relatively deep cooling zone through which the needles are operated. This zone is considerably deeper than the diameter of the conduit.

In a typical unit having the preferred construction heretofore set forth, in which the blower is provided with an impeller six inches in diameter, driven at a speed of 3450 R. P. M., and in which the conduit 42, 45 has an inside diameter of about ¾ of an inch, it has been found that a stream of air may be projected along the path indicated in a volume of about .2 cubic foot per second. This corresponds with a velocity of flow of about 65 feet per second through the conduit and calls for a blower efficiency of about 70% since the blade tip speed is about 90 feet/sec. Depending upon the duty to which the machine is to be subjected, the quantity of cooling air supplied may be varied somewhat. If the machine utilizing the invention is provided with only two needles, and the cooling requirements are not too severe, the diameter of the conduit may be reduced somewhat but it is preferable, in any case, to have the discharge end of the conduit somewhat greater in width than the total spacing of the needles. If the diameter of the conduit is greatly reduced, the quantity of air which it is capable of delivering from a simple blower of the type illustrated will be reduced by more than the square of the reduction in diameter. This is due to the increased friction in the smaller tubing. Accordingly, a much higher pressure is required to force a given quantity of air per second through a small tube than through a large one. By way of illustration, it has been found that air may be supplied at the rate of about .19 cubic foot per second through an unrestricted conduit of ¾ inch diameter at a tube pressure of only 1.3 inches of water above atmospheric. To deliver the same quantity of air through a ⅜ inch tube requires a pressure of 6.8 inches of water. This pressure cannot be attained by a simple blower within the speed and dimensional limitations imposed by present-day sewing machine construction.

To further assist in explaining the principles of the present invention, certain illustrative examples of typical and test operations of the improved cooling means and method will now be described.

In the normal operation of a unit constructed in accordance with the preferred disclosure above set forth, a feed-off-the-arm machine of the type illustrated was operated at 5300 R. P. M. in the felling of twill army shirts. Simultaneously a competing machine was operated at 4600 R. P. M. in performing the same type of operation. This competing machine was not equipped with the improved needle cooling system. It was found that the needles of the machine constructed and operated in accordance with the invention were 63° F. cooler than those of the competing machine.

In another test a three-needle, flat-bed machine, embodying the same improved needle cooling devices, was operated at 5000 R. P. M. on four-ply blue denim stitched in a continuous coil. The machine was operated, without a stop, for one hour using plain steel needles of .054" diameter. No needle breakage and not a single thread breakage occurred. However, when the same machine was operated at the same speed and in the same manner, but with the substitution of chromium-plated needles for the plain steel needles and with the needle cooling system rendered inactive, the needle thread broke on an average of 26 times an hour.

To determine the effect of variations in the rate of flow of the cooling air, the flat-bed machine mentioned above was operated at different speeds upon a strip of blue denim, four ply, and 30 inches long. Determinations were made of the speed of operation at which the needles of the machine would just reach a dark straw color under varying rates of flow of the cooling air. It was

found that when no cooling air was supplied, the needles attained the dark straw color at 3200 R. P. M. When cooling air was supplied at the rate of 25 feet per second, through the ¾ inch diameter conduit, having its discharge outlet 1½ inches away from the center needle point at the top of its stroke, a speed of 3800 R. P. M. was attained before the needles reached the dark straw color. Under the same conditions, except for an increase in the rate of air flow to 35 feet per second, it was found that the same speed could be attained, i. e., 3800 R. P. M., before the needles reached the dark straw color. So also, the same result was found when the rate of air flow was increased to 52 feet per second. Upon increasing the air flow to 64 feet per second, however, with the other conditions remaining the same, it was found that a speed of 3900 R. P. M. could be attained before the dark straw color of the needles was reached.

In another series of tests on the same machine, determinations were made as to the rate at which the needles became heated, with and without provision of cooling air in accordance with the invention. These tests indicated that the benefit of the cooling action was not so great in the formation of short seams, 12 inches long, but the benefit increased rapidly up to the formation of seams 36 inches long and from that point the benefit continued to increase, but more gradually, in the formation of longer seams. For example, in forming a 12 inch seam without the benefit of cooling air, the needles were heated to 300° F. When cooling air was supplied at the rate of 52.4 feet per second, however, the needles attained a temperature of only 250° F. in forming a 12 inch seam. In similarly forming a 24 inch seam, the non-cooled needles reached 400° F. while the cooled needles reached only 300° F. In forming the 36 inch seam, the non-cooled needles were heated to 475° F. while the cooled needles reached only 350° F. In forming a 48 inch seam, the two temperatures were 510° and 360° F., respectively, while in forming a 72 inch seam the respective temperatures were 550° and 375° F. In similar tests in which the machine was operated at 3900 R. P. M., it was found that in forming 12 inch, 24 inch, 36 inch, 48 inch and 72 inch seams, respectively, the temperatures attained by the uncooled needles were 375°, 525°, 600°, 625°, and 640°, while the temperatures of the cooled needles, under the same conditions, were 300°, 400°, 475°, 510° and 550° F.

The flat-bed machine hereinabove mentioned was subjected to a further series of tests to determine the effect of increased speeds of operation upon the temperature of the needles without the supply of cooling air and with the delivery of cooling air, in accordance with the invention, at two different velocities, i. e., 45 feet per second and 68 feet per second. In this series of tests a 48 inch section of four-ply blue denim was stitched. The needles employed were plain steel and .049" in diameter. A specially constructed thermocouple was applied to one of the needles immediately upon the completion of an operation to determine its temperature. In order to compensate for the cooling of the needle in the time required to apply the thermocouple, a series of readings was taken at the conclusion of each operation. The first reading was taken six seconds after completion of a seam and four other readings were taken at three-second intervals. By plotting a straight line through the readings thus taken, on a temperature against time curve, the

original temperature of the needle upon completing the seam was determined. In those operations in which cooling air was supplied in accordance with the invention, the air blast was turned off just before the machine was stopped. The results obtained were as follows:

	Needle Temperature Degrees F. Corresponding with—			
	500 R. P. M.	1500 R. P. M.	3000 R. P. M.	4400 R. P. M.
	Degrees	*Degrees*	*Degrees*	*Degrees*
No Air	250	410	600	700
Air at 45' per second	215	370	565	660
Air at 68' per second	200	320	530	640

In further tests of the same machine, observations were made as to the condition of the needle thread upon the successive stoppages of the machine. In all of these tests the machine was operated at 4500 R. P. M. and a 36 inch seam was formed in four-ply, blue denim. These operations subjected the motor of the machine to substantially the limit of the load which should be imposed upon it. In the first series of operations no cooling air was supplied. The machine was stopped abruptly upon completion of each seam and an observation made as to the condition of the thread at the point passing through the eye of the needle. It was found that the thread was rather badly scorched at the points indicated, although it did not break in the course of the operations. A similar series of operations was performed in which cooling air was delivered, in accordance with the invention, to the zone through which the needles operate on the entrant side of the work. As a result of these tests, it was found that under the severe conditions involved, air delivered through the conduit at a velocity of 70 feet per second overcame the thread-scorching effect almost completely. Substantial improvement in the condition of the thread was noted at even slower air velocities. In fact, in certain operations in which the cooling air was supplied to the needle even after the stopping of the machine, it was found that a velocity of 35 feet per second was adequate to prevent any substantial scorching of the thread. It is to be noted in connection with the foregoing that the delivery of air at 70 feet per second is well within the range of a simple type of blower having an impeller of approximately six inch diameter, such as proposed in connection with the preferred embodiment of the invention.

While an illustrative construction and mode of operation in accordance with the present invention have been described in considerable detail, it will be understood that numerous changes may be made in both the construction and operation without departing from the general principles of the invention. Thus, as indicated in the foregoing, while it is preferred to so mount and arrange the blower as to drive it only so long as the machine is in operation, the arrangement may be such as to continue the operation of the blower even when the machine is stopped. For this purpose the blower may be operated continuously so long as the motor is in operation. So also, in lieu of mounting the blower upon the transmitter unit with its axis in line with the belt pulley shaft of the latter, it may be mounted on a separate axis and provided with a separate pulley adapted to be driven, for example, by the same belt which

connects the transmitter pulley with the pulley of the sewing machine. Moreover, while the invention has been illustrated and described in connection with the more common type of sewing machine, in which the work supporting surface is disposed horizontally, it will be appreciated that the invention is applicable also to machines in which the work supporting surface is otherwise disposed. The various dimensions and other values hereinbefore mentioned are also subject to some variation within the scope of the invention. Thus, the quantity of air delivered in the cooling stream may well be varied between .1 and .3 cubic feet per second or even between .05 and .4 cubic feet per second under some circumstances. The diameter of the conduit may be varied between one-half and one inch or even wider limits. The velocity of the air in the conduit may vary between 10 and 100 feet per second and should insure a flow of substantially 10 feet per second and upwards over the major portion of the area traversed by the needles. The distance of the discharge end of the conduit from the point of penetration of the needles into the work may well vary from 1 to 3 inches or even more, depending upon the circumstances. Within the conduit the air may be under a pressure of, say, between 1 and 4 inches of water above atmospheric. It will be understood that variations in atmospheric conditions, such as altitude, humidity, temperature, barometric pressure, and the like will influence the values and dimensions to be employed under particular circumstances. The terms and expressions used herein have been employed as terms of description and not of limitation.

I claim:

1. In a sewing machine a work supporting surface, complementary stitch forming means including a reciprocable needle arranged to operate on work supported on said surface, means for actuating said stitch forming means, an electromotor transmitter unit for driving said actuating means, said unit comprising a driving motor and a driven shaft, means connected directly with said unit for producing a continuous current of air, said last mentioned means comprising a rotary blower having a rotor fixed to said driven shaft, means for shifting said driven shaft bodily incident to its connection and disconnection with the driving motor, a blower housing cooperatively associated with said rotor, said housing being mounted on said transmitter unit and having sufficient clearance with respect to said rotor to permit bodily shifting thereof with said shaft, and a conduit for delivering said current of air to the zone through which said needle operates.

2. In a needle cooling apparatus for sewing machines a rotary blower including a rotor fixed to the driven shaft of a conventional electromotor transmitter unit, means for shifting said driven shaft endwise incident to its connection and disconnection with the driving motor, a blower housing carried by said transmitter unit surrounding said rotor, said housing having sufficient side clearance for said rotor to permit endwise shifting thereof with said shaft, and means for conducting the stream of air generated by said blower to the zone of operation of the needle or needles of a sewing machine driven by said transmitter unit.

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