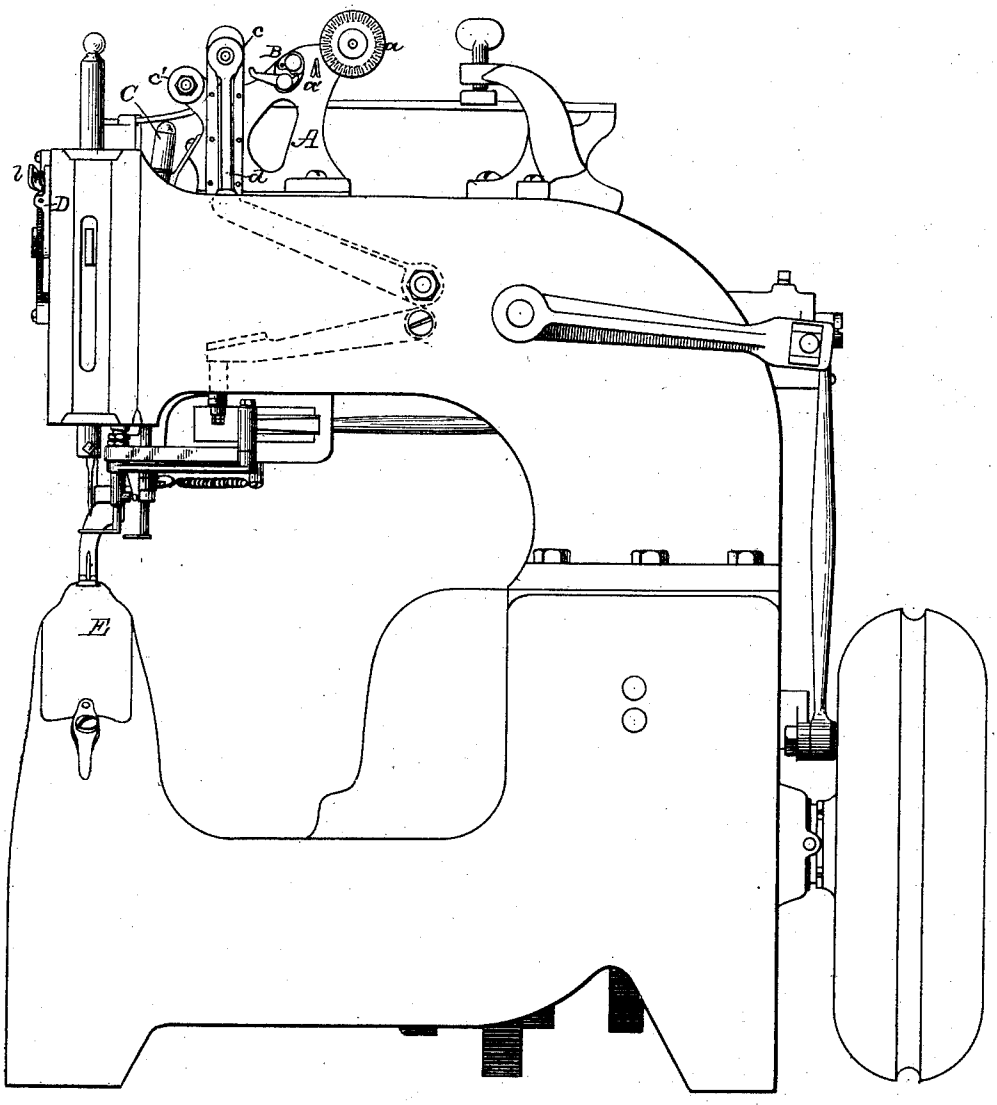
(No Model.) 8 Sheets—Sheet 1.

D. H. CAMPBELL.

WAX THREAD SEWING MACHINE.

No. 374,934. Patented Dec. 20, 1887.

Fig. 1.



Attest:
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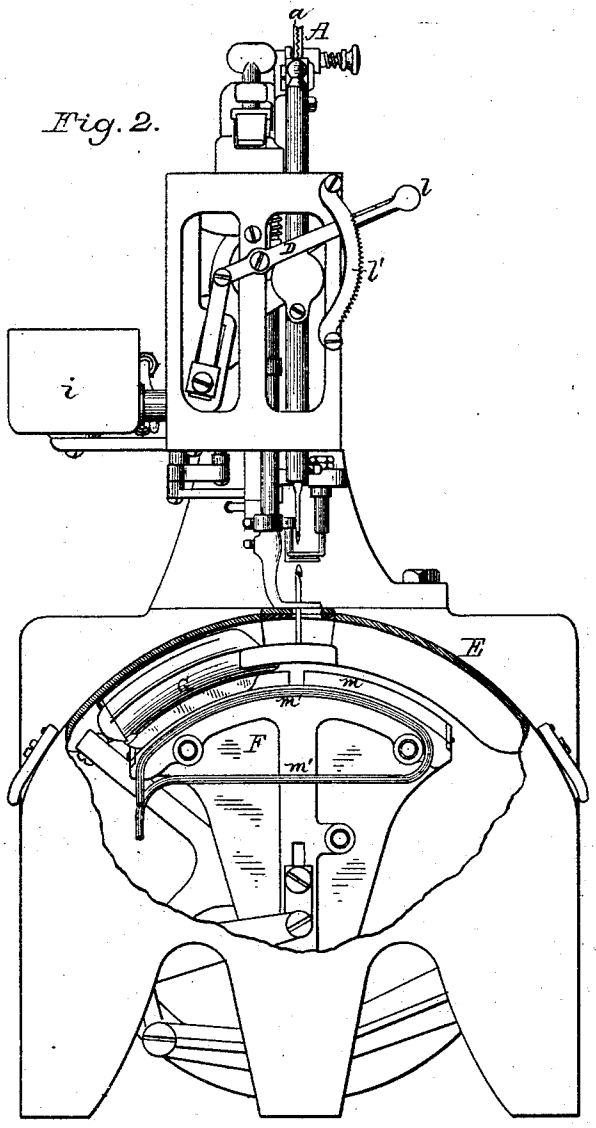
(No Model.) 8 Sheets—Sheet 2.

D. H. CAMPBELL.

WAX THREAD SEWING MACHINE.

No. 374,934. Patented Dec. 20, 1887.

Fig. 2.



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(No Model.) 8 Sheets—Sheet 3.

D. H. CAMPBELL.

WAX THREAD SEWING MACHINE.

No. 374,934. Patented Dec. 20, 1887.

Fig. 3.

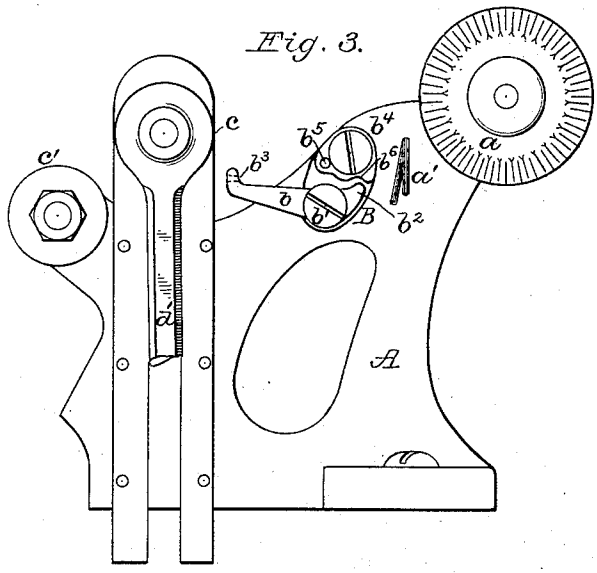


Fig. 5.

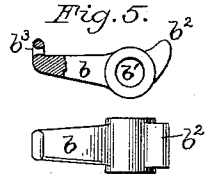


Fig. 4.

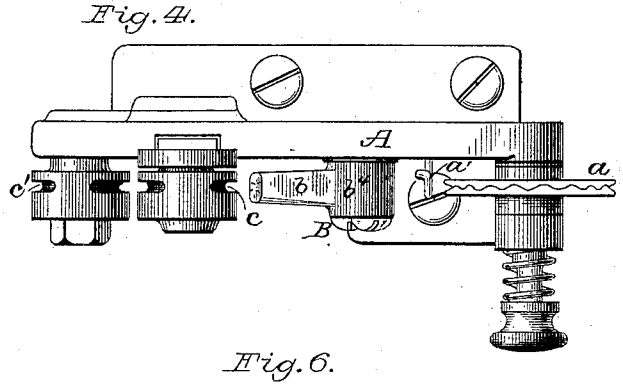
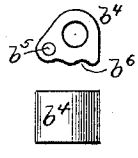


Fig. 6.



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(No Model.) 8 Sheets—Sheet 4.

D. H. CAMPBELL.

WAX THREAD SEWING MACHINE.

No. 374,934. Patented Dec. 20, 1887.

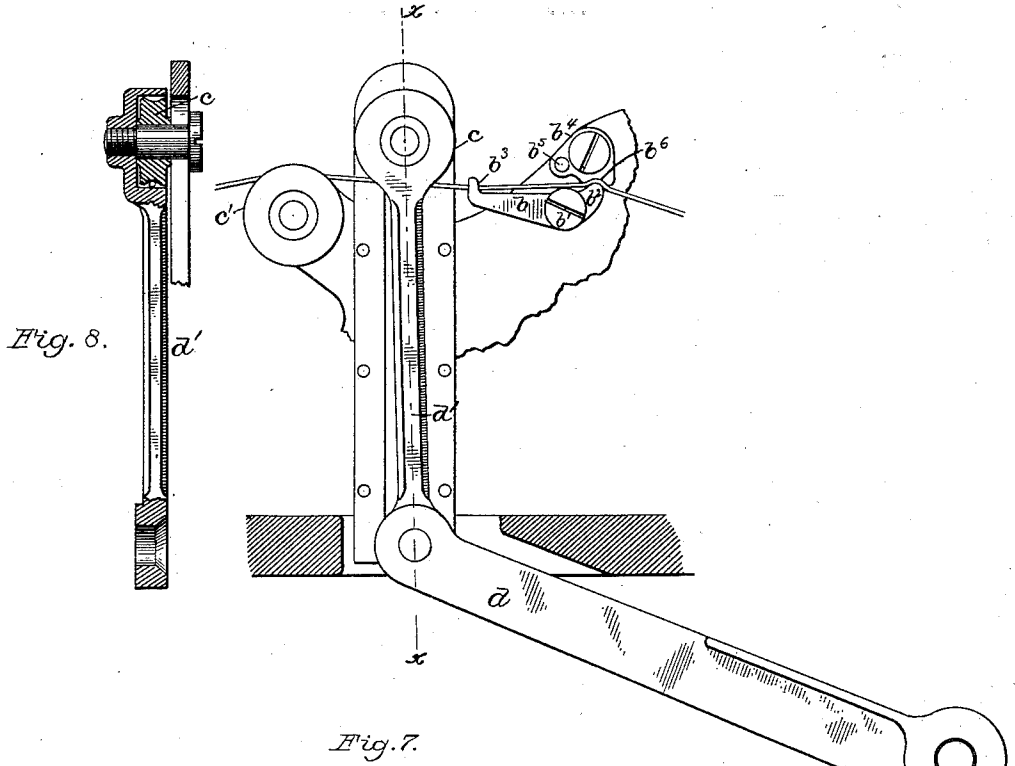

Fig. 8.

Fig. 7.

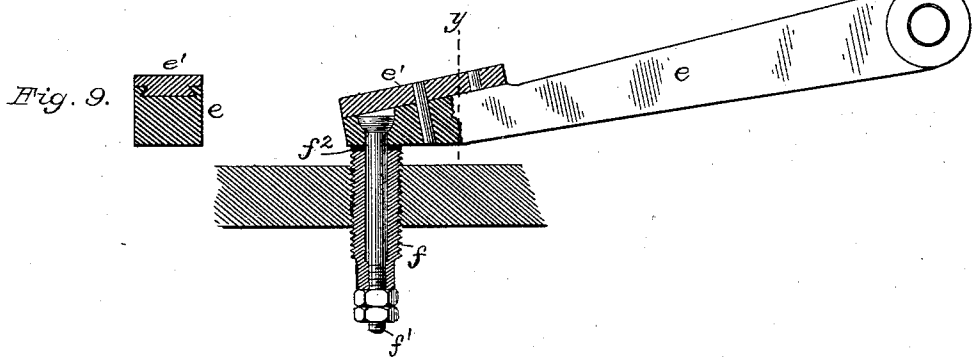

Fig. 9.

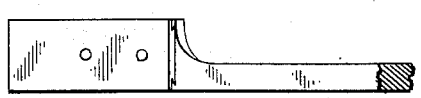

Fig. 10.

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D. H. CAMPBELL.

WAX THREAD SEWING MACHINE.

No. 374,934. Patented Dec. 20, 1887.

Fig. 11.

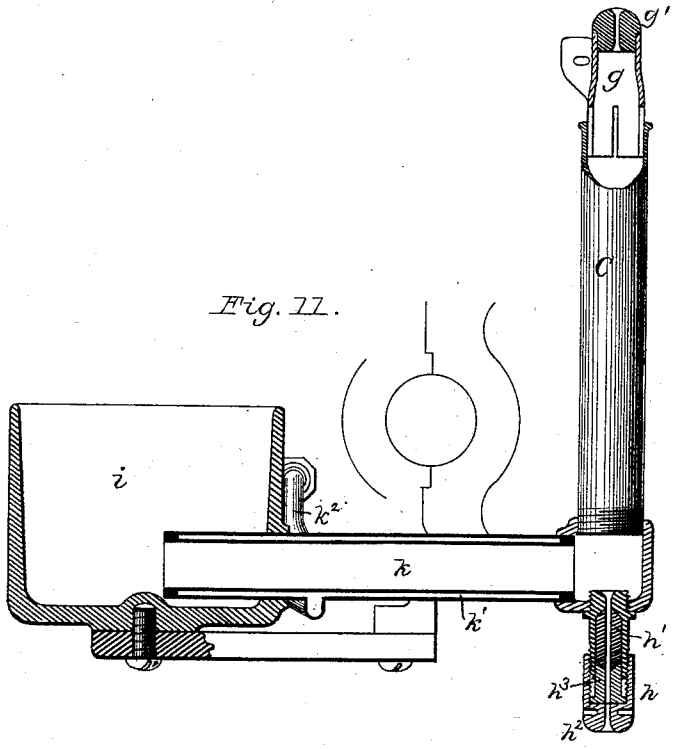

Fig. 13.

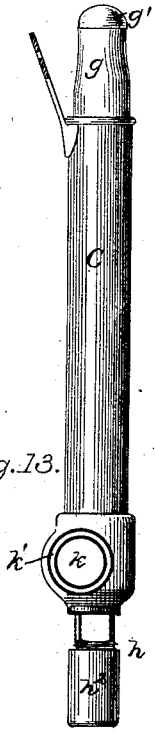

Fig. 12.

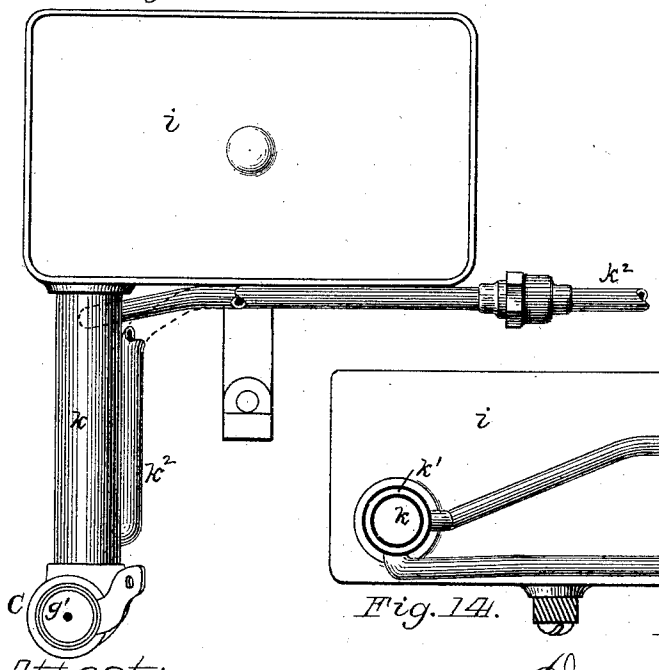

Fig. 14.

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D. H. CAMPBELL.

WAX THREAD SEWING MACHINE.

No. 374,934. Patented Dec. 20, 1887.

Fig. 15.

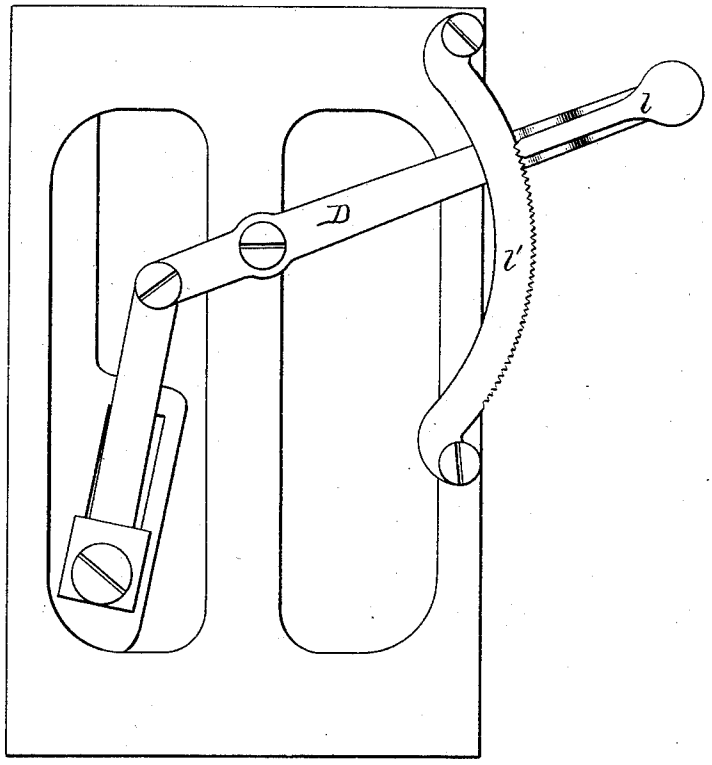
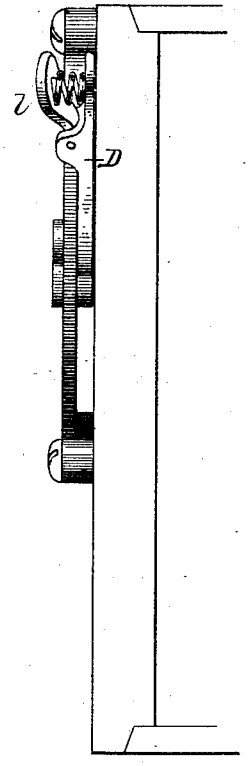


Fig. 16.



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WAX THREAD SEWING MACHINE.

No. 374,934. Patented Dec. 20, 1887.

Fig. 17.

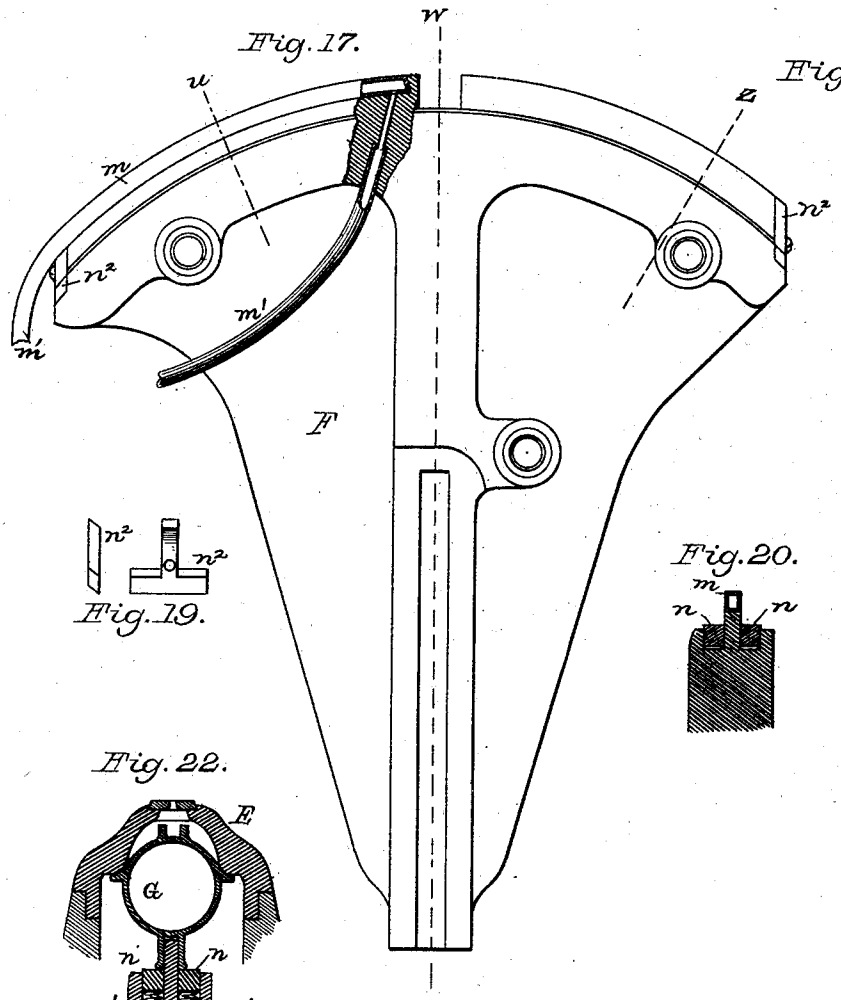


Fig. 18.

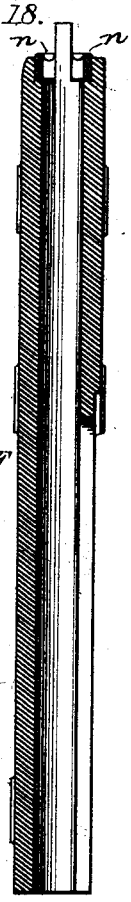
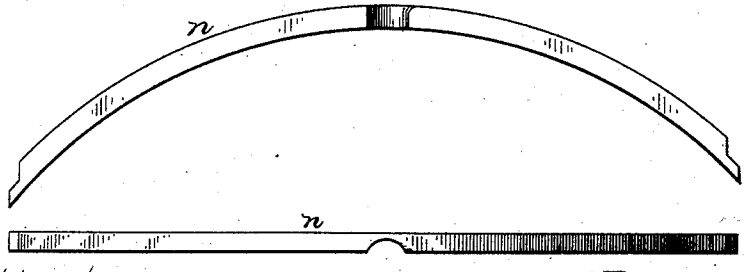


Fig. 19.

Fig. 20.

Fig. 22.

Fig. 21.



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(No Model.) 8 Sheets—Sheet 8.

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WAX THREAD SEWING MACHINE.

No. 374,934. Patented Dec. 20, 1887.

Fig. 23.

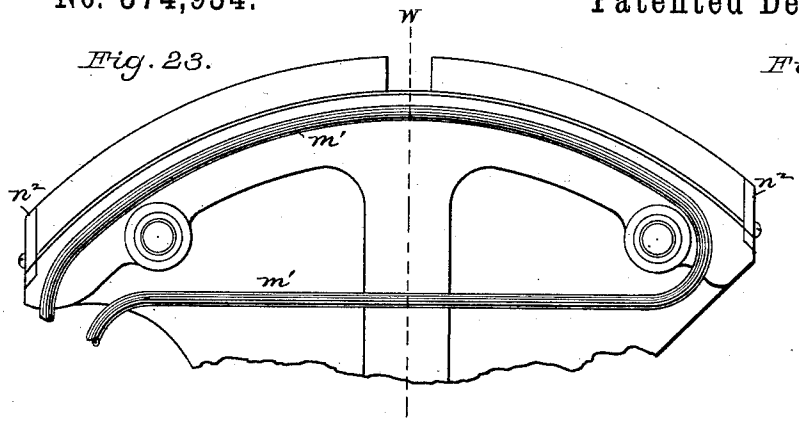


Fig. 24.

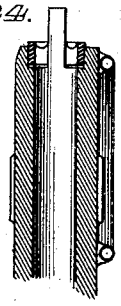


Fig. 25.

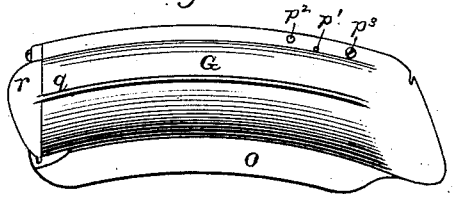


Fig. 27.

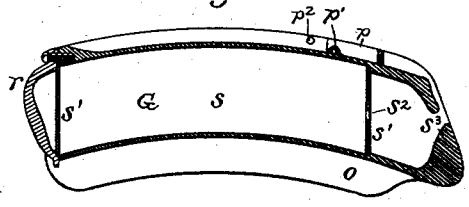


Fig. 26.

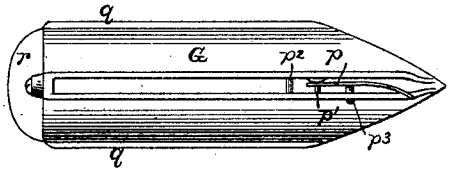


Fig. 28.

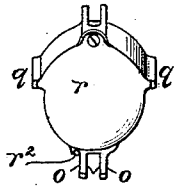
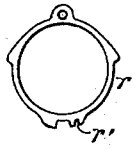


Fig. 29.



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UNITED STATES PATENT OFFICE.

DUNCAN H. CAMPBELL, OF PAWTUCKET, RHODE ISLAND, ASSIGNOR TO THE CAMPBELL MACHINE COMPANY, OF SAME PLACE.

WAX-THREAD SEWING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 374,934, dated December 20, 1887.

Application filed February 12, 1885. Serial No. 155,708. (No model.)

To all whom it may concern:

Be it known that I, DUNCAN H. CAMPBELL, of Pawtucket, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Sewing-Machines; and I do hereby declare that the following specification, taken in connection with the drawings furnished and forming a part of the same, is a clear, true, and complete description of my invention.

Although some of my said improvements may be capable of use upon any sewing-machine adapted to heavy service, all of them have been devised and organized by me with special reference to their practical use upon such waxed-thread shuttle-machines as have heretofore been disclosed by me in my Letters Patent No. 231,954, September 7, 1880, and Nos. 253,156 and 253,157, dated January 31, 1882. In one of said Letters Patent I show how dry shoe-thread is delivered directly from a spool, reel, or ball and then waxed within the head of the machine; and one object of my present invention is to obtain a more positive control of the dry thread during the operation of the take-up mechanism than has, as I believe, been heretofore accomplished.

It is well known that dry shoe-thread is generally smooth and slippery, and instead of relying upon friction-drums or brake wheels and levers operating therewith, as heretofore, I have arranged a tension-stand of such height above and so located at the rear of the waxing-tube in the head of the machine that the waxed portion of the thread will not be exposed to contact with the tension device, which consists of serrated tension-disks (between which the dry thread passes) provided with means for frictionally controlling them, and an automatic thread-clamp, embodying a thread-block and a thread-lever which is controlled wholly by such tensile strains on the waxed portion of thread as are due to the action of the "take-up," so that during the completion of each stitch the dry thread will be thoroughly clamped between the brake-lever and the thread-block without liability of injury thereto, because the coincident faces of the lever and block are concavo-convex and engage with the thread without any shearing action; and I also obviate the liability of such uneven rendering of the thread as is obviously liable when waxed thread is engaged by the tension devices.

In operation my machines necessarily involve take-up mechanism which will apply very heavy tensile strains to the thread, sometimes within a small fraction of its capacity for resistance, and these strains are applied with a heavy pounding action for drawing the bight of the shuttle-thread into the leather. In thus operating, the thread back of the take-up mechanism must be rigidly held against longitudinal movement by mechanism which can be controlled by the thread itself and with a minimum liability of injury to the thread; and as I now operate said mechanism by dry thread I have specially devised the aforesaid thread brake-lever and its thread-block, between which the dry thread passes on its way from the tension-disks to the take-up mechanism.

Heretofore in my machines I have employed a cushioning-pad for relieving the shock and deadening the sound incident to the hammering of the take-up lever upon the abutment or stop, which limits the upward draft of the upper and lower threads; and the object of another portion of my invention is to render the pad more durable and effective than heretofore, and I accomplish this by mounting a pad upon a pivoted arm beneath the take-up lever and so arranging it with relation thereto that the coincident surfaces of said pad and lever will always be parallel during their contact, regardless of any variations which may be made in the vertical adjustment of said pad-arm, and by having the pad-arm as described I am enabled to employ a pad having a much greater area of resisting-surface than when mounted upon the end of a screw, as heretofore.

Another portion of my invention relates to the peculiar construction of the delivery-head of the waxing-tube through which the thread passes directly to the needle, said head serving to strip the surplus wax. This portion of my improvement consists in the combination, with the screw-cap of the head and its flexible packing, of a follower interposed between them, whereby said packing is rendered more durable and is more easily and effectually

controlled than when the screw-cap has its bearing directly upon the packing.

I am well aware that packing of various kinds has heretofore been employed in connection with piston-rods and in glands variously constructed; but in such prior cases the sole object is to obtain a steam or a water tight joint, whereas that with sluggish-flowing wax is easily obtained; but I need to so control the packing that it will effectually force wax into the thread, and into fine thread as well as coarse, and also to strip the thread and give it a favorable external surface. In said prior connections the packing can in no manner be impaired in its action by its contact with the rotative gland-cap, because the metal rods cannot thereby be adversely affected; but if my flexible packing be twisted and compressed by the rotative screw-cap the thread will be flattened or otherwise forced out of its proper cylindrical shape.

Another portion of my invention consists in coupling a wax-tank to a vertical waxing-tube through which the thread passes by means of a jacketed pipe which is heated by hot air, steam, or hot water, and which not only heats the wax in transit, but also heats the contents of the tank and the waxing-tube.

I am aware that British Letters Patent No. 2,548 of 1876 show below the work-plate a wax-cup, into which a needle is supposed to dip with its thread, and a wax-tank and a coupling-pipe connecting said cup and tank, and also that said coupling-pipe and tank are open-jacketed for the passage of heated air from a flame afforded by a lamp or gas-burner. This prior contrivance in no manner relates to the last-recited feature of my invention, which essentially includes a vertical thread-waxing tube through which the thread passes on its way to a needle, and it must of necessity be wholly above the work-plate, thus precluding the possibility of using the wax-cup described in said English patent.

Another portion of my invention relates to the feed-adjusting mechanism; and it consists in the combination, with the feed-controlling lever, of a segmental plate provided with regular V-shaped serrations or notches and a latch on said lever having one or more corresponding notches or serrations on its face, whereby more minute variations in feed can be made than is possible with the pin-latch or bolt, and the segmental plate provided with holes for receiving the pin of said latch, as heretofore employed.

Another portion of my invention consists of a novel construction of an arched shuttle rail and race, whereby the shuttle is held with yielding pressure in contact with that portion of the race against which it bears when centrifugally influenced, and I have also devised novel means for heating the race and the shuttle while therein.

The shuttle now used by me embodies certain features heretofore patented by me; but it also contains certain novel features of value in my improved machine. This shuttle is, as heretofore, specially adapted for use on an arched shuttle-rail, and it is therefore curved longitudinally to conform to the arching form of the race, and the interior of the shuttle conforms generally to its exterior outlines.

The waxed shuttle-thread is now, as heretofore in my machine, first wound into straight cylindrical cops, which deliver from their interior, and therefore when placed within a shuttle each cop is bent or curved to conform to the interior of the shuttle. As heretofore constructed, the ends of the shuttle-cop chamber, as seen in my Letters Patent No. 253,156, occupied planes which radiated from the center of the circle of which the shuttles were substantial segments. It is obvious that a cop should thoroughly fill the cop-chamber, so as to be secured against independent movement therein, and it is therefore bent to conform to and fill said cop-chamber; and heretofore the ends of the cop have assumed the radial positions occupied by the ends of the cop-chamber, so that the coils of thread in each cop when thus bent were so separated at the outer or convex side of the cop as to render imperfect delivery liable. In my improved shuttle the cop-chamber has its two ends parallel, so that when a cop of proper dimensions is bent and placed therein its ends are maintained in similarly parallel positions, and therefore its coils remain in their normal condition, and a more reliable and even delivery of the thread is afforded. I have also devised a tension device of special value on a longitudinally-curved shuttle operating upon an arched rail.

In describing my invention I will refer to the accompanying eight sheets of drawings, and after a description thereof in detail the several features deemed novel will be specified in the several clauses of claim hereunto annexed.

Figure 1, Sheet 1, is a side elevation of my improved machine. Fig. 2, Sheet 2, is a front view of the same, partially in elevation, and with a portion of the front lower plate broken away and the arched work-plate in section. Figs. 3 and 4, Sheet 3, are respectively a side elevation and plan of my tension-stand, with the thread-brake and a portion of the take-up. Fig. 5 in two views illustrates the thread-brake lever detached. Fig. 6 in two views illustrates the thread-block with which the brake-lever co-operates. Fig. 7, Sheet 4, illustrates, partially in side view and partially in section, the take-up, its lever and its pad-arm, and portions of the frame of the machine and of the tension-stand. Fig. 8 is a sectional view of the upper portion of Fig. 7 on line *x*. Fig. 9 is a sectional view of the pad-arm on line *y*, Fig. 7. Fig. 10 is a top view of the pad and a portion of its arm. Fig. 11, Sheet 5, is a vertical central section of the waxing apparatus complete. Fig. 12 is a plan view of the waxing apparatus. Fig. 13 is a side view of the wax-tank, and also shows said jacketed

pipe in section. Fig. 14, Sheet 5, is a side view of the waxing-tube detached and shows in section the jacketed pipe by which it is coupled to the wax-tank. Figs. 15 and 16, Sheet 6, in front and side views illustrate the feed-graduating lever, its notched segmental plate, and thumb-latch. Fig. 17, Sheet 7, illustrates a vertical stationary complex segmental frame-plate, which is below the arched work-plate and supports the main shuttle-rail, portions of both of which are broken away to disclose the steam-passages by which said rail and the shuttle are heated. Fig. 18 is a sectional view of said complex frame-plate on line *w*, Fig. 17. Fig. 19 in two views illustrates one of two detachable end blocks by which yielding auxiliary shuttle-rails are properly confined with relation to the main rail. Fig. 20 is a section of the upper portion of Fig. 17 on line *u*. Fig. 21 in side and top views illustrates the auxiliary shuttle-rails detached. Fig. 22 is a sectional view of the arched work-plate, shuttle-race, rails, and shuttle on line *z*, Fig. 17. Fig. 23, Sheet 8, in front view shows the upper portion of the segmental complex frame-plate provided with another arrangement of steam-passages for heating the shuttle-rail and shuttle. Fig. 24 is a sectional view of Fig. 23 on line *w*. Figs. 25, 26, and 28 are respectively side, top, and rear end views of the shuttle. Fig. 27 is a longitudinal central section of the shuttle. Fig. 29 is a front end view of the shuttle-cap detached.

After particularly describing the several features of my invention in connection with the detailed figures their organization in the complete machine will be readily understood by referring to Figs. 1 and 2.

The tension-stand A (shown in Figs. 1 to 4, inclusive) is mounted upon the top or arm of the machine-head and located at such a height and sufficiently to the rear of the front of the head to prevent the waxed portion of the thread from reaching the dry-thread tension-disks *a*, between which the thread passes directly from a reel, spool, or ball. These tension-disks are coincidently corrugated and are provided with the usual thumb-screw and spring for adjusting tension.

From the tension-disks the dry thread passes through a thread-eye, *a'*, and thence to the brake B, which I believe to be novel in its construction, and is composed in part of the lever *b*, pivoted at *b'* to the stand, and having a convex compressing-face, b^2, on its short arm and a thread-eye, b^3, at the outer end of its long arm. The lever *b* co-operates with a thread-block, b^4, also secured to the stand by means of a screw, and rendered non-rotative thereon by means of a pin, b^5, at one side of and parallel with said screw and occupying a hole therefor in the stand. The under side of the thread-block is provided with a concave face, b^6, which reversely corresponds to the convex face b^2 of the lever. These concavo-convex faces engage the dry thread with great tenacity and without any shearing action. These faces have properly engaged with thread of such variable sizes as I have employed; but for rendering the brake universally operative on all sizes of thread I should mount the thread-block on the stand, so that it could be readily adjusted with reference to the lever. From the brake-lever the thread passes beneath the vertically-reciprocating pulley *c*, which is connected to and operated by a take-up lever, as in my prior machines, and thence over the stationary pulley *c'* to the waxing-tube on its way downward to the stitching mechanism. While the thread is moving downward with the needle the take-up pulley *c* is elevated, thus permitting the thread to occupy a straight line from the top of the pulley *c'* to the faces of the brake, and therefore the thread will then be freely delivered at the tension afforded by the disks *a;* but as soon as the take-up pulley is carried downwardly for completing a stitch the outer end of the brake-lever is forcibly depressed and the dry thread so securely clamped between the brake-faces that the operation of the take-up is rendered absolutely reliable.

While I am aware that tension-disks as shown and described have long been used on ordinary sewing-machines, I believe I am the first to employ them on a wax-thread machine, and especially in connection with waxing apparatus, a take-up, and a brake, so that said disks can only operate on the dry portion of the thread, it being obvious that should wax or other extraneous matter be interposed between said disks their efficiency as suitable tension devices would be practically destroyed.

In operating my machine much power is involved in the operation of the take-up, and the necessity for exactly limiting the lift of the shuttle-thread is such that, as in my prior patented machines, a take-up stop is employed, and also a pad, for deadening the noise and relieving the shock incident to the driving contact of the take-up lever and its stop. My improvements in this connection are indicated in dotted lines in Fig. 1 and in detail in Figs. 7 to 10, inclusive. The take-up pulley *c* has a concave periphery, and is mounted upon a stud fitted to slide in a vertical slot in the tension-stand and secured within a housing on the upper end of a link, *d'*, which at its lower end is pivoted to the take-up lever *d*, substantially as in my prior machines. Beneath the take-up lever and parallel with it is a pad-arm, *e*, pivoted at its rear end to the frame of the machine below the rock-shaft on which the take-up lever is mounted. At its outer end said pad-arm is provided with a seat for the pad *e'*, which is rectangular in form and may be secured to its seat in various ways, although I prefer to form a dovetail recess in the arm and fit the pad thereto, as illustrated in section in Fig. 9, and to also employ securing-pins, as shown. For vertically adjusting the pad and arm, and thus varying the lift of the locked threads, I employ a tubular screw, *f*, tapped into a threaded hole in an adjacent

portion of the frame, and so arranged that the outer end of the pad-arm rests upon the top of said screw *f*. For locking the arm and screw together and preventing the rebound of the arm when its pad is struck by the take-up lever, said arm has a large countersunk hole loosely occupied by the head of a screw, *f'*, which is housed within the adjusting-screw *f* and is provided at its lower end with set-nuts. As thus constructed and arranged, it will be seen that at whatever vertical adjustment the pad may be placed its entire resisting-surface will always be parallel with a corresponding portion of the under side of the outer end of the take-up lever *d*, and therefore the most desirable deadening results will be accomplished. It will also be seen that a much larger pad can be used than would be practicable if it were mounted upon an adjustable stop-screw, as heretofore; and for still further deadening the sound I interpose between the pad-arm and the top of the adjusting-screw *f* a copper washer, f^2.

The waxing apparatus is shown in Figs. 1 and 2, but can be best described in connection with Figs. 11 to 14, inclusive. It embodies a waxing-tube, C, which, as in my prior machines, and as shown in my Letters Patent No. 253,157, is above the work-plate and located in the head of the machine, and is secured therein by screws and an inclined bracket on the upper end of the tube. At its upper end this tube C has a detachable tubular cap, *g*, slitted and expanded at its lower end, so as to frictionally enter the tube, and it is provided on top with a perforated plug, *g'*, through which the thread is reciprocated to and fro and delivered downwardly to the needle. At its lower end this tube has a delivery-head, *h*, which, as in my prior machines, has a tubular flexible or compressible packing, *h'*, and an adjusting screw-cap, h^2; but as a novel feature I have introduced the tubular follower h^3, by which I am enabled to secure much more satisfactory control of the packing and to render the latter more durable than when the cap engages directly with the packing. This improved delivery-head is also satisfactorily employed by me in a waxing and shuttle-cop-winding apparatus.

The waxing-tube C is supplied with hard wax from a wax-tank, *i*, by way of a pipe, *k*, which enters the thread-waxing tube just above its delivery-head *h*, so that the melted wax will rise in said tube to its level in the tank. The pipe *k* is jacketed to afford a steam-space, *k'*, communicating with induction and eduction steam-pipes k^2, provided with screw-couplings for connection with other pipes leading to and from the machine. The jacketed pipe *k* extends into the wax-tank and keeps a portion of its contents in a sufficiently-liquefied condition for flowing to the waxing-tube without danger of overheating or burning the reserve wax in the tank.

The feed-adjusting mechanism (here shown for varying the feeding movement of the awl) is, mainly, as in my prior machines. The feed-lever D is provided with a thumb-latch, *l*, having at its tip, which is slightly beveled, one or more V-shaped notches or serrations, and said latch engages with corresponding notches or serrations on the edge of the segmental plate *l'*. This arrangement of the notches enables finer or more limited variations in feed than are possible when a pin-latch and a segmental plate drilled to receive the pin of the latch are employed, as in my prior machines, and the notches enable quite as reliable engagement of the latch with the segmental plate as when the pin and holes are employed.

Having thus described such of my improvements as relate to the upper part of the machine, I will next describe those which relate to the mechanism below the arched work-plate E, which in a general way corresponds to that heretofore patented to me, but which differs therefrom in many desirable particulars, and is shown in Fig. 2, but best described in connection with Figs. 17 to 29, inclusive.

In Figs. 17 and 18 I show a complex segmental frame-plate, F, mounted fixedly in the machine and having a vertical central passage for the reception of the reciprocating needle-bar. This frame-plate is novel in that it has a hollow main shuttle-rail, *m*, serving as a steam-chamber for heating the shuttle G when on the rail, steam being circulated in said rail by means of the pipes *m'*. The main shuttle-rail *m* is in two parts—one on each side of the central space traversed by the needle—and both parts may be thus heated, if desired, although I find that one will generally be all that is required. This main shuttle-rail serves to guide the shuttle in its path; but in connection with arched bearing-webs on the under side of the arched work-plate E it serves, also, as a part of an arched shuttle-race. The shuttle is supported by two arched auxiliary rails, *n*, Fig. 21, which are located in grooves at each side of the main rail, are coincidently recessed adjacent to the needle-path, and are mounted upon expansive spiral springs *n'*, so that they support the shuttle and force it toward the work-plate webs of the race with yielding pressure. The auxiliary rails are secured in position by inverted-T-shaped blocks n^2, each of which overlies the two adjacent recessed ends of said rails *n* and is fastened by a screw to the adjacent end of the main rail.

As a substantial equivalent of the hollow main rail, I apply a steam heating-pipe, *m'*, to the side of the frame-plate F, as shown in Figs. 23 and 24, so that by conduction through the pipe to the plate and thence to the rail heat will be successfully communicated to the shuttle.

In Figs. 25 to 29, inclusive, the longitudinally-curved shuttle G is particularly illustrated in detail, and it embraces many features heretofore patented to me. It has, as heretofore, a longitudinal groove on its under side, afforded by the two parallel webs *o*; but these

webs for the first time are relied upon for a supporting or bearing contact with auxiliary rails on each side of the main rail. I also employ on the top of the shuttle, as shown in my Letters Patent No. 253,156, a longitudinal slot or groove afforded by two webs and containing a flat tension-spring, *p;* but this latter is rendered more effective by combining therewith a pin, *p'*, which passes across the slot and through a hole or recess in the spring, by which the thread is prevented from passing beneath the spring on its way from the delivery-aperture in the nose of the shuttle upward and rearward over said pin *p'* and beneath a second pin, p^2, which also extends across the slot, but at the rear of the free end of the tension-spring, which is provided with an adjusting-screw, p^3.

The sides of the shuttle are each provided with a curved bearing-web, *q*, the upper surfaces of which are held in light engagement with the coincident webs of the shuttle-race by the auxiliary rails *n*, as will be readily seen on reference to Fig. 22. A shuttle-race composed of the two upper webs or top guides and a main rail, broadly considered, was disclosed by me in my Letters Patent No. 241,609, dated May 17, 1881; but as there shown, and also as shown in my Letters Patent No. 253,156, the main rail supports the shuttle, while in my present machine the shuttle is supported by the auxiliary yielding rails.

The shuttle cap or cover *r* is composed of sheet metal struck up in a die, and has a sufficiently heavy center for properly resisting the engagement therewith of one arm of the shuttle lever or driver, and it conforms in outline to the rear end of the shuttle shell. Said cap is pivoted at its top to the shell so as to swing laterally thereon, and at its lower side it has a notch, *r'*, into which the nose of a small spring-latch, r^2, enters for securing it in its closed position. The cop-chamber *s* within the shuttle has two parallel ends, *s'*, one of which is in the cap or cover and the other is near the nose of the shuttle, and this is centrally perforated at s^2 for the passage of thread from the interior of a cop to the delivery-apture s^3 in the nose of the shuttle. It will be seen that when a properly-proportioned straight cylindrical cop of waxed thread is placed in the cop-chamber it will be bent, but that its two ends will be maintained in parallel planes, and hence the bending of the cop will in no manner derange the coils of the cop.

For a better understanding, if need be, of such portions of the machine shown as do not relate to my present improvements, I will refer to my several Letters Patent hereinbefore designated.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. In a wax-thread sewing-machine, the combination, substantially as hereinbefore described, of the waxing apparatus organized to wax thread on its way to the work-plate, the take-up mechanism engaging with the dry thread before it reaches the waxing apparatus, and the tension-disks, brake-lever, and thread-block organized, substantially as described, for operating only upon the thread prior to its receiving wax, as set forth.

2. The combination, substantially as hereinbefore described, of the thread-brake B, with and interposed between the tension device and the take-up mechanism, and essentially embodying the pivoted brake-lever, having at its take-up end an eye for the passage of the thread and at its opposite end a compressing face, and a thread-block co-operating with said lever and provided with a compressing-face conforming to that on the lever, whereby thread in passing from the tension device will pass between said faces and through said eye to the take-up mechanism and enable the latter to cause the thread to be firmly clamped between said faces.

3. The combination, with the take-up lever, in a wax-thread sewing-machine, of a pad mounted upon an arm which is located below said lever and pivoted adjacent to the rock-shaft on which said lever is mounted, substantially as and for the purposes described.

4. The combination, with the pad and its arm, in a wax-thread sewing-machine, of the tubular adjusting or stop screw and the interior screw by which the pad-arm is locked to its stop screw, substantially as described.

5. In a wax-thread sewing-machine, the combination, in a waxing-tube head, of the flexible packing having a hole therein for the passage of thread, the screw-cap, and the follower interposed between the cap and packing, substantially as described, whereby the packing may be well controlled for engaging with fine or with coarse thread, and the opening through the packing secured against derangement when the cap is rotated.

6. The combination, in a wax-thread sewing-machine, of the wax-tank, the thread-waxing tube above the work-plate and occupied by thread on its way to the needle, and the heated jacketed pipe extended into said tank and connecting it with the bottom of said tube, substantially as described.

7. The combination, in a wax-thread sewing-machine, of the feed-adjusting lever, a latch thereon having one or more V-shaped notches or serrations, and a segmental plate having a series of notches or serrations corresponding to those on the latch, substantially as described.

8. The combination, substantially as hereinbefore described, of a shuttle-rail having a steam-conducting passage by which said rail is highly heated, and a shuttle mounted on said rail and provided with parallel webs, forming a groove occupied by said rail, whereby a direct conduction of heat is secured between the surfaces in contact with the steam and the interior of the shuttle.

9. The arched shuttle-race having webs and a main shuttle-rail, and also an auxiliary yielding rail on each side of the main rail,

in combination with a shuttle having webs which afford a longitudinal groove between them for receiving the main rail, and which have bearing contact with the auxiliary yielding rails, substantially as described, whereby the shuttle is supported by said auxiliary rails and forced toward the webs of the race by yielding pressure.

10. The combination, with an arched shuttle-rail, of a waxed-thread shuttle longitudinally curved and provided with webs on its under side, and also having a longitudinal thread slot or groove on its upper side, the tension-spring within said groove and operating toward one side thereof, and the lateral pin p' across said groove and through said spring, and a similar pin, p^2, at the rear of said spring, substantially as described, whereby thread in passing from the nose of the shuttle rearwardly between said spring and one side of the groove is prevented from passing beneath the free end of the spring, as set forth.

11. The combination, with an arched shuttle-rail, of the longitudinally-curved shuttle having a similarly-curved cop-chamber which has parallel ends, substantially as described, whereby when a waxed-thread cop is bent and occupies said chamber its two ends will be parallel and prevent the separation of its coils at its outer or convex side.

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Witnesses:

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