May 15, 1945. J. E. WERTZ 2,376,216

SEWING MACHINE AND METHOD OF OPERATING THE SAME

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FIG. II

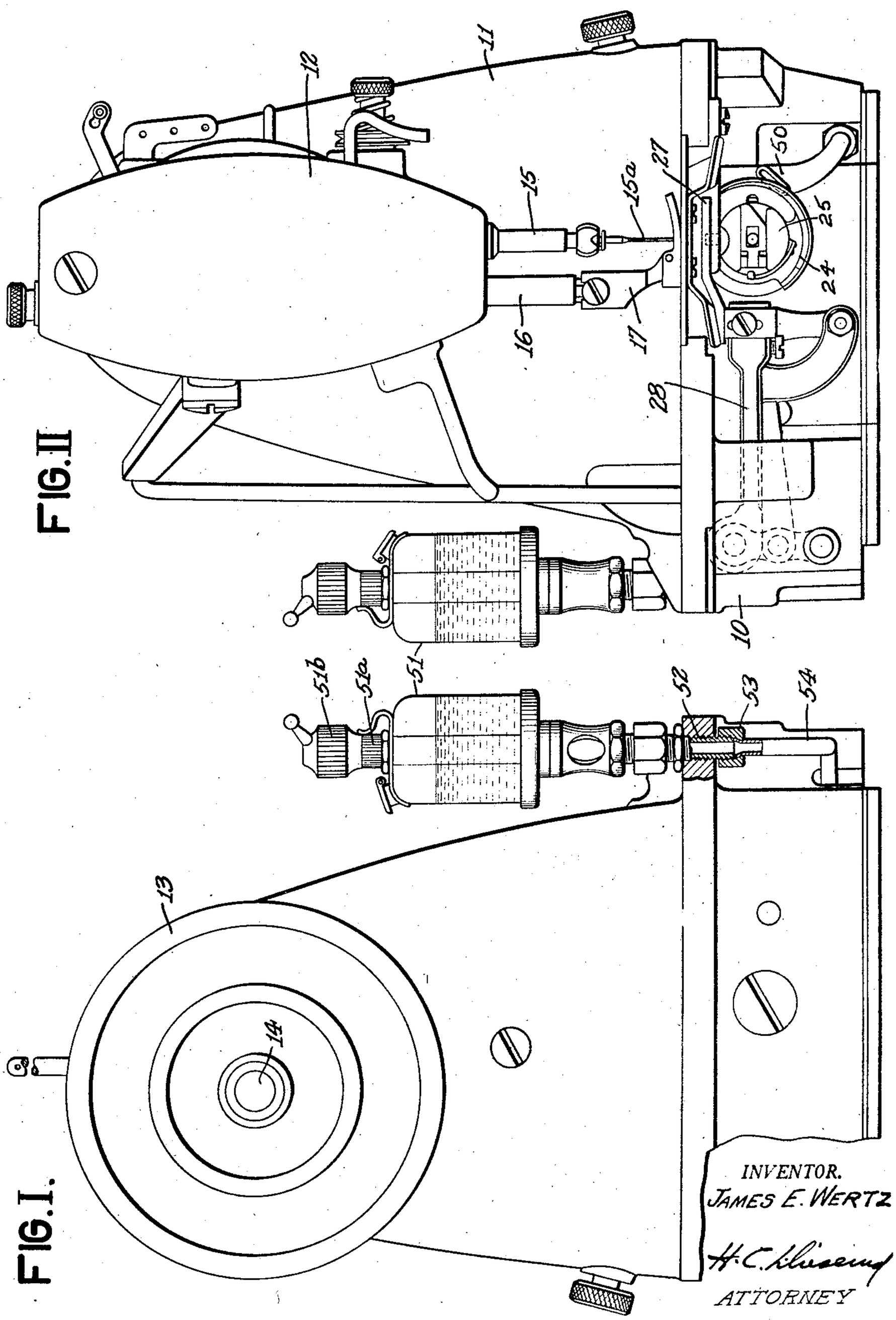


FIG. I.

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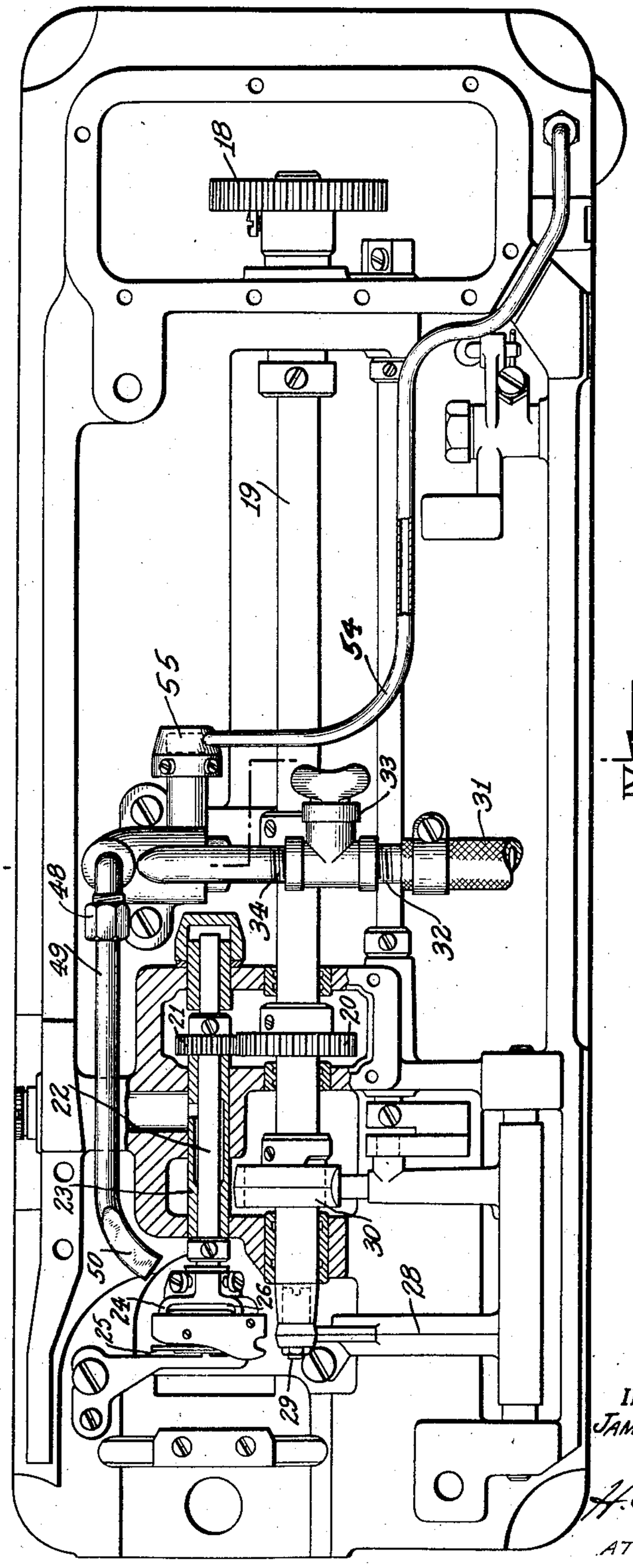
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SEWING MACHINE AND METHOD OF OPERATING THE SAME

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FIG. III.



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SEWING MACHINE AND METHOD OF OPERATING THE SAME

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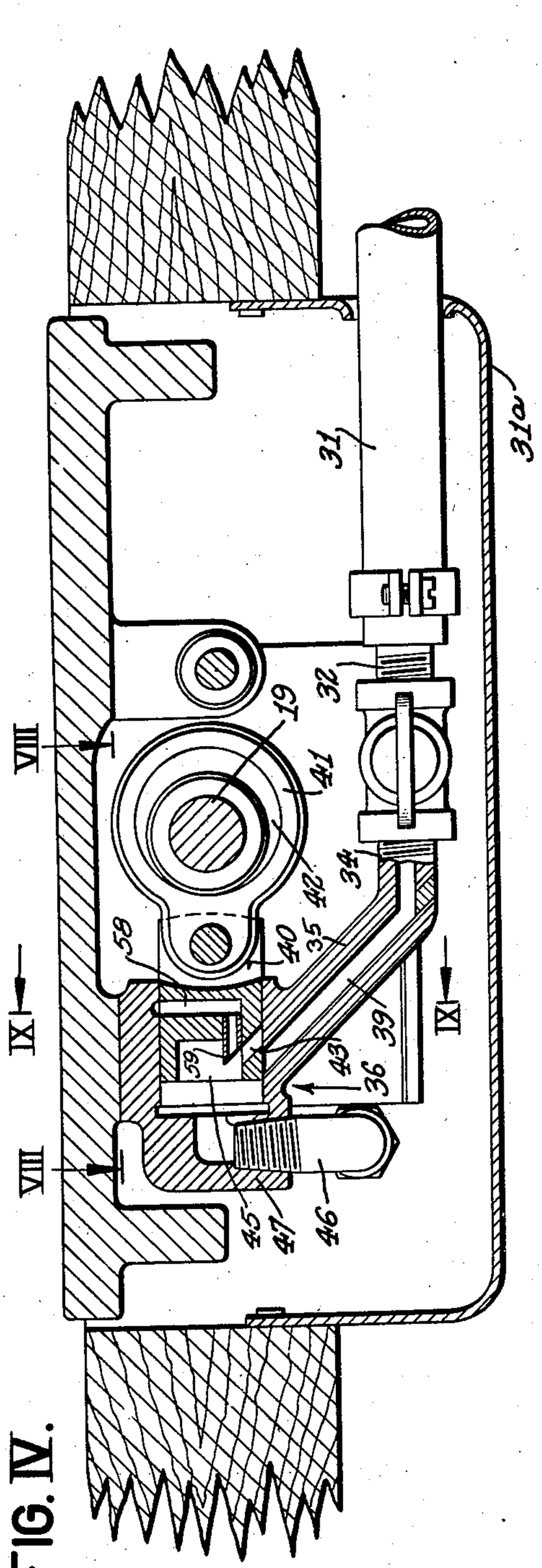


FIG. IV.

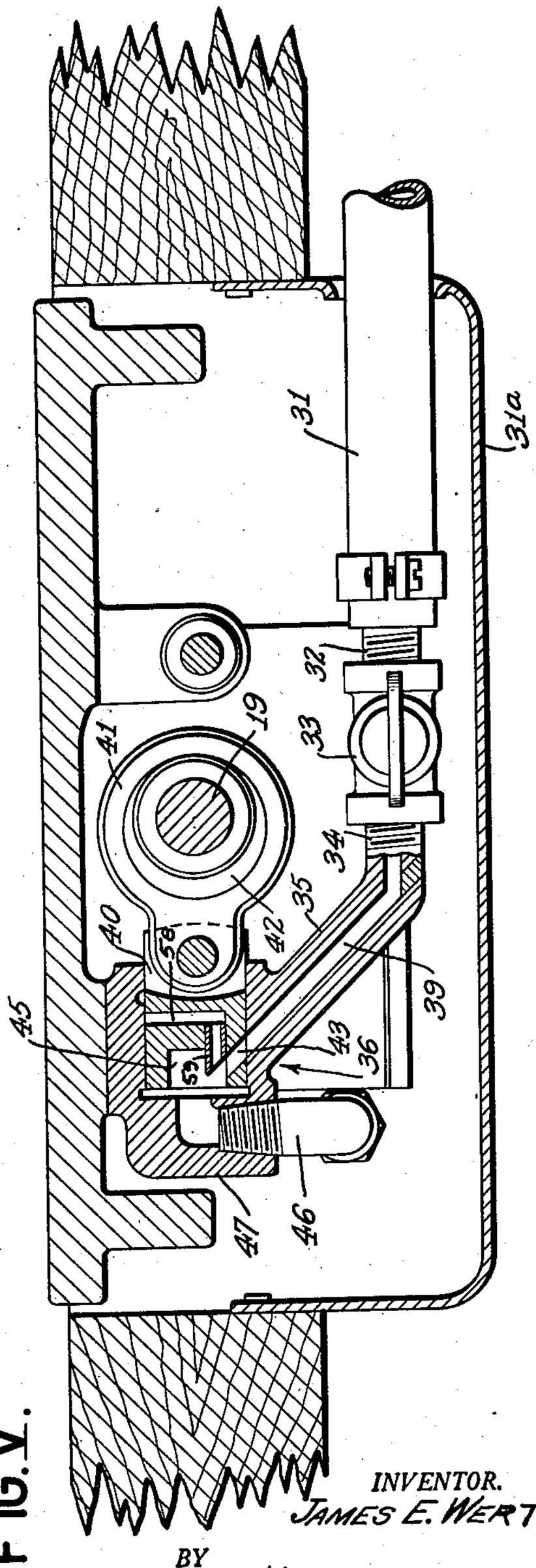


FIG. V.

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SEWING MACHINE AND METHOD OF OPERATING THE SAME

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FIG. VII.

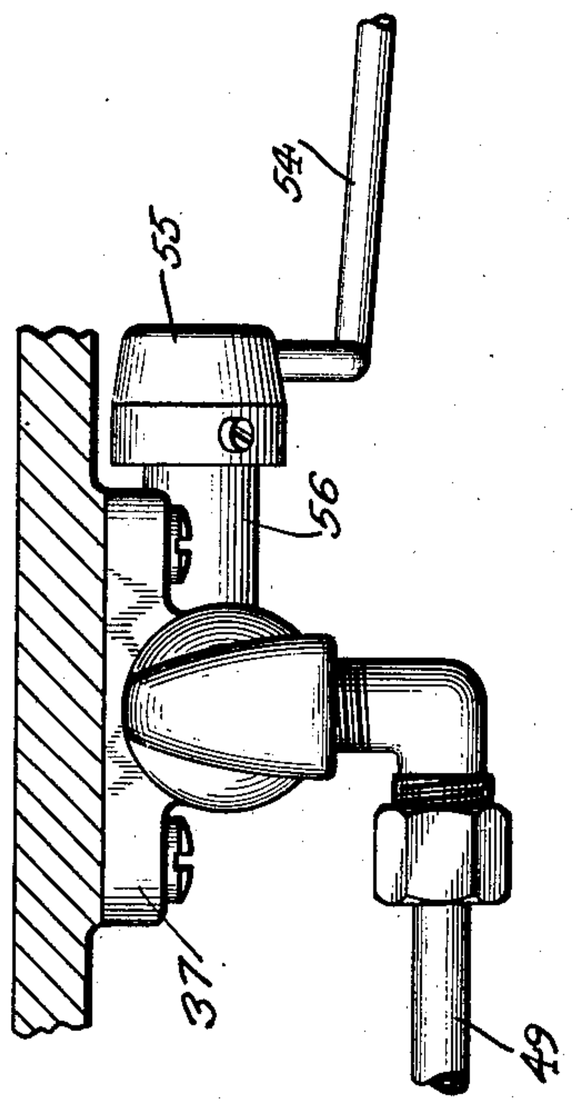


FIG. IX.

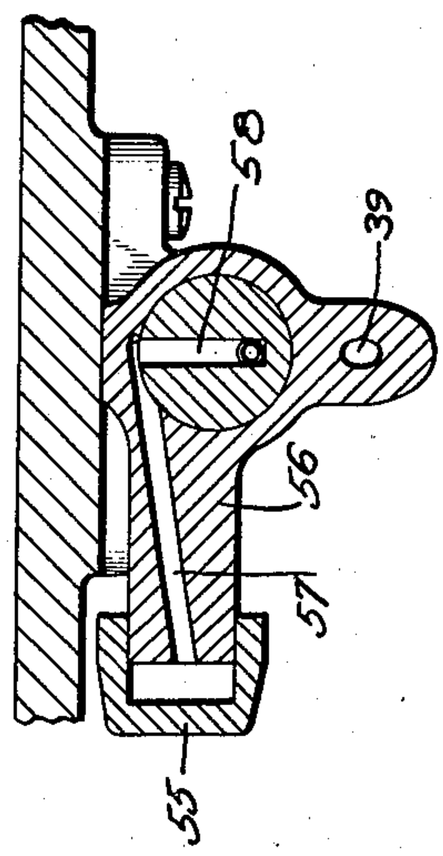


FIG. VI.

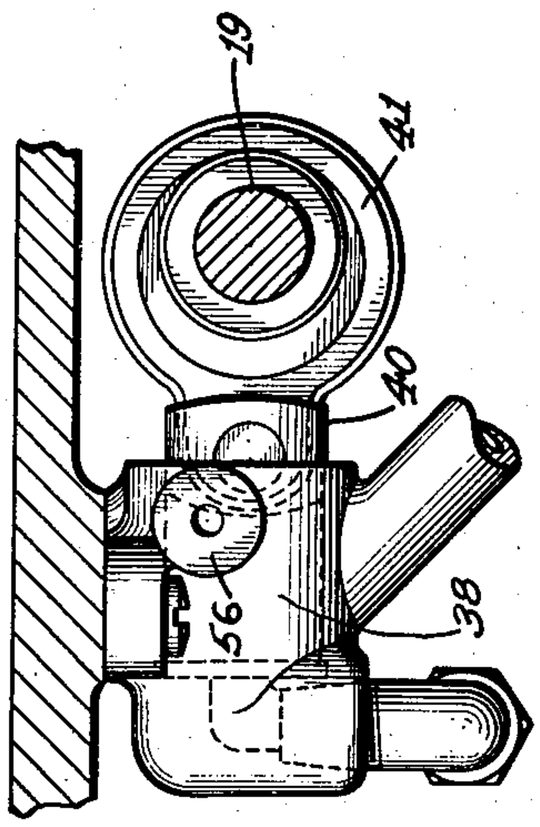
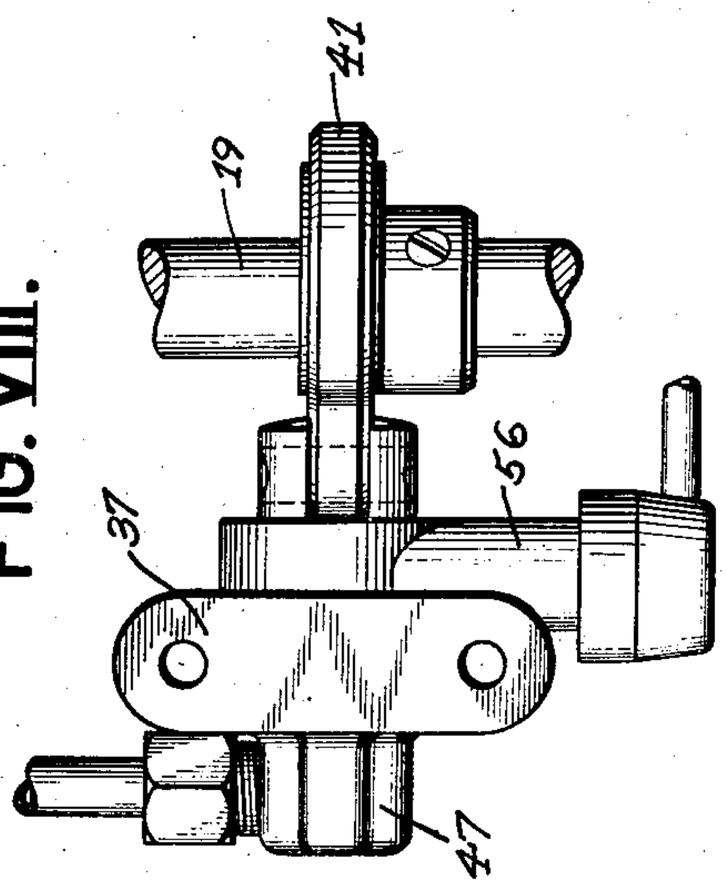


FIG. VIII.



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Patented May 15, 1945 2,376,216

UNITED STATES PATENT OFFICE

2,376,216

SEWING MACHINE AND METHOD OF OPERATING THE SAME

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Application November 21, 1942, Serial No. 466,418

13 Claims. (Cl. 112—218)

This invention relates to a lockstitch sewing machine having a rotary hook comprising a rotating component with a raceway and a stationary component, forming a bobbin holder, with a rib in bearing engagement with the raceway. It is concerned more specifically with a method of and an arrangement for increasing the permissible speed of operation of machines of this character. Toward this end a novel method and means are provided for lubricating the raceway of the hook and for simultaneously cooling the hook.

A primary object of the invention has been to provide a simple and inexpensive way of effectively delivering an appropriate amount of lubricant to the raceway of a rotary hook of the character indicated and simultaneously directing a blast of cooling air against the hook to dissipate heat generated in the course of operating the same. In the high speed operation of sewing machines, in accordance with the present trend toward maximum output for each machine, considerable heat is normally developed due to friction between the bearing surfaces of the rotating and stationary components of the hook. This friction may be reduced to a minimum by effective lubrication of the hook raceway. However, even with proper lubrication, the rotation of the hook at speeds in the neighborhood of 10,000 R. P. M. tends to develop heat which may prove objectionable if not dissipated. By directing cooling air against the hook during operation of the machine, in addition to appropriate lubrication, the machine is rendered highly efficient and danger of overheating the hook is substantially eliminated.

An important feature of the invention is the provision of means, under direct control of the sewing machine, for discharging against an appropriate portion of the rotary hook a stream or blast of air laden with a mist or finely divided particles or droplets of lubricating oil. The air for this purpose is derived from any suitable source of supply, such as a compressor at a distant point, and means are provided for periodically interrupting the flow of air at high frequency and delivering a drop or small quantity of oil during the brief interruptions of the air flow into position for subsequent introduction into and atomization by the air stream. There is thus provided an interrupted flow of the stream or blast of air containing the finely divided spray of oil but the frequency of the interruptions is such that the effect of a continuous blast is produced.

Another feature of the invention is the provision of simple but effective means for automatically introducing a desired amount of lubricant into the air stream.

Other objects, features and advantages of the invention will appear from a detailed description of an illustrative form of the same which will now be given in conjunction with the accompanying drawings, in which:

Fig. I is a rear end elevation of a sewing machine embodying the invention, certain parts being broken away to better illustrate their construction.

Fig. II is a front end elevation of the machine.

Fig. III is a bottom plan view of the machine with certain parts broken away and others indicated in horizontal section for purposes of better illustration.

Fig. IV is an enlarged, transverse, sectional view through the base of the machine, taken along the broken line IV—IV of Fig. III.

Fig. V is a view similar to Fig. IV but showing the parts in a different position, assumed in the course of operation of the machine.

Fig. VI is a detail view, in elevation, showing the means for introducing the lubricant into the air stream.

Fig. VII is an elevational view of the same devices as seen from the left in Fig. VI.

Fig. VIII is a top plan view of the same devices, as indicated by the line VIII—VIII in Fig. IV, and

Fig. IX is a transverse section along the line IX—IX of Fig. IV.

For purposes of illustration, the invention has been shown applied to a machine of the type disclosed in the Christensen et al. Patent No. 2,113,572, granted on April 12, 1938. The machine comprises a frame having a base portion 10, a vertical standard 11, and an overhanging arm projecting laterally from the upper end of the standard and terminating with a needle head portion 12. Power is supplied to the machine from any suitable source by means of a belt (not shown) connected with a combined hand wheel and pulley 13 secured to the end of a main drive shaft 14 which extends longitudinally of the overhanging arm. Suitable connections are provided from the shaft 14 for vertically reciprocating a needle bar 15 mounted in the needle head. This bar carries at its lower end one or more needles 15*a*. Also mounted in the needle head, for vertical movement, is a presser bar 16 carrying at its lower end a presser foot 17. This bar, as will be understood, is spring-urged downward-

ly to retain the presser foot yieldingly against the work supporting surface of the base 10 and in cooperation with suitable work feeding devices within the latter.

Through appropriate gearing within the standard, power is also transmitted from the shaft 14 to a gear 18 secured to the end of a shaft 19 suitably journaled within the base of the machine and extending lengthwise thereof. A gear 20 secured to the shaft 19, intermediate its ends, and meshing with a pinion 21 secured to a hook shaft 22, mounted in a bearing 23 in the base, serves to drive the hook shaft at double the angular speed of the shaft 19. In this way a rotary component 24 of a rotary hook unit is driven at double the frequency with which the needle 15 is reciprocated in the formation of stitches. Within the rotary component of the hook there is mounted a stationary component 25 serving as a bobbin holder, the latter being held against rotation in any suitable and well known manner. It will be understood that the rotary hook is of a type having a raceway in the inner surface of the circumferential wall of the rotary component 24, this raceway receiving, and being in bearing engagement with, ribs projecting from the periphery of the bobbin holder 25. As indicated in Fig. III, the main body of the rotary component has one or more openings 26 in its wall, at or adjacent its base, through which the bottom or inner end of the bobbin case is exposed.

Connections are also provided from the shaft 19 for imparting a four-motion operation to a feed dog 27 which cooperates with the presser foot 17 in the manner hereinabove mentioned. This feed dog is mounted upon a feed bar 28 which is given its lifting and lowering movements by means of an eccentric or crank pin 29 at the end of the shaft 19 and is given its feeding and return movements by an eccentric secured to the shaft 19 and cooperating with an eccentric strap 30. For further details as to the construction and operation of the feed mechanism, and also the stitch forming devices, reference may be had to the above-mentioned Christensen et al. patent.

Turning now to the devices for delivering to the rotary hook a blast, or series of intermittent blasts, of cooling air containing finely divided particles of a suitable lubricant, reference may be had particularly to Figs. III to IX, inclusive. The air may be received through a hose 31 connected with any suitable source of supply of air under pressure. It may, for example, be connected with the usual air line to be found in a mill or it may otherwise be connected with a compressor unit or a tank containing air under pressure. If a compressor is used the air should be cooled somewhat before it is delivered through the hose 31. This hose is passed through a small opening in a pan or casing 31*a* carried by the supporting table for the machine. A nipple 32 serves to connect the hose with a valve 33 which may be manually operated to control the supply of air to the machine. The outlet side of the valve 33 is connected with a threaded stem 34 of a downwardly extending branch 35 of a combined mixing or atomizing chamber and automatic valve unit 36. The latter may conveniently be provided with a laterally extending bracket portion or base 37 adapted to be attached by screws or the like to the under surface of the top of the base of the machine. The unit 36 has a main cylinder or chamber portion 38 with the interior of which a bore or passage 39, extending axially of the branch 35, is adapted to communicate. Within the chamber 38 there is mounted for reciprocation, with a relatively close fit, a reciprocating plunger or valve member 40. The outer end of the latter is pivotally connected with an eccentric strap 41 arranged to cooperate with an eccentric 42 secured to the shaft 19. Thus, upon each cycle of operation of the machine the valve member 40 will be reciprocated.

Valve member 40 is provided with a port 43 which at times is alined with the passage 39, as shown in Fig. V, and at times is displaced so as to close off the interior of the chamber with respect to the passage 39, as shown in Fig. IV. When the port is alined with the passage, air delivered through the hose 31 will be carried into the interior of the chamber 38 which constitutes a mixing compartment. A recess 45 in the inner end of the valve member 40 forms a part of this compartment. Air delivered into the mixing compartment is discharged through an outlet 46 having screw-threaded engagement with an extension 47 of the chamber 38. The outlet 46 is connected by a coupling 48 with a tube or pipe 49 which serves to convey the air to a point adjacent the rotary hook. The discharge end 50 of the tube is preferably flattened and is so disposed as to direct the air at an angle against the inner or rear surface of the rotary component of the hook. As the hook rotates, a part of the air so discharged will pass through the opening 26 and strike the base of the bobbin holder.

To increase the effectiveness of the cooling air and bring about proper lubrication of the hook raceway simultaneously with the cooling action, provision is made for introducing oil into the air in small, measured or regulated amounts and this is accomplished in such a way as to atomize the oil. For this purpose the oil is supplied by gravity from an oil cup 51 suitably mounted on the base of the machine and having the usual regulating means 51*a* and shut-off means 51*b* for controlling the flow of the oil. The cup is secured to the base of the machine by a screw-threaded stem or nipple 52 having threaded engagement with an opening in the base. Beneath the top of the machine base the stem is connected by a nipple 53 with a tube 54 which serves to convey the oil to a cap 55 secured to an extension 56 forming part of the combined unit hereinabove mentioned. The extension 56 is provided with an upwardly inclined passage 57 which is substantially tangent to the periphery of the valve member 40 and terminates directly over the axis of the latter. A diametrically extending port 58 in the valve member is adapted at times to communicate with the upper end of the passage 57, as indicated in Figs. IV and IX, and at other times is adapted to be out of registration with the passage 57, as indicated in Fig. V. At the lower end of the port 58 a small tube 59 serves to place the port in communication with the pocket or recess 45 in the valve member. Thus, whenever the valve member is in the position indicated in Fig. IV, a drop or small, measured quantity of oil will be delivered through the passage 57, port 58 and tube 59 to a point just above the port 43. As the valve member is shifted from the left into the Fig. V position, however, communication with the supply of oil will be cut-off and the port 43 will be placed in communication with the air delivery channel 39. This will result in atomization of some or all of the oil in the tube 59 and port 58, which will be drawn, by the suction action of the

air, into the stream, and the delivery of the spray of oil and the blast of air through the pipe **46** and tube **49** to the rotary hook. Since the shaft **19** is rotated ordinarily at a speed of between 3,000 and 5,000 R. P. M. during the operation of the machine, the valve **40** will be reciprocated at this frequency and the puffs of oil-laden air will be discharged against the rotary hook at this frequency. To all intents and purposes, therefore, a continuous stream of oil-laden air will be directed against the hook so long as the machine is in operation. During idle periods, on the other hand, i. e., between successive seam formations, the supply of oil will preferably be cut off by the valve **40** and simply a continuous blast of cooling air will be directed against the hook. This may be insured by so timing the operation of the parts that the valve will assume the Fig. V position when the needle is in its uppermost position. Care is usually taken to stop the machine, between successive seam formations, with the needle substantially at the top of its stroke. If desired, the relation between the plunger **40**, the port **43** and passage **57** may be such that when the machine is stopped with the needle at the top of its stroke, both the air and oil lines will be cut-off. The stroke of the plunger may be increased somewhat for this purpose. When the machine is to be left idle for a relatively long period, as at the close of the day, the valve **33** should be turned to its closed position to completely cut-off the supply of air and the control member **51***b* on the oil cup may be turned to cut-off the supply of oil.

The operation of the machine, and particularly the hook cooling and lubricating devices, is believed to be clear from the foregoing. Through the reciprocation of the valve member **40**, by the operation of the eccentric **42**, a rapid succession of air blasts is created, each serving to atomize a drop or small quantity of oil delivered to a point just above the port **43** after each blast. The atomized lubricant and cooling air are delivered against the base of the rotary component of the hook and, due to the large open space **26** at this point, a good part of the air and oil will be discharged into the interior of the rotary component and will eventually reach the raceway, due to centrifugal force, and will lubricate the bearing surfaces on the rotary and stationary components.

While a preferred form of the invention has been described in considerable detail, it will be understood that numerous changes may be made in the construction and arrangement of the various parts without departing from the general principles and scope of the invention.

I claim:

1. In a lockstitch sewing machine a rotary hook having rotating and stationary components in bearing engagement, means for driving the rotary component, a mixing chamber, means for delivering air under pressure to said chamber, means for delivering oil to said chamber, means operated by said driving means for controlling the intermittent delivery of air and oil to said chamber, and a conduit for delivering the mixture of air and oil from said chamber to said rotary hook.

2. In a lockstitch sewing machine a rotary hook having rotating and stationary components in bearing engagement, means for driving the rotary component, a mixing chamber, means for delivering air under pressure to said chamber, means for delivering oil to said chamber, valve means for controlling the intermittent delivery of air and oil to said chamber, means operated by said driving means for controlling said valve means, and a conduit for delivering the mixture of air and oil from said chamber to said rotary hook.

3. In a lockstitch sewing machine a rotary hook having rotating and stationary components in bearing engagement, means for driving the rotary component, a mixing chamber, means for delivering air under pressure to said chamber, means for delivering oil to said chamber, valve means for controlling the delivery of air and oil to said chamber, means operated by said driving means for controlling said valve means to admit the air at one point and oil at another point in the cycle of the driving means and thus alternately to said chamber, and a conduit for delivering the mixture of air and oil from said chamber to said rotary hook.

4. In a lockstitch sewing machine a rotary hook having rotating and stationary components in bearing engagement, means for driving the rotary component, a mixing chamber, means for delivering air under pressure to said chamber, means for delivering oil to said chamber at a point adjacent the point of delivery of the air thereto, means operated by said driving means for controlling the intermittent delivery of air and oil to said chamber, and a conduit for delivering the mixture of air and oil from said chamber to said rotary hook under the force of said air.

5. In a lockstitch sewing machine a rotary hook having rotating and stationary components in bearing engagement, means for driving the rotary component, a mixing chamber, means for delivering air under pressure to said chamber, means for delivering oil to said chamber, a reciprocatory plunger arranged to control the alternate introduction of air and oil into said chamber, connections from said driving means for operating said plunger, and a conduit for delivering the mixture of air and oil from said chamber to said rotary hook.

6. In a lockstitch sewing machine a rotary hook having rotating and stationary components with surfaces in bearing engagement, means for driving the rotary component, an atomizing chamber, means for directing a stream of air under pressure into said chamber, means operated by said driving means for periodically interrupting the flow of air into said chamber, means for delivering a small quantity of oil into the path of said air stream during each period of interruption of flow of the air, and means for delivering the resulting stream of atomized oil to the hook for cooling and lubricating the same.

7. In a lockstitch sewing machine a rotary hook having rotating and stationary components with surfaces in bearing engagement, means for driving the rotary component, an atomizing chamber, means for directing a stream of air under pressure into said chamber, means controlled by said driving means for intermittently introducing small quantities of oil into the path of said stream for atomization thereby within said chamber, and means for delivering the resulting stream of atomized oil to the hook for cooling and lubricating the same.

8. In a lockstitch sewing machine a rotary hook having rotating and stationary components with surfaces in bearing engagement, means for driving the rotary component, an atomizing chamber, a valve member associated with said chamber and connected with said driving means for continuous operation thereby back and forth

between two positions, means for introducing a small quantity of oil into said chamber each time said valve member is in one of said positions, means for introducing air under pressure into said chamber each time said valve member is in the other of said positions, and means for delivering the resulting mixture of oil and air to the rotary hook for cooling and lubricating the same.

9. In a lockstitch sewing machine a rotary hook having rotating and stationary components with surfaces in bearing engagement, means for driving the rotary component, an atomizing chamber, a valve member associated with said chamber and connected with said driving means for continuous operation, said member being placed in each of two positions upon each cycle of operation of the machine, means for introducing a small quantity of oil into said chamber each time said valve member is in one of said positions, means for introducing air under pressure into said chamber each time said valve member is in the other of said positions, and means for delivering the resulting mixture of oil and air to the rotary hook for cooling and lubricating the same.

10. In a lockstitch sewing machine a rotary hook having rotating and stationary components with surfaces in bearing engagement, means for driving the rotary component, an atomizing chamber, means for delivering air under pressure from a remote source to said chamber, means controlled by said driving means for delivering a regulated, small quantity of oil into said chamber upon each cycle of operation of the machine, the arrangement being such that said oil is atomized by said air, and means for delivering the atomized oil under the force of said air to said rotary hook for cooling and lubricating the same.

11. In a lockstitch sewing machine a rotary hook having rotating and stationary components with surfaces in bearing engagement, means for driving the rotary component, an atomizing chamber, means for delivering air under pressure from a remote source to said chamber, oil storage means mounted on said machine, means controlled by said driving means for delivering a regulated, small quantity of oil by gravity from said storage means into said chamber upon each cycle of operation of the machine, the arrangement being such that said oil is atomized by said air, and means for delivering the atomized oil under the force of said air to said rotary hook for cooling and lubricating the same.

12. A method of sewing at high speed on a lockstitch sewing machine having a rotary hook which comprises alternately introducing a regulated quantity of oil and a blast of air under pressure into a mixing zone, and directing the resulting mixture by means of the air blast against the rotary hook to cool the same and lubricate the bearing surfaces thereof.

13. A method of sewing at high speed on a lockstitch sewing machine having a rotary hook which comprises introducing a regulated quantity of oil into a confined mixing zone upon each cycle of operation of the machine, and alternately introducing a blast of cool air under pressure into said zone and simultaneously discharging the resulting mixture of air and oil against the rotary hook to cool the same and lubricate the bearing surfaces thereof.

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