Nov. 1, 1960 J. F. GERBE 2,958,303

THREAD PICK-UP MECHANISM FOR BUTTON HOLE MACHINES

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FIG. 1

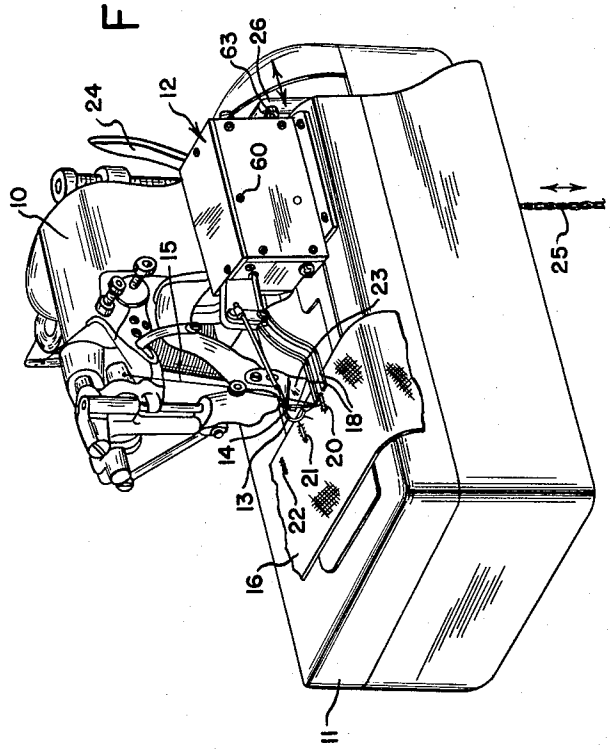
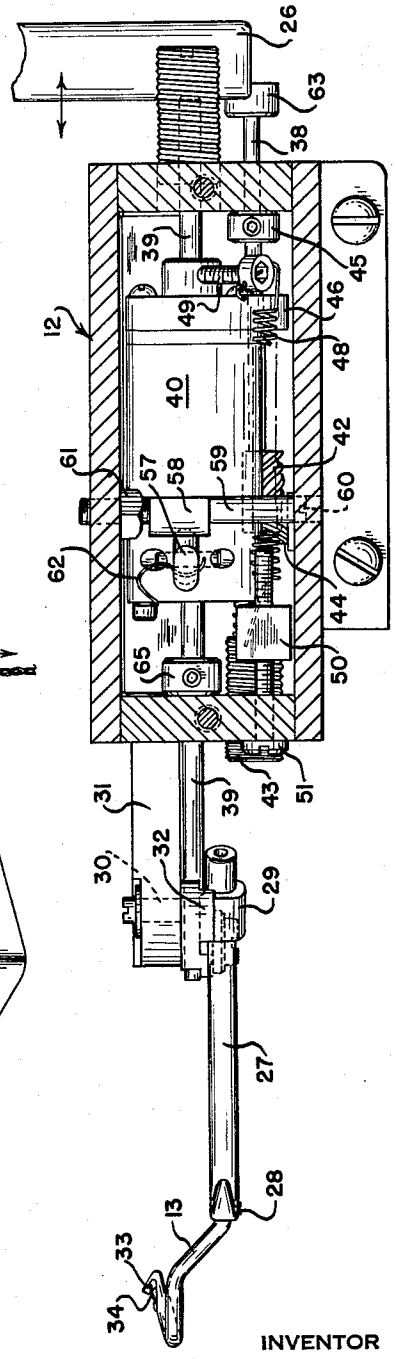


FIG. 2



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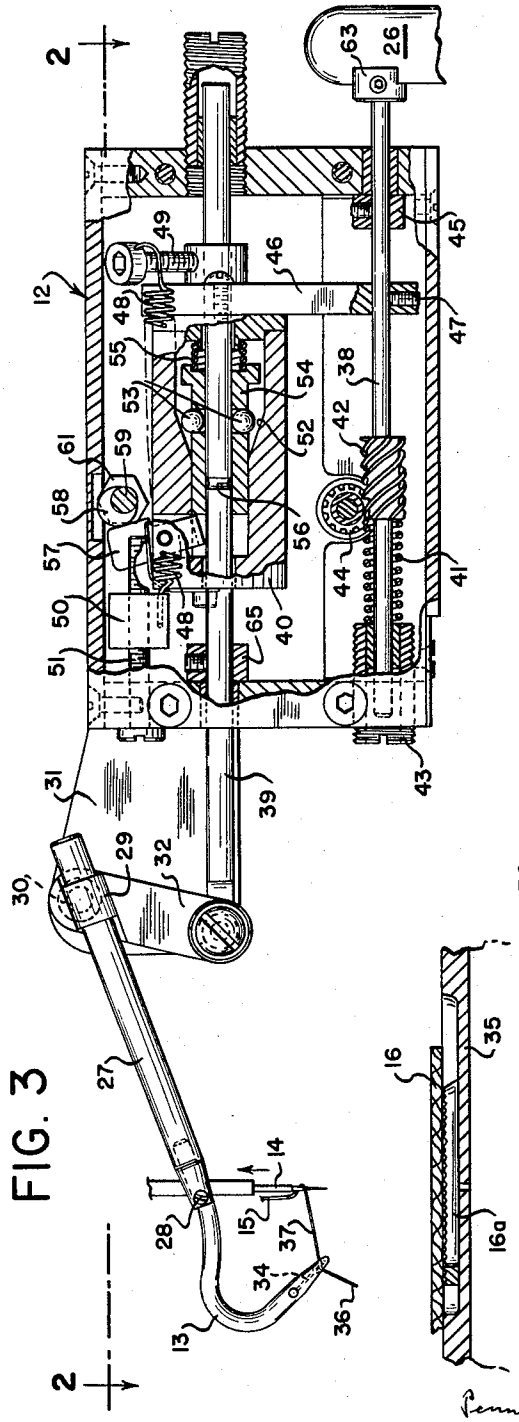


FIG. 3

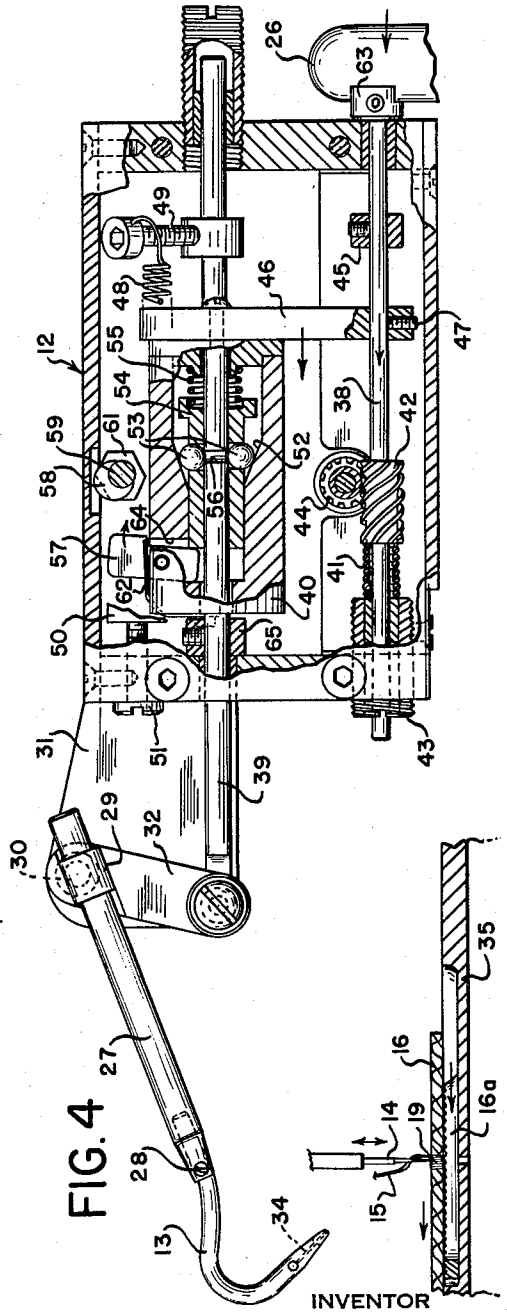


FIG. 4

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THREAD PICK-UP MECHANISM FOR BUTTON HOLE MACHINES

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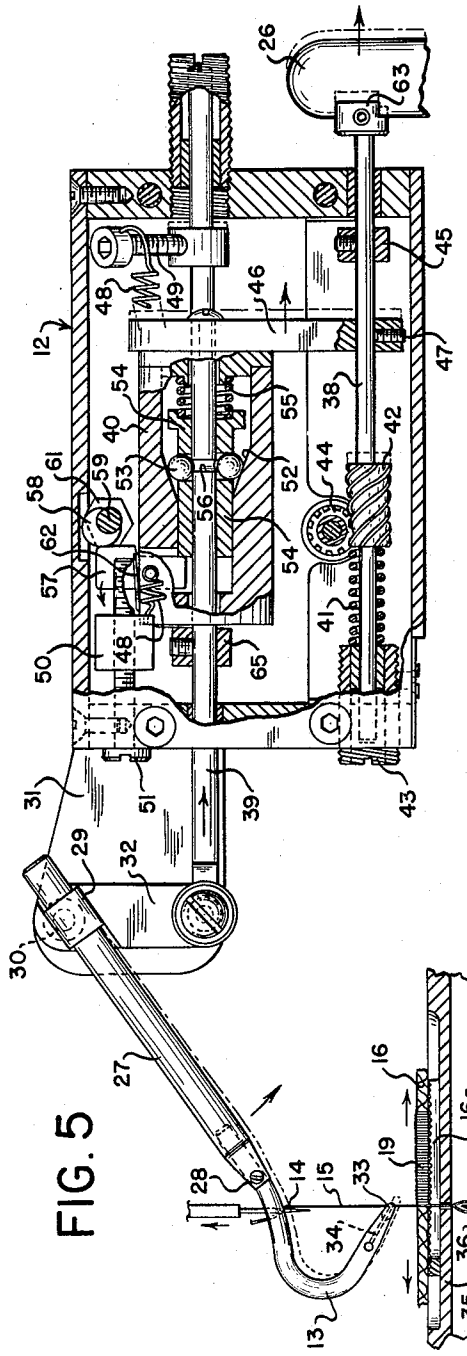


FIG. 5

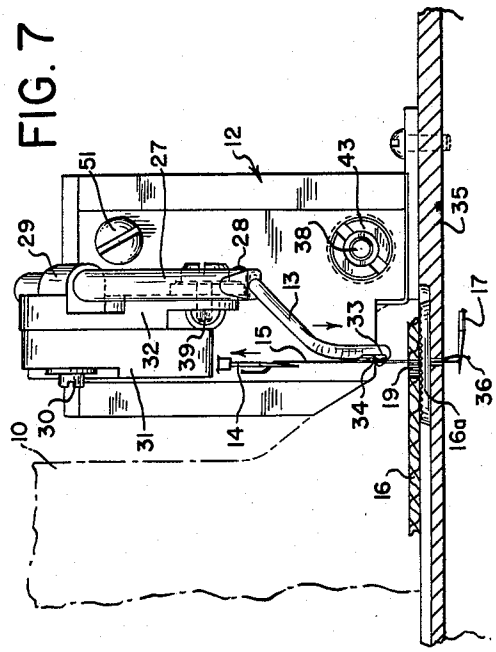


FIG. 7

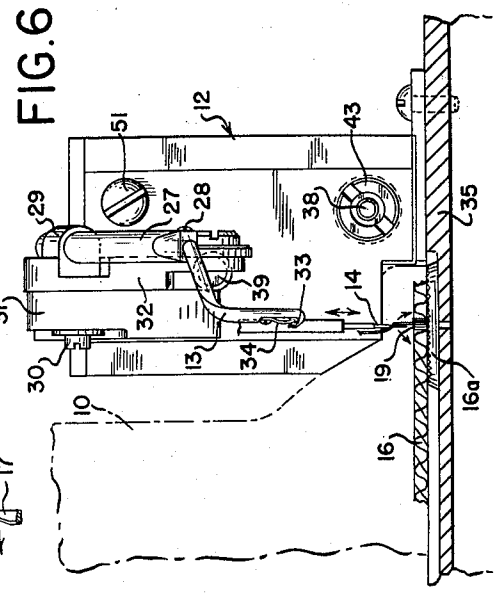


FIG. 6

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THREAD PICK-UP MECHANISM FOR BUTTON HOLE MACHINES

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1 Claim. (Cl. 112—253)

This invention relates to machines for making button holes.

In the conventional button hole machine, when each button hole is completed the single thread used is severed beneath the workpiece, that is, beneath the feeding mechanism or bed plate of the machine, but the end of this thread is held frictionally by the workpiece and is carried over the surface of the workpiece to the next succeeding button hole. Hence, in making a series of button holes in a garment, such, for example, as a sweater, the button holes are connected with each other by a loose thread extending over the surface of the cloth. These loose threads which bridge over from one button hole to another are at present removed by hand, one end being merely pulled away from its frictional engagement with the cloth, and the other end being cut by a pair of scissors, knife, or the like. Thus in order to make the garment presentable, an extra hand operation is required.

The object of the present invention is to provide the button hole machine with mechanism for eliminating such a thread interconnecting adjacent button holes.

The mechanism comprises a hook member which is operated in timed relation to the reciprocation of the needle and other parts of the stitch forming mechanism such as the thread cutter below the bed plate in such a way as to pull free of the work the thread which extends from the workpiece upward to the needle at the end of the operation of making a button hole. This hook member pulls the lower end of such thread free from its frictional attachment to the work, and lifts it up to about the level of the needle which is now stationary and at the upper end of its stroke.

After the work has been shifted to the location where it is desired to make the next succeeding button hole the hook member still holds the thread while the needle descends on its first few strokes in making the new button hole. A friction device, such as a flat spring is provided in the bight of the hook which frictionally engages the thread and from which the thread is pulled or drawn during these strokes of the needle, so that this length of thread is consumed in making the first part of the new button hole. In this way the bridging threads interconnecting the button holes are completely eliminated.

While this mechanism can be built into the button hole machine, that is, included as a part of the mechanism of such machine, it can also be provided as an attachment for existing button hole machines, and will so be described and illustrated in the present application.

The invention will be understood from a consideration of the accompanying drawings and the following detailed description of such an attachment device applied to a button hole machine.

In these drawings:

Fig. 1 is a perspective view of a conventional button hole machine equipped with the thread lifting device of the invention;

Fig. 2 is a horizontal sectional view of the thread pick-up mechanism taken on line 2—2 of Fig. 3;

Fig. 3 is a front elevation of the thread pick-up mechanism with a portion broken away and showing the parts in vertical section and in their normal position prior to the commencement of the making of a button hole;

Fig. 4 is a view similar to Fig. 3 but with the parts in position to actuate the thread pick-up device, that is, in the position they occupy during the making of the button hole;

Fig. 5 is also a view similar to Fig. 3 but showing the parts in a still different position just prior to the pick-up of the thread by the pick-up device, the button hole having been completed;

Fig. 6 is an elevation looking from the left of Fig. 4; and

Fig. 7 is a similar view looking from the left of Fig. 5.

Referring now to these drawings, in Fig. 1 there is shown in perspective a conventional button hole machine which comprises a main frame **10** mounted on a base **11** which houses the lower portion of the mechanism of the button hole machine. Mounted on the front of the main frame **10** there is a rectangular casing **12** which contains the mechanism for operating the hook member **13** which serves to pick up and eliminate the threads that would otherwise interconnect the button holes.

The stitch-forming mechanism of the button hole machine is conventional in all respects and includes the usual vertically reciprocating needle **14** through which a single thread **15** is fed to the remaining parts of the stitch-forming mechanism located within the base **11**. Some of these additional parts of the stitch-forming mechanism include a work feeding device **16***a* which feeds the workpiece **16** in a direction lengthwise of base **11** or crosswise of the workpiece as shown; also loop-forming mechanism (not shown) and a knife **17** (Figs. 6 and 7) which severs the thread **15** at the loop at the end of the button hole making operation; also a pair of clamp arms **18** are lowered at the start of each button hole making operation and serve to hold the workpiece **16** while it is fed in a direction lengthwise of these arms during the sewing of the button hole stitching indicated at **19** in Fig. 5.

A series of button holes such as indicated at **20**, **21** and **22** in Fig. 1 may be made. To form the stitching, as for button hole **20**, the work is fed first in one direction the desired length of the button hole and then in the opposite direction, returning to the starting end of the button hole. Thereupon a knife blade **23** descends and cuts through the material of the workpiece **16** between the two lines of button hole stitching which have been made. The button hole forming mechanism ceases operation automatically, and the operator, by means of handle **24**, raises the clamp arms **18** and shifts the workpiece **16** to the proper location for the next button hole **21**.

The button hole forming cycle starts at the left hand end of each button hole as viewed in Fig. 1, and the cycle also ends at the same point. The cycle is initiated by the operator of the machine by depressing a pedal, or similar device, attached to the lower end of a chain **25**, the upper end of which is connected to a start and stop motion, or control, mechanism. The only part of this mechanism shown is the stop bolt holder member **26** located near the right end of casing **11**. In starting, member **26** is moved to the left about ½", from the position shown in Fig. 3 to that of Fig. 4, and this motion of member **26** is utilized to operate the mechanism of the thread pick-up attachment illustrated in Figs. 2–7 and contained within the casing **12**.

The hook member 13 is carried at the end of an arm 27 and is adjustable thereon by means of a clamp screw 28. Arm 27 is mounted near its right end in a support 29, in which it is longitudinally adjustable, and support 29 has a horizontal pivot 30 in a bracket 31 which projects from the left end of casing 12. Support 29 also has an integrally formed actuating lever 32 which projects downwardly and by which support 29 can be rocked about its pivot so as to swing arm 27 and hook 13 as required in its thread lifting or pick-up operation. Support 29 is mounted to the right of the machine needle 14 as viewed in Figs. 6 and 7, and hook 13 has a double curvature in order to locate the bight 33 of the hook substantially in line with needle 14 in the direction of feed of the workpiece during the making of the button hole stitching.

In operating the hook 13 to lift the thread, the hook is first swung from its uppermost position (Fig. 3) (which is about in line with the eye of needle 14 when at the top of its stroke) to its lowermost position shown in Fig. 5 where the bight 33 of the hook is close to the surface of workpiece 16. It engages thread 15 while the needle 14 is approaching its uppermost position in making its last upward stroke at the completion of the button hole stitching operation. On the inside of bight 33 there is mounted a small plate spring 34, best shown in Figs. 2, 6 and 7.

The thread 15 is pinched between the surface of spring 34 and the outside tip of the bight 33 (Fig. 2) so that the thread is frictionally held by the hook. As soon as needle 14 reaches the upper end of its last stroke, hook 13 is swung quickly upwardly back to its original position shown in Figs. 3 and 4. Just before the commencement of the upward movement of hook 13, knife 17 severs the thread 15 at the loop (not shown) formed by the stitch-forming mechanism and beneath the work 16, feeding means 16*a* and the bed plate 35. Hence the upward movement of the hook pulls the lower end 36 of the severed thread free of the workpiece 16 and holds it suspended above bed plate.

As this takes place at the end of the formation of a button hole, the operator now shifts the workpiece 16 to the next button hole location and again presses the control pedal to restart the machine. During the first few strokes of needle 14 in making the new button hole stitching, the length of thread 37 from the needle to the cut-off end 36 is drawn into and consumed into forming the button hole stitching for the new button hole. The outer end of this thread is allowed to slide under the slight frictional resistance by spring 34 and the outer tip of the hook bight 33.

The mechanism for operating hook 13 to carry out these movements is mounted within casing 12. The principal parts of this mechanism are: an operating shaft 38, a hook actuating shaft 39, and a ball clutch 40. Shafts 38 and 39 are mounted in parallel relation for sliding movement in bearings in opposite ends of the casing. Hook actuating shaft 39 is pivoted at its right end to lever 32, the pivot pin operating in a short radial slot in this lever.

On the operating shaft 38 there is a strong compression coil spring 41, the right end of which engages a worm 42 fixed to the shaft. Its left end is adjustable in position by means of a threaded sleeve 42 whereby the force exerted by the spring can be varied. This sleeve also supports a bushing that serves as the bearing for the left end of shaft 38. A worm gear 44 is driven by worm 42 when shaft 38 is moved longitudinally as will be described, this worm gear turning against a friction washer and providing a fixed frictional resistance for a purpose which will also appear later.

Spring 41 urges shaft 38 towards the right its movement being limited by a collar 45 fixed to the shaft, and the shaft also carries a vertical bar 46 which extends upwardly and is secured to the right end of clutch 40. This bar is fixed to shaft 38 by means of a set screw 47.

A tension coil spring 48 is arranged to urge shaft 39 towards the left and therefore urging hook 13 towards its upper position. Spring 48 is connected at its right end to a projection 49 which is fixed to shaft 39, and at its left end to a block 50, the position of which is adjustable from the outside of the casing by turning screw 51 so as to adjust the force of spring 48.

Clutch 40 is a hollow cylindrical member having an interior bore which is larger at the right end than at the left and which includes a conical clutching surface 52. A plurality of balls 53 co-act with this conical surface to produce the clutching action and their position is controlled by a carrier sleeve 54 which is slidable on shaft 39. A coil spring 55 surrounding shaft 39 urges the ball carrier and balls 53 into engagement with the conical surface 52, which in turn urges the balls 50 into engagement with shaft 39, and particularly into engagement with a circular groove 56 in the surface of this shaft.

Clutch 40 is provided with a release lever 57 which is pivoted on the clutch above shaft 39 and midway between its ends. The lower end of release lever 57 engages the left end of ball carrier sleeve 54, and the upper end or head of the lever engages an adjustable stop 58 when the clutch is shifted to the right. Stop 58 is in the form of an eccentric carried on a cross shaft 59 having one end slotted at 60 (Fig. 2) and the opposite end in threaded engagement with an aperture in the wall of casing 12. The eccentric stop member 58 can be adjusted by turning shaft 59, and locking it in adjusted position by means of a lock nut 61. The release lever 57 is biased by means of a spring 62 which urges the lever towards the locking position of ball carrier 54.

The operating shaft 38 is provided at its right end with a head 63 suitably shaped to engage the left hand surface of the stop bolt holder 26 of the button hole machine control mechanism.

The operation of this mechanism will now be described:

The operator adjusts the workpiece 16 so that the right end of a button hole location is directly beneath needle 14, and then depresses the pedal (not shown). This motion through chain 25, forces stop bolt holder 26 of the button hole machine control mechanism toward the left from the position shown in Fig. 3 to that shown in Fig. 4. At this time, the hook 13 is in its raised or uppermost position as shown in both Figs. 3 and 4. The movement of stop bolt holder 26 to the left causes shaft 38 to slide to the left and compress spring 41 as shown in Fig. 4.

Shaft 38 carries with it the bar 46 and clutch 40 and moves these parts to the left so that the head of release lever 57 is shifted away from its coacting stop member 58 (Fig. 4). This lever turns on its pivot under the action of spring 62 and also under the action of spring 55 which actuates the ball carrier 54 and shifts it towards the left also, so that its left end projects beyond the right side 64 of the aperture in which release lever 57 is mounted. The left hand movement of clutch 40 sliding along shaft 39 is sufficient to bring the clutch balls 53 into engagement with the groove 56 in the shaft, and the shaft 38 is now locked to shaft 39 through the cross bar 46 and clutch member 40.

The movement above described of shaft 38 by the stop bolt holder 26, compressing the main or operating spring 41, and the corresponding movement of clutch 40 and its locking engagement with actuator shaft 39 might be considered as a setting movement or "cocking" of the hook actuating mechanism.

The movements above described take place rapidly as the operator depresses the pedal of the button hole machine. The depressing of the pedal also places the stitch-forming mechanism of the machine in operation. The needle 14 reciprocates rapidly in coordination with the other parts of the stitch forming mechanism, while the cloth is fed first to the left and then back to the right and

to the starting point. Knife **23** is operated at the completion of the button hole stitching.

The last parts to move at the end of such a cycle are the knife **17** (Fig. 5) to cut the thread beneath bed plate **35** and the stop bolt holder **26** automatically shifting back to its right hand position. Such movement of member **26** causes operating shaft **38** to move toward the right under the action of spring **41**. The force of main operating spring **41** is greater than that of the tension spring **48**, and shaft **38** being connected with shaft **39** through clutch **40** as previously described, the entire mechanism, that is, not only shaft **38** but bar **46**, clutch **40**, and shaft **39** commence to move toward the right. This swings arm **27** and hook **13** downward and at the same time tensions spring **48**.

In Fig. 5 hook **13** and member **26** are shown in full line positions at the instant before they reach their extreme downward positions, which are indicated in dot and dash lines. In Fig. 5 the head of release lever **57** has engaged the eccentric stop member **58** and the lever is commencing to swing on its pivot. In another fraction of a second, the lower end of this lever will have shifted the ball carrier **54** to the right releasing the balls **50** from the groove **56**, that is, triggering the release of actuator shaft **39** and allowing it to snap in the opposite direction towards the left under the action of tension spring **48**.

The leftward movement of shaft **39** takes place in a fraction of a second and swings the hook **13** from the lowermost position shown in dotted lines in Fig. 5 to the original upward position shown in Fig. 3, this movement being stopped by the engagement of a collar **65** fixed to shaft **39** with the interior surface of the end wall of casing **12**. Such leftward movement of this shaft, and upward movement of hook **13** occurs in a very small fraction of a second and is timed to take place immediately after the severing of thread **15** by knife **17**. Inasmuch as the entire operation takes place almost simultaneously with the movement of member **26** to the right at the end of the button hole forming cycle, it is desirable to delay the operation of the hook **13** to a slight extent. This delay is

obtained in the attachment mechanism shown by means of the worm **42**, worm gear **44**, and its cooperating friction washer, together with the compression adjustment of the main operating spring **41** by threaded sleeve **43**.

I claim:

In a button hole machine having button hole stitch forming mechanism including a needle, work feeding means, a knife below said feeding means, operating mechanism for said stitch forming mechanism operative automatically through a cycle to form a button hole, and a hook member for lifting the thread which extends between the work and the needle at the end of a button hole forming cycle, means for operating said hook member, said means comprising mechanism including a clutch member for swinging said hook between an upper position at the level of the top stroke of the needle and a lower position adjacent the bottom stroke, a mainspring for operating said hook swinging mechanism through said clutch member, a device operative at the beginning of a button hole cycle for tensioning said mainspring and simultaneously moving said clutch member into engaged position with said hook swinging means, and means operative at the end of said cycle for releasing said mainspring and allowing it to actuate said hook swinging means, a second spring for returning said hook from its lower to its upper position, said spring being tensioned by said mainspring during the downward movement of said hook member, and means for releasing said clutch when the hook reaches said lower position thereby causing said second spring to return the hook to its upper position carrying said thread.

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