Dec. 30, 1969 R. M. KAPLAN 3,486,472

SEWING MACHINE PNEUMATIC NEEDLE THREADERS

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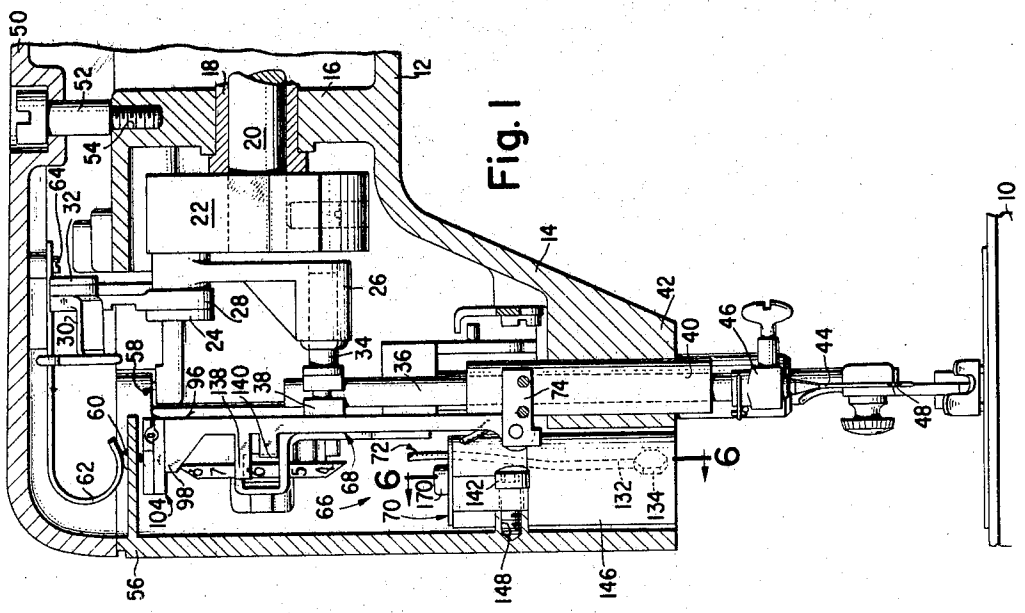


Fig. 1

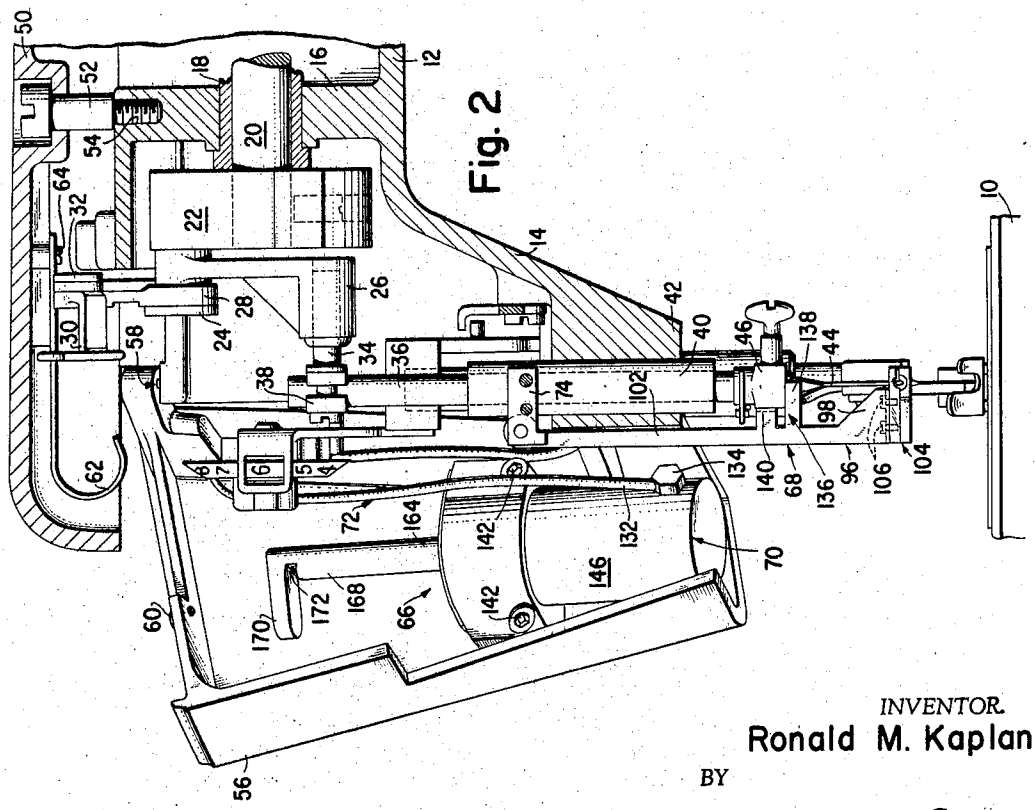


Fig. 2

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Fig. 3

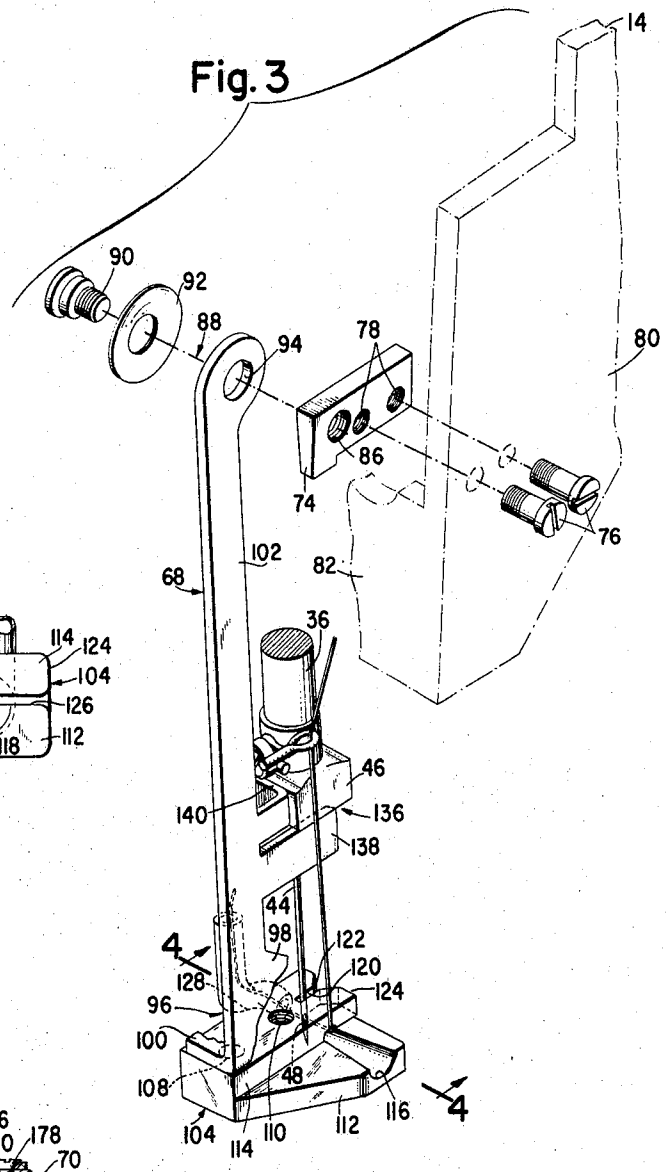


Fig. 5

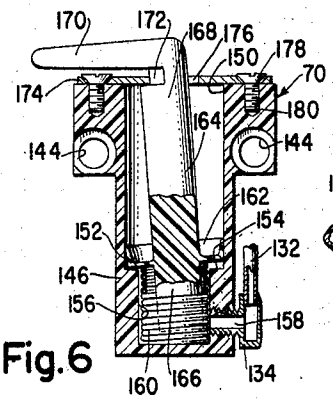


Fig. 6

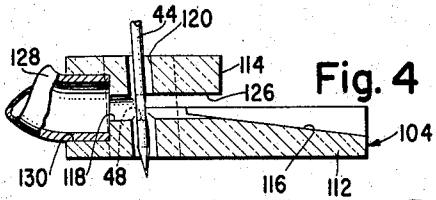


Fig. 4

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SEWING MACHINE PNEUMATIC NEEDLE THREADERS

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Fig.7.

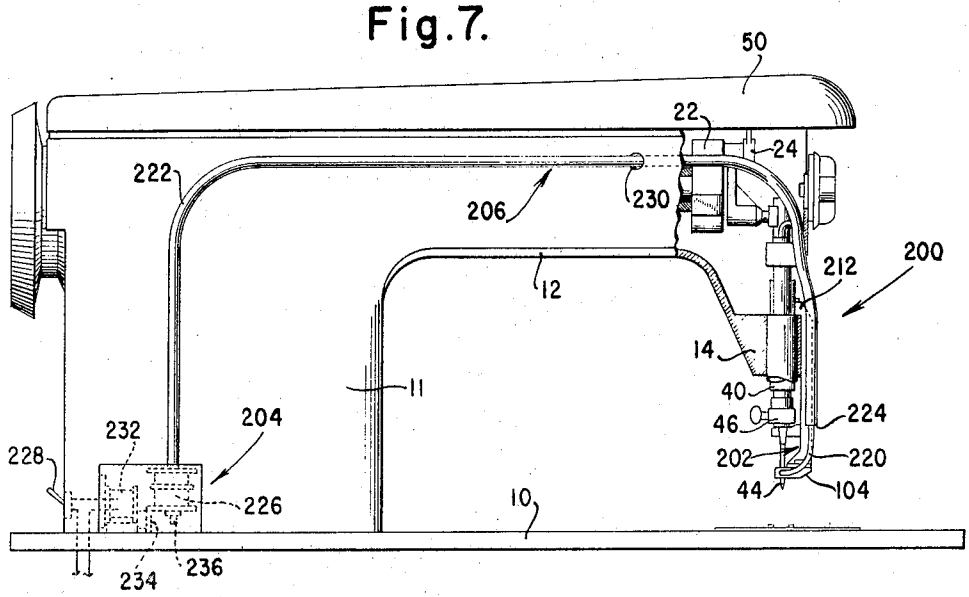


Fig.8.

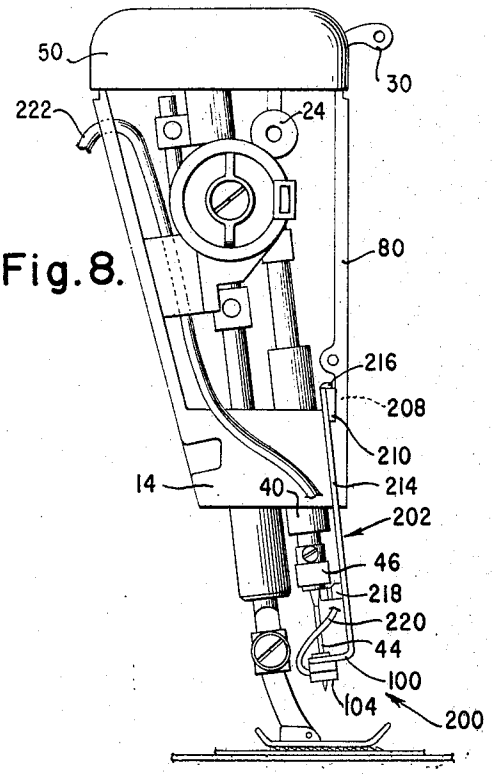
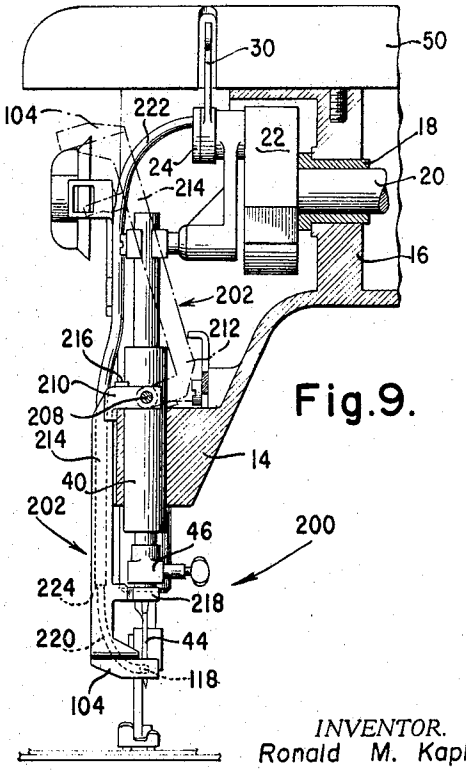


Fig.9.



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3,486,472

SEWING MACHINE PNEUMATIC NEEDLE THREADERS

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Continuation-in-part of application Ser. No. 584,148, Oct. 4, 1966. This application July 10, 1967, Ser. No. 659,265

Int. Cl. D05b 87/00

U.S. Cl. 112—225 10 Claims

ABSTRACT OF THE DISCLOSURE

This disclosure relates to a pneumatic needle threader adapted for use in a sewing machine.

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of my copending application, Ser. No. 584,148, filed Oct. 4, 1966 and now abandoned for "Vacuum Needle Threader for Sewing Machines."

BACKGROUND OF THE INVENTION

Heretofore, threading of the needle was done by hand or with the aid of a guide or hook device. Either method had obvious deficiencies ranging from the poor eyesight of the operator to doubling the thickness of the thread required to be drawn through the needle. A primitive pneumatic device of the vacuum type was used which had some of the above disadvantages in that its positioning was left to the operator, but further it required establishing an air seal at the point of contact. The pressure exerted in maintaining the seal undoubtedly caused the breaking of many needles and the resultant loss of the time sought to be saved.

SUMMARY OF THE INVENTION

In accordance with the present invention, a pneumatic needle threader adapted for use in a sewing machine having a frame provided with a head in which is journaled a needle bar with needle eye reference means and carrying an eye pointed needle. The pneumatic needle threader includes a pneumatic pump means and a lever having an orifice extending through one end. The lever is swung from a pivot connection in the head to an operative position with its free end adjacent to the needle. In the operative position, orifice positioning means provided on the lever co-act with the needle eye reference means on the needle bar to align the needle eye in proximity to the open end of the orifice. A conduit means connects the pneumatic pump and the orifice so that with the lever in the operative position, thread placed adjacent to said eye will be threaded through said eye on the operation of said pump means.

An object of the present invention is to provide an improved pneumatic needle threader mechanism which overcomes the prior art disadvantages; which serves to thread the needle; which may be connected to the sewing machine and stored out of sight ready for use; which may be accessible for use by opening the normally closed face plate of the head; which uses a pivotally connected lever that is swung as much as 180° into operative position; which positions needle eye reference means of the needle bar to align the needle eye into threading position while protecting against needle breakage; and which insures placing the needle eye in proximity to an orifice in the free end of the lever.

Another object of this invention is to provide an improved pneumatic needle threader mechanism which substantially eliminates failure of the mechanism due to conduit breakage by minimizing the movement of the flexible conduit; which may use a vacuum pump that is manually operated and spring loaded and adapted to be mounted in the face plate; which may have a manual vacuum pump capable of being locked in the loaded position; which may have a switch operated vacuum pump; which is simple, economical and reliable.

Other objects and advantages will be apparent from the following description of several embodiments of the invention and the novel features will be particularly pointed out hereinafter in the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

This invention is illustrated in the accompanying drawings in which:

FIGURE 1 is a vertical sectional view in part of the sewing machine's head embodying the invention with the lever in a stored inoperative position.

FIGURE 2 is a vertical sectional view in part of the sewing machine's head embodying the invention with the front plate open and the novel pneumatic needle threading mechanism in operative position.

FIGURE 3 is an exploded detailed view of the improved lever in operative position.

FIGURE 4 is an enlarged sectional view of the free end of the improved lever taken along line 4—4 of FIGURE 3.

FIGURE 5 is a front elevation in part of the free end of the improved lever.

FIGURE 6 is a vertical section in part of the improved pneumatic pump taken along line 6—6 of FIGURE 1.

FIGURE 7 is a rear view, partly in section, of a sewing machine with the face plate removed in which another embodiment of the present invention is illustrated.

FIGURE 8 is a sectional view taken along line 8—8 of FIGURE 7.

FIGURE 9 is a front vertical sectional view of the head of the sewing machine illustrated in FIGURE 7.

DESCRIPTION OF THE INVENTION

In the illustrated embodiments of the invention the sewing machine may be of any conventional type, such as is shown in the drawings, particularly FIGURES 1, 2 and 7, having a bed **10**, a standard **11** (see FIGURE 7) extending vertically from one end of bed **10** and from which is cantilevered a bracket arm **12** that terminates in a head **14** overhanging the bed.

The embodiment of the invention illustrated in FIGURES 1–6 and 7–9 will be depicted in the same type of sewing machine in which the bracket arm **12** has a rib **16** into which bearing **18** is mounted. The actuating shaft **20** is journaled in bearing **18** and has one of its ends connected to a source of rotatable power (not shown) and the other end has mounted thereon a counterbalanced crank **22**. Crank pin **24** connects a needle bar reciprocating link **26** and a needle thread take-up link **28** to the counterbalanced crank **22**. Crank pin **24** connects a needle bar reciprocating link **26** and a needle thread take-up link **28** to the counterbalanced crank **22**. A take-up lever **30** is suitably connected to the needle thread take-up link **28** as by pin **32**. Link pin **34** extends from engagement in needle bar reciprocating link **26** to have its outer end fixedly connected to the upper end of a needle bar **36** by a needle bar link clamp **38**. The needle bar **36** is journaled for vertical reciprocation in bearing **40** vertically disposed in bottom wall **42** of head **14**.

The upper end of an eye pointed needle **44** is connected to the lower end of needle bar **36** by a suitable needle eye reference means such as a needle clamp **46**. An eye **48** adapted to receive thread is formed in the lower end of the needle **44**.

On rotation of shaft **20** the connecting components **22** and **26** will cause the vertical reciprocation of needle bar **36** and its connected needle **44**.

Both bracket arm **12** and head **14** have an open top which is closed by a cover **50** removably connected and fixedly held in place by screws **52**, only one of which is shown, threaded into threaded hole **54** in rib **16**. Cover **50** extends over the end of head **14** and this additional open area is closed by a substantially "U" shaped face plate **56** pivotally mounted as at **58**. The normally closed position of face plate **56** is maintained by a spring catch **60** being yieldably engaged by a retaining spring **62** connected to cover **50** by screw **64**. Slight pressure will open face plate **56** so as to provide ready access to the interior of head **14**.

This invention is applicable to pneumatic forms of needle threading. The embodiments of FIGURES 1–6 and 7–9 depict vacuum type needle threaders which serve to draw the thread through the eye of the needle. However it will be understood by those skilled in the art that the scope of the present invention extends to pneumatic needle threading by means of blowing the thread into said eye so as to accomplish the pneumatic threading of said eye. In other words though a vacuum pump has been shown and described, it could readily be replaced by a blower type pneumatic pump with little or no modification of the other components and provide the pneumatic needle threading.

The embodiment of the novel pneumatic needle threader mechanism, generally designated as **66**, is illustrated in FIGURES 1–6 and has a lever **68**, a pneumatic pump means in the form of a vacuum pump **70** and a conduit means **72** connected therebetween.

A mounting plate **72** shown in FIGURE 3 is fixedly connected by two screws **76** threaded into threaded holes **78** to the front vertical wall **80** of head **14**. Mounting plate **74** extends outwardly from its fixed connection over a low vertical side wall **82** formed integrally with bottom wall **42**. Also, a third threaded hole **86** is partially overhung and somewhat larger than holes **78**, has its center serve as an axis of oscillation, designated generally as **88**, for lever **68**. Lever **68** is pivotally connected to plate **74** by a screw **90** passing through washer **92** and pivot hole **94** to threadingly engage hole **86**. This overhung pivot connection permits lever **68** to describe an arc of approximately 180° about the axis of oscillation **88** from its vertical upwardly extended stored inoperative position shown in FIGURE 1 from which after opening of face plate **56**, lever **68** is swung to the vertical downwardly extended operative position shown in FIGURE 2.

The free end **96** of lever **68** has a web **98** that terminates in a rearwardly extending flange **100**, perpendicular to the stem **102** of lever **68**. A foot **104** is fixedly connected to flange **100** by screws **106** which pass through holes **108** of flange **100** to thread into threaded holes **110** of foot **104**.

Foot **104** as shown in FIGURES 3, 4 and 5 has a front section **112** that extends from a shoulder **114**. A conical entrance **116** is formed on front section **112** with the taper in the direction of the shoulder. The conical entrance **116** leads to an orifice **118** that extends through foot **104** in a plane substantially perpendicular to stem **102**.

A needle slot **120** having a tapered entrance **122** extends inwardly from edge **124** of foot **104** in a plane normal to stem **102** and intersects orifice **118**. Needle slot **120** is so disposed that on placing lever **68** in the operative position slot **120** will lie in the same vertical plane as does needle **44**. This permits needle **44** to enter slot **120** on lever **68** being swung vertically downwardly to the operative position as described more fully hereinafter.

A thread removal slot **126** lies in a plane substantially perpendicular to stem **102** and creates an opening from orifice **118** to edge **124** and from slot **120** to shoulder **114**.

The end of orifice **118** remote from shoulder **114** has a rigid conduit **128** connected into counter-bore **130**. Conduit **128** will extend from orifice **118** along stem **102** in the direction of axis of rotation **88** adjacent which it will have its other end disposed. A flexible conduit **132** as shown in FIGURES 2 and 6 has one end fixedly disposed in a coupler **134** connected into vacuum pump **70** and extends upwardly therefrom to a junction (not shown) with rigid conduit **128** adjacent to the axis of rotation **88**.

The rigid conduit **128** and flexible conduit **132** combine to make up conduit means **72**. The possibility of conduit wear or failure is reduced by having rigid conduit **128** travel with lever **68** and connect to flexible conduit **132** immediately adjacent axis of rotation **88** so that the interconnection remains in head **14**. Also, the movement of the flexible conduit **132** is limited to that corresponding to the small radius measured from the junction to the axis of rotation **88**.

Intermediate the pivotal connection of lever **68** and foot **104** an orifice positioning means, generally designated **136**, is disposed on lever **68** and includes a seat lug **138** and a stop lug **140**, each extending outwardly from stem **102**. The vertical distance between the bottom of the needle clamp **46** and the needle eye **48** is a fixed distance. The vertical distance between the seating edge of seat lug **138** and orifice **118** is predetermined to coincide with said fixed vertical distance. The horizontal distance between the edge of the needle clamp **46** to be abutted by stop lug **140** and the vertical axis of needle **44** is also a fixed distance. The horizontal distance between the abutting edge of stop lug **140** and orifice **118** is predetermined to coincide with said fixed horizontal distance. Placing lever **68** in the operative position with needle clamp **46** seated on seat lug **138** and abutted by stop lug **140** will cause needle **44** to be disposed in needle slot **120** with needle eye **48** in alignment with and in proximity to orifice **118**. Stop lug **140** serves to negate needle **44** breakage caused by excessive or over swinging of lever **68** by preventing needle **44** from contacting the walls of slot **120**.

Vacuum pump **70** as shown in FIGURES 1, 2 and 6 is mounted in face plate **56** by screws **142** passing through holes **144** in its housing **146** to thread into threaded holes **148** in the face plate.

A cylinder **150** as shown in FIGURE 6 is formed in housing **146** into which is disposed a piston **152** in sealingly engagement therewith. A shoulder **154** is formed in the lower portion of cylinder **150** to act as a stop which prevents piston **152** from further descent. The section below shoulder **154** is of smaller diameter and defines a cavity **156**. Coupler **134** has a passage **158** which communicates cavity **156** with flexible conduit **132**. A compression coil spring **160** is disposed in cavity **156** and extends upwardly into the cylinder to engage piston **152**. Piston **152** has a yieldable upwardly extending annular edge **162** that sealingly engages cylinder **150**. Rod **164** is formed integrally with piston **152** and has a vertical downwardly extending lower section **166** and a vertical upwardly extending upper section **168**. The lower section **166** is disposed within spring **160** to act as a retainer. The upper section **168** of rod **164** terminates in an outwardly turned handle **170** below which a recess **172** is formed. The distance from the underside of piston **152** to the underside of handle **170** coincides with the distance from shoulder **154** to the top of cylinder **150**. A cylinder cover **174** having a round hole **176** of slightly larger diameter than that of rod **164** so as not to bind the vertical travel rod **164** is connected to housing **146** by screws **178** threaded into holes **180**. With piston **152** abutting shoulder **154** to latch or lock vacuum pump **70** in this "loaded" position, the handle **170** is tilted to engage cover **174** in recess **172** of rod **164**. The yieldable edge **162** permits such tilting without adversely effecting the sealing engagement of piston **152** and cylinder **150**. The upward urging of spring **160** will act to

press the lower edge of the recess **172** against cover **174** and prevent accidental "unloading" of the vacuum pump **70**. To operate vacuum pump **70**, the handle is placed vertically so as to remove the cover **174** from recess **172** thus permitting the compressed spring **160** to force piston **152** in the upward direction and evacuates the cavity **156** and cylinder **150** below the rising piston **152** to produce a vacuum condition in pump **70**, conduit means **72** and orifice **118**. The vacuum pump **70** can be reloaded by depressing and latching the handle **170** to cover **174**. Thread is introduced into the conical entrance **116** and on unlatching handle **170** the vacuum pump **70** will operate to suck the thread through the needle eye **48** and into orifice **118** to vacuum thread the needle, similar to that depicted in FIGURE 3.

To facilitate removal of the now threaded needle **44**, a thread removal slot **126** permits the thread to exit from foot **104** while remaining in eye **48** so that lever **68** may be swung to a vertical upwardly extended stored inoperative position in head **14** as shown in FIGURE 1. The end of the thread in orifice **118** and rigid conduit **128** will be withdrawn therefrom on the rising of lever **68**.

After the vacuum needle threader mechanism **66** has performed the vacuum threading of needle **44** the vacuum pump **70** can be reloaded by depressing and relatching handle **170**. The face plate **56** will be closed with the vacuum needle threader mechanism **66** stored in head **14** in a manner which does not interfere with the sewing operation of the machine and wherein it will remain out of sight ready for its next use.

The embodiment of the novel pneumatic needle threader mechanism, generally designated as **200**, is illustrated in FIGURES 7, 8 and 9 and may be assumed to be associated with the same type of sewing machine as was the pneumatic needle threader mechanism **66**.

Like reference characters shall be used in the embodiment of the invention shown in FIGURES 7, 8 and 9 for like components shown and referred to previously for the embodiment of the invention depicted in FIGURES 1–6.

The pneumatic needle threader mechanism **200** has a lever **202**, a pneumatic pump in the form of an electrically operated vacuum pump **204** and a conduit means **206** connected therebetween.

The lever **202** as shown in FIGURES 8 and 9 is pivotally connected to the head **14** by a shoulder screw **208** that passes through a hole in the lever **202** and stop plate **210** to be threadedly received in the front vertical wall **80** thereof. Thus, in the present embodiment the center of shoulder screw **208** will serve as the axis of oscillation.

The lever **202** does not have an overhung mounting but may still describe an arc of approximately 180° about the axis of oscillation because it is pivotally connected at the end of a short offset leg **212** that is formed perpendicular to and integrally with the main stem **214** of lever **202**. The inoperative position of lever **202** is illustrated in FIGURE 9 by the dotted representation of the same. From its stored position the lever **202** will be swung downwardly until a stop lug **216** extending outwardly from offset leg **212** comes into contact with the upper edge of stop plate **210**, in which position main stem **214** will be substantially vertical.

A seat lug **218** extends outwardly from stem **202** in the same direction as and parallel to offset leg **212**. The seat lug **218** is located at the point on stem **202** which will on seating of the needle clamp **46** thereon permit the eye (not shown) of needle **44** to be aligned with the orifice, designated generally as **118** for the same purposes as was described hereinbefore. The orifice positioning means are defined by stop lug **216** and seat lug **218** which coact with needle eye reference means defined by stop plate **210** and needle clamp **46**.

Once again foot **104** will be suitably connected to flange **100** formed at the free end of lever **202**. Reference may be had to FIGURES 3, 4 and 5 for the details of construction of foot **104**, and therefore need not be repeated. Foot **104** lies in a plane parallel to seat lug **218** and offset leg **212**. Over-swinging of lever **202** is prevented by stop lug **216** which insures the placing of stem **214** in parallel relationship to needle **44** wherein on seating the needle clamp **46** on the seat lug **218** alignment of the needle **44** with the orifice **118** is automatic.

The conduit means **206** is made up of a rigid conduit **220** and a flexible conduit **222** that are suitably connected to each other as at **224**. The free end of rigid conduit **220** is connected to foot **104** in communication with orifice **118**. The free end of flexible conduit **222** is connected to vacuum pump **204** in communication with diaphragm chamber **226** as shown in FIGURE 7. The conduit means **206** will be suitably affixed to the lever **202** so as to prevent the end of rigid conduit **220** from becoming disconnected from orifice **118**.

FIGURE 7 shows the vacuum pump mounted on the top of the bed **10** on the rear side of standard **11** with the manual switch **228** positioned on the side of standard **11** remote from needle **44**, but still within convenient reach of the operator. Flexible conduit **222** is shown extending externally of standard **11** and most of bracket arm **12** before passing through hole **230** formed in bracket arm **12** near head **14**. The flexible conduit **222** after entering hole **230** will pass along the inner side of the rear wall of head **14** so as not to interfere with the normal sewing operation while having sufficient play to permit oscillation of lever **202** from its stored position to its operative position.

The switch **228** electrically connects or disconnects the vacuum pump **204** which is of a conventional design and readily purchasable in the market. The type shown has a solenoid **232** which will alternately operate to draw one leg of an L shaped plate **234**, the other leg of which is connected to the diaphragm shaft **236**. The shaft **236** and consequently the L shaped plate **234** are spring returned to an inoperative position so as to effect a pulsing of the diaphragm (not shown) during alternate operation of solenoid **232**.

The lever **202** is normally in the raised stored position. Accordingly, the needle **44** may be vacuum threaded by opening face plate (not shown) and swinging lever **202** downwardly into its operative position with stop lug **216** abutting stop plate **210** and needle clamp **46** seated on seat lug **218** thus aligning the eye of needle **44** with the orifice **118**. The operator will place the thread adjacent the eye of the needle and orifice **118** and loosely hold it in this general area. The switch **228** is operated to the "on" position to actuate the vacuum pump **204** either before or after placing the thread adjacent the needle eye. With pump **204** in operation a continuous vacuum will exist outside of orifice **118**. The vacuum will draw the thread through the needle eye and into orifice **118**. Thereafter the operator will flip the switch **228** to the "off" position to electrically disconnect the vacuum pump **204**.

Once needle **44** has been threaded and the vacuum pump **204** shut off, the lever **202** may be swung to its stored position within head **14**, so that on closing of the face plate the machine is ready to sew.

It will be understood therefore that various changes in the details, materials, arrangements of parts and operating conditions which have been herein described and illustrated in order to explain the nature of the invention may be made by those skilled in the art within the principles and scope of the invention.

Having thus set forth the nature of the invention, what I claim herein is:

1. In a sewing machine having a frame provided with a head, a needle bar journaled in said head and carrying at its lower end an eye pointed needle, needle-eye refer-

ence means on said needle-bar, a pneumatic needle threader comprising:

(a) a lever having an orifice formed at one end,

(b) means pivotally connecting said lever, at the end thereof remote from the orifice, to said head to permit said lever to be inoperatively positioned remote from the needle-eye and operatively positioned with the orifice aligned with the needle-eye,

(c) pneumatic pump means,

(d) conduit means connecting said pump means to said orifice, and

(e) orifice positioning means provided on said lever fixedly to engage the needle eye reference means to place the lever in operative position whereby thread placed adjacent to the needle eye will be threaded through said eye on the operation of said pump means.

2. The combination claimed in claim **1** wherein:

(a) the orifice positioning means including a seat lug and a stop lug,

(b) the seat lug extending from the lever to seat the needle-eye reference means thereon on the lever being placed in the operative position, whereby the needle-eye reference means is prevented from being lowered out of position, and

(c) the stop lug adapted to prevent the lever from being overswung into the needle on the lever being swung into operative position.

3. The combination claimed in claim **1** wherein:

(a) the lever disposed inside the head and adapted to be swung downwardly in the direction of the needle to place it in the operative position,

(b) a needle slot formed in the end of the lever remote from the pivotal connection and adapted to receive the needle on the lever being placed in the operative position,

(c) the needle slot intersecting the orifice, and

(d) a thread removal slot formed in the end of the lever remote from the pivotal connection and intersecting the needle slot whereby the threaded needle may be withdrawn from the needle slot and orifice without removal of the thread from the needle-eye.

4. The combination claimed in claim **3** wherein:

(a) a foot formed on the end of the lever remote from the pivotal connection,

(b) the orifice extending through the foot,

(c) the needle slot formed in the foot on the same side as the positioning means, and intersecting the orifice,

(d) the thread removal slot formed in the foot adjacent to and in intersection with the needle slot,

(e) a front section formed on the foot and extending in the direction away from the conduit means, and

(f) a conical entrance to the orifice formed in the front section and adapted to funnel the thread in the direction of the orifice.

5. The combination claimed in claim **1** wherein:

(a) the conduit means including a rigid conduit and a flexible conduit,

(b) the rigid conduit connected at one end to the orifice to extend along and be movable with the lever and having the other end disposed adjacent the pivotal connection of the lever, and

(c) the flexible conduit connected at one end of the pneumatic pump and disposed within the head, and having the other end connected to the other end of the rigid conduit so that the swinging movement of the lever between inoperative position and operative position will only move the junction of the flexible and rigid conduit through an arc of small radius substantially within the head.

6. The combination claimed in claim **1** wherein:

(a) a face plate pivotally mounted to the head to be rotated between an open and a closed position,

(b) the pneumatic pump defines a vacuum pump fixedly connected to the face plate and accessible on opening of the face plate, and

(c) the lever disposed in the head in spaced relation to the pivotal mounting of the face plate to permit the lever to swing between the operative and inoperative position on opening of the face plate.

7. The combination claimed in claim **6** wherein:

(a) a vertical wall formed on the side of the head opposite the face plate, and

(b) the lever having its pivotal connection above and extended outwardly from the vertical wall to normally extend in a vertical upwardly stored position with the face plate closed and on opening of the face plate the lever adapted to be swung about 180° to a vertical downwardly operative position.

8. The combination claimed in claim **1** wherein:

(a) the pneumatic pump is vacuum operated and includes a housing, a piston and a spring,

(b) the housing defining an internal cylinder,

(c) the piston disposed in sealing engagement in the cylinder,

(d) a cover connected to the housing to cover the cylinder,

(e) a hole in the cover,

(f) a rod integrally formed with the piston and extending out of the hole in the cover,

(g) a recess formed in the rod to be normally disposed out of the cylinder and on lowering of the piston in the cylinder the recess to be engaged by the cover to prevent movement of the rod and piston,

(h) passage means formed in the housing adjacent the end thereof remote from the cover to connect that side of the cylinder to the conduit means and orifice,

(i) the spring disposed on the passage means side of the piston whereby on disengagement of the cover from the recess the spring to force the piston upwardly to create a vacuum which acts to suck the thread through the eye and into the orifice.

9. The combination claimed in claim **8** wherein:

(a) the piston having an upturned annular edge yieldably engaging the cylinder,

(b) a shoulder formed in the lower end of the cylinder to define a cavity of smaller diameter than the cylinder,

(c) the piston to abut the shoulder at the point of its lowest descent, and

(d) the recess disposed on the rod a distance from the piston equal to the distance between the shoulder and the cover whereby on the piston abutting the shoulder a tilting of the rod will engage the cover in the recess.

10. The combination claimed in claim **1** wherein:

(a) the pneumatic pump is disposed remote from the head, and

(b) a switch in circuit with the pneumatic pump to selectively render said pump operative and inoperative.

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