United States Patent

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[72] Inventor **Robert A. Haye**
Franklin Park, Illinois

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[73] Assignee **Union Special Machine Company**
Chicago, Illinois
a corporation of Illinois

[54] WORK FEEDING MECHANISM

13 Claims, 8 Drawing Figs.

[52] **U.S. Cl.** **112/212**
[51] **Int. Cl.** **D05b 27/04**
[50] **Field of Search** 112/212, 207

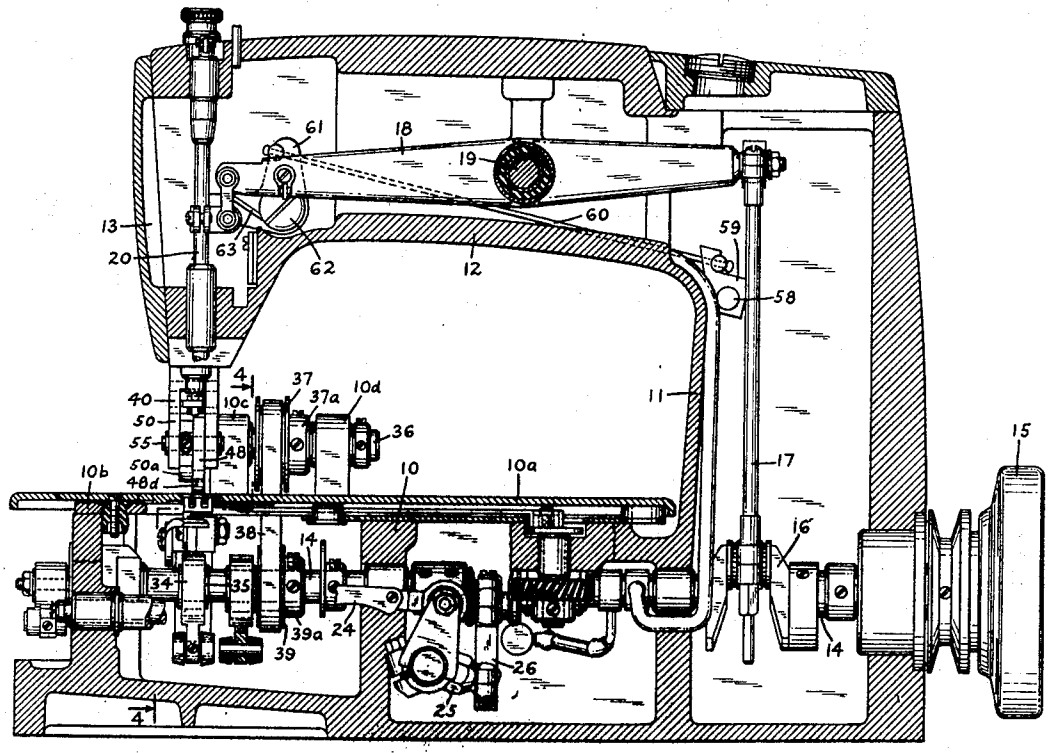
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Primary Examiner—Richard J. Scanlan, Jr.
Attorney—H. C. Dieserud

ABSTRACT: A sewing machine having work feeding mechanism adapted to engage the work on its upper and under surfaces to insure advancing the work to the desired extent in the course of a stitching operation. It is particularly concerned with sewing machines normally having only one rotary drive shaft which is disposed in the base portion of the machine, beneath the surface along which the work being stitched is advanced. The invention involves the provision of a second rotary shaft at only a slight distance above the work supporting surface. The usual connections are provided from the drive shaft to a feed dog below the work supporting surface and special connections are also provided to a feed dog above the work supporting surface from said second rotary shaft. The mechanism for accomplishing this is of minimum weight and both feed dogs are lifted and lowered and also reciprocated in the direction of feed and then returned in the opposite direction by relatively short and direct connections from the rotary shafts mentioned. This enables operation of both the top and bottom feed dogs at exceptionally high speeds, with a minimum of vibration being created.



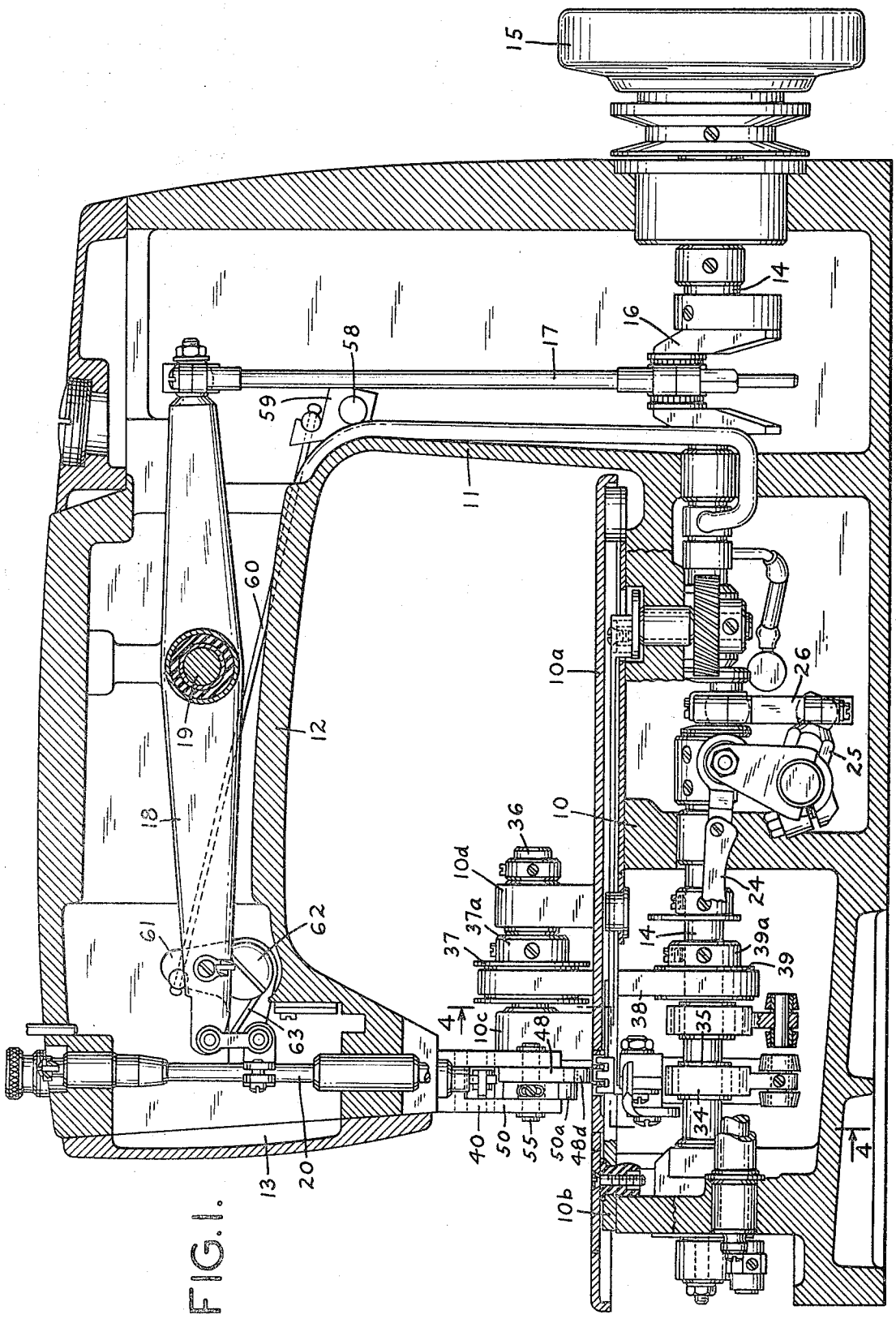
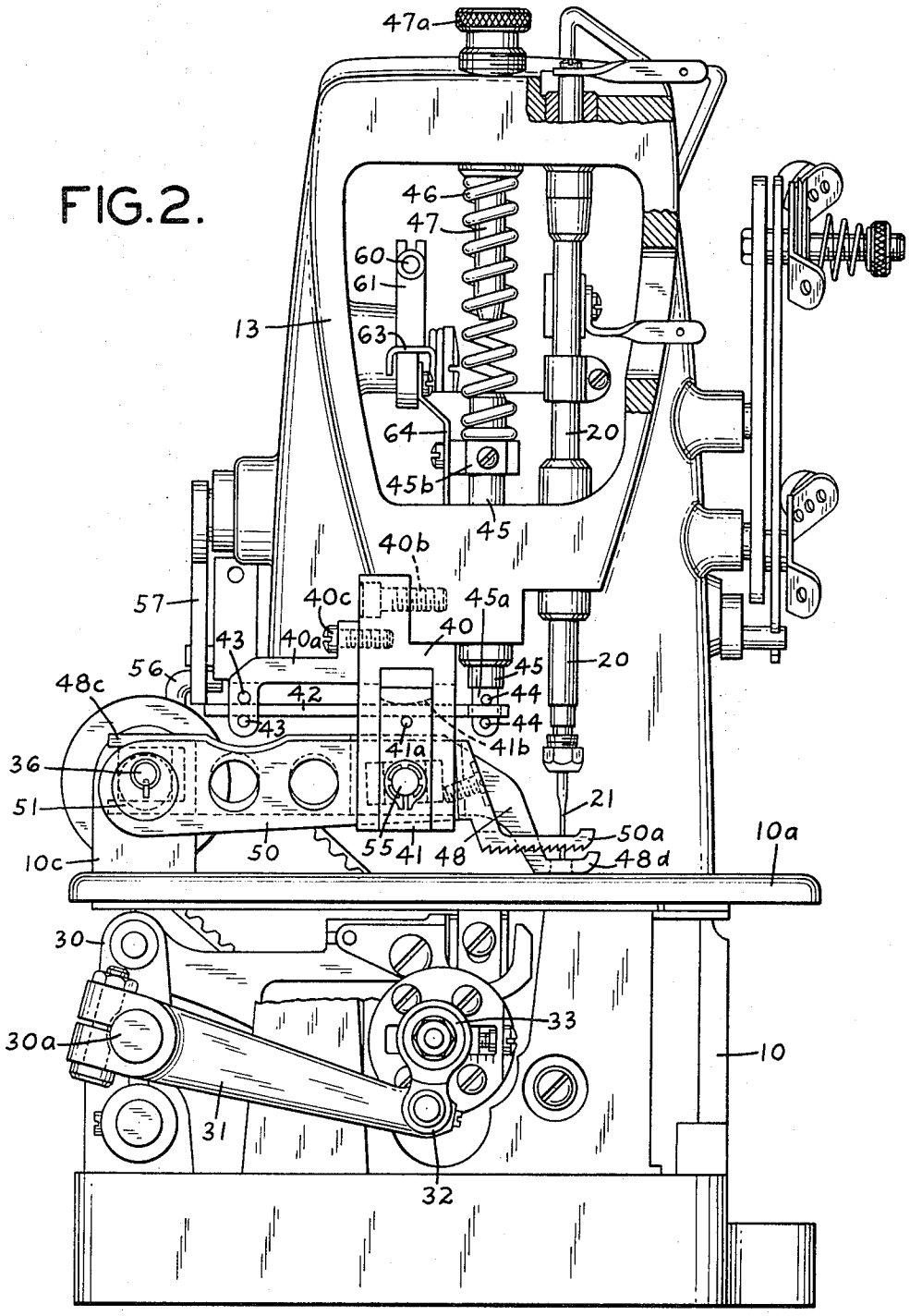

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58
59
11
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19
12
18
10a
26
25
10
36
10d
24
37a
37
14
39a
39
61
62
4
10c
48
38
35
63
40
50
55
50a
48d
34
4
13
20
10b

FIG. 1.

FIG. 2.


47a
46
47
60
61
13
63
64
20
45b
45
40b
57
40c
45a
43
40a
40
45
20
56
48c
42
44
43
44
41a
41b
36
21
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50a
10a
10c
50
55
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48d
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33
30a
10
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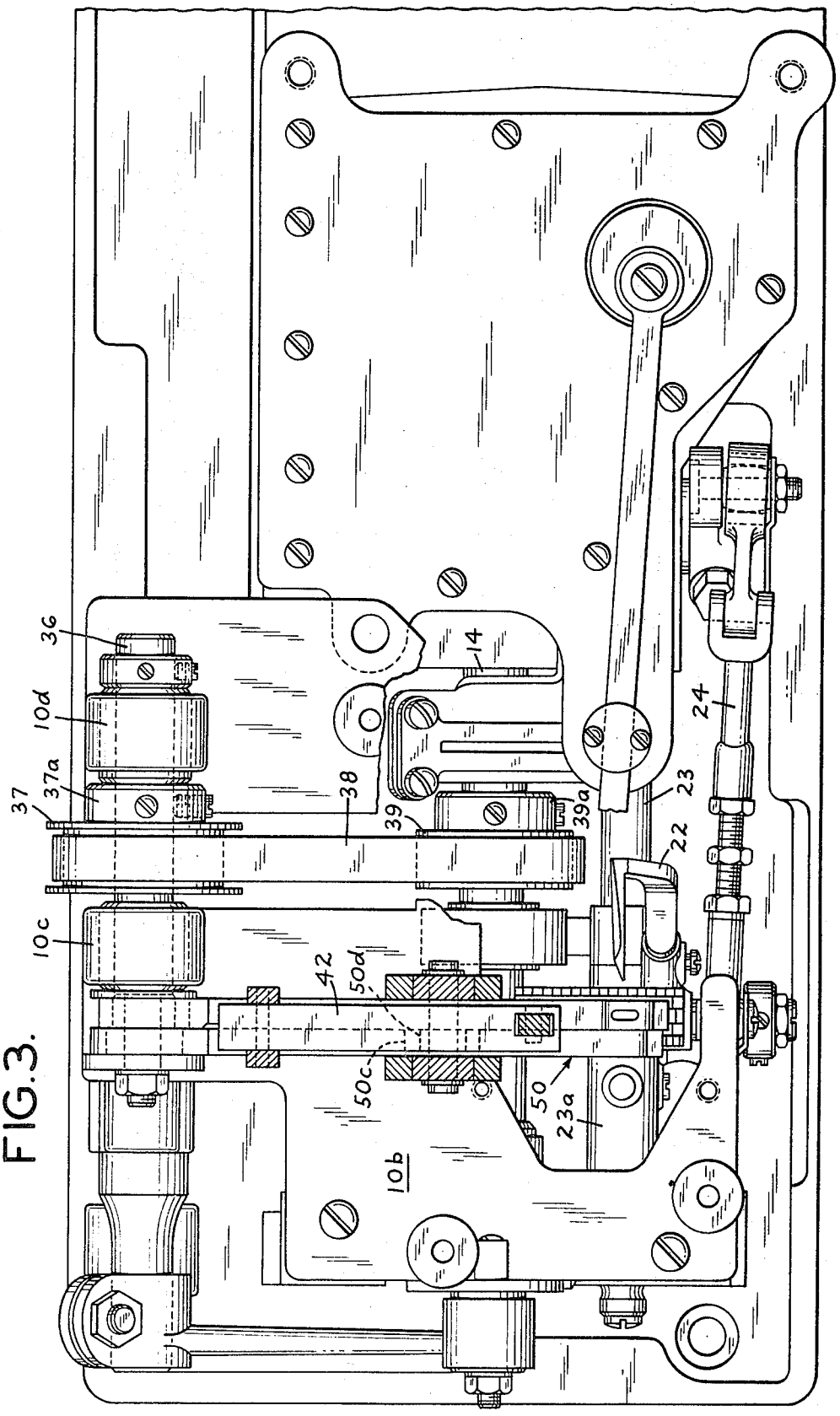


FIG. 3.

FIG. 4.

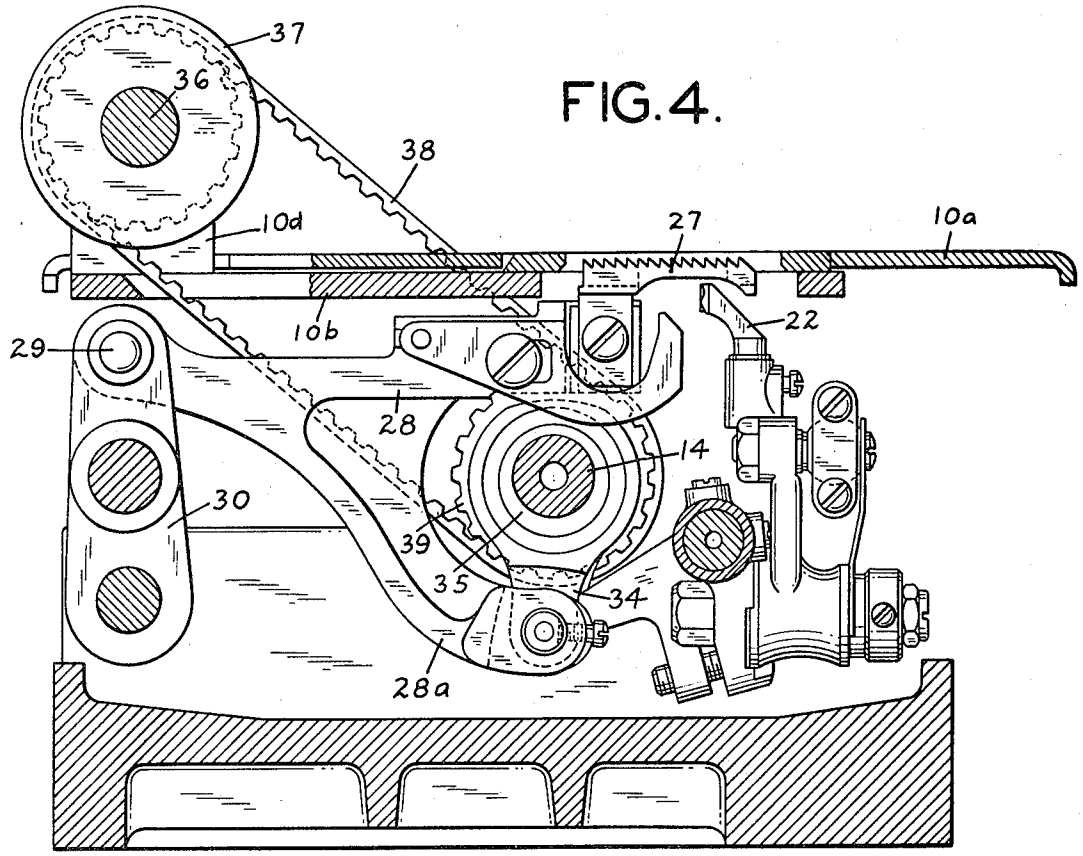
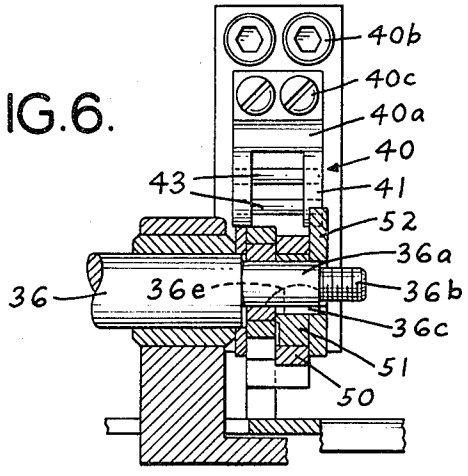

37
36
38
10d
27
10a
10b
22
29
28
14
30
39
35
34
28a

FIG. 6.


40b
40c
40a
40
43
41
52
36a
36
36e
36b
36c
51
50

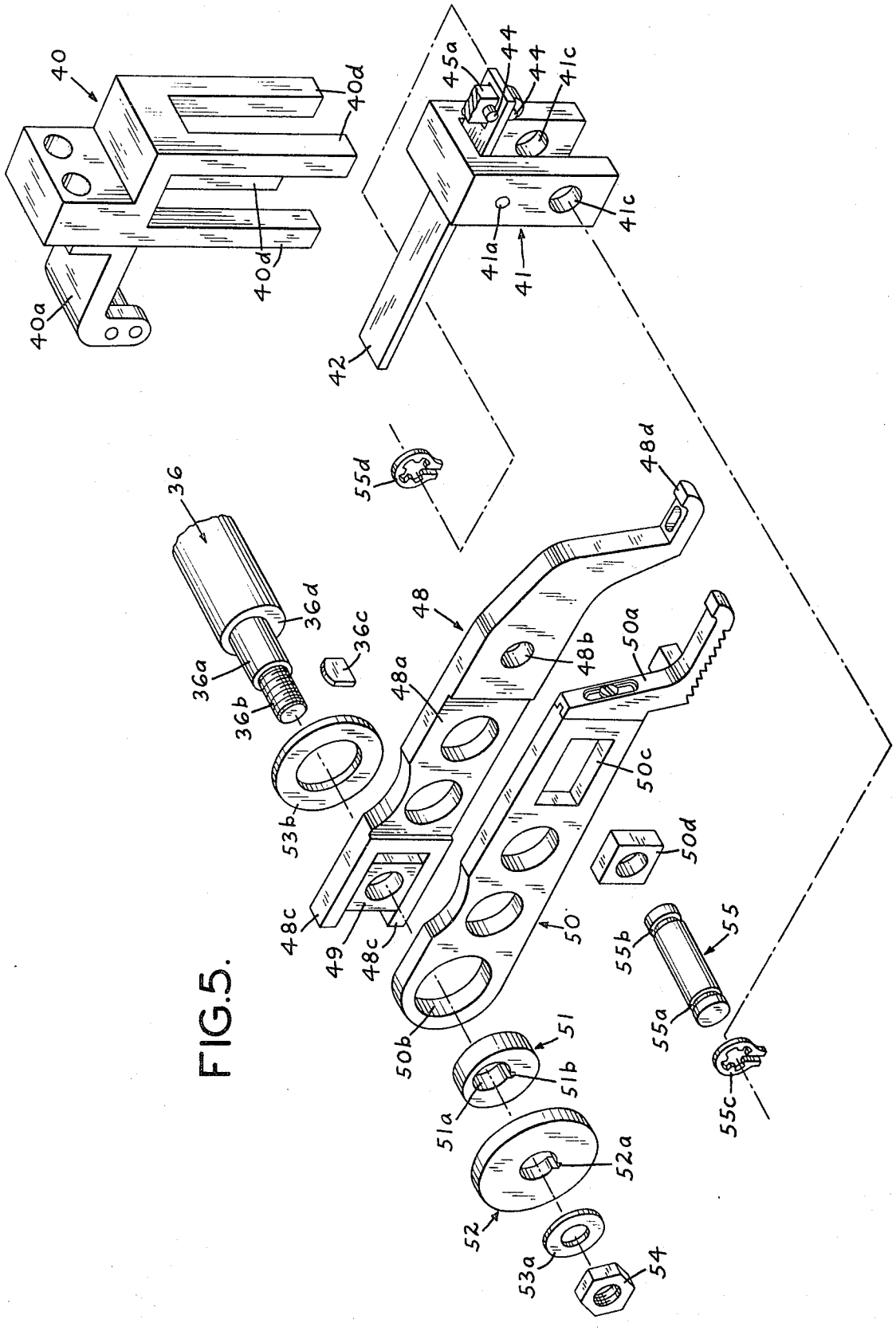

40
40d
40d
40a
42
45a
44
44
41c
41c
41a
41
55d
48d
36
36d
36c
36a
36b
48
48a
48b
50a
50c
53b
50d
48c
49
48c
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55b
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55a
55c
50b
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51b
51a
52a
52
53a
54

FIG.5.

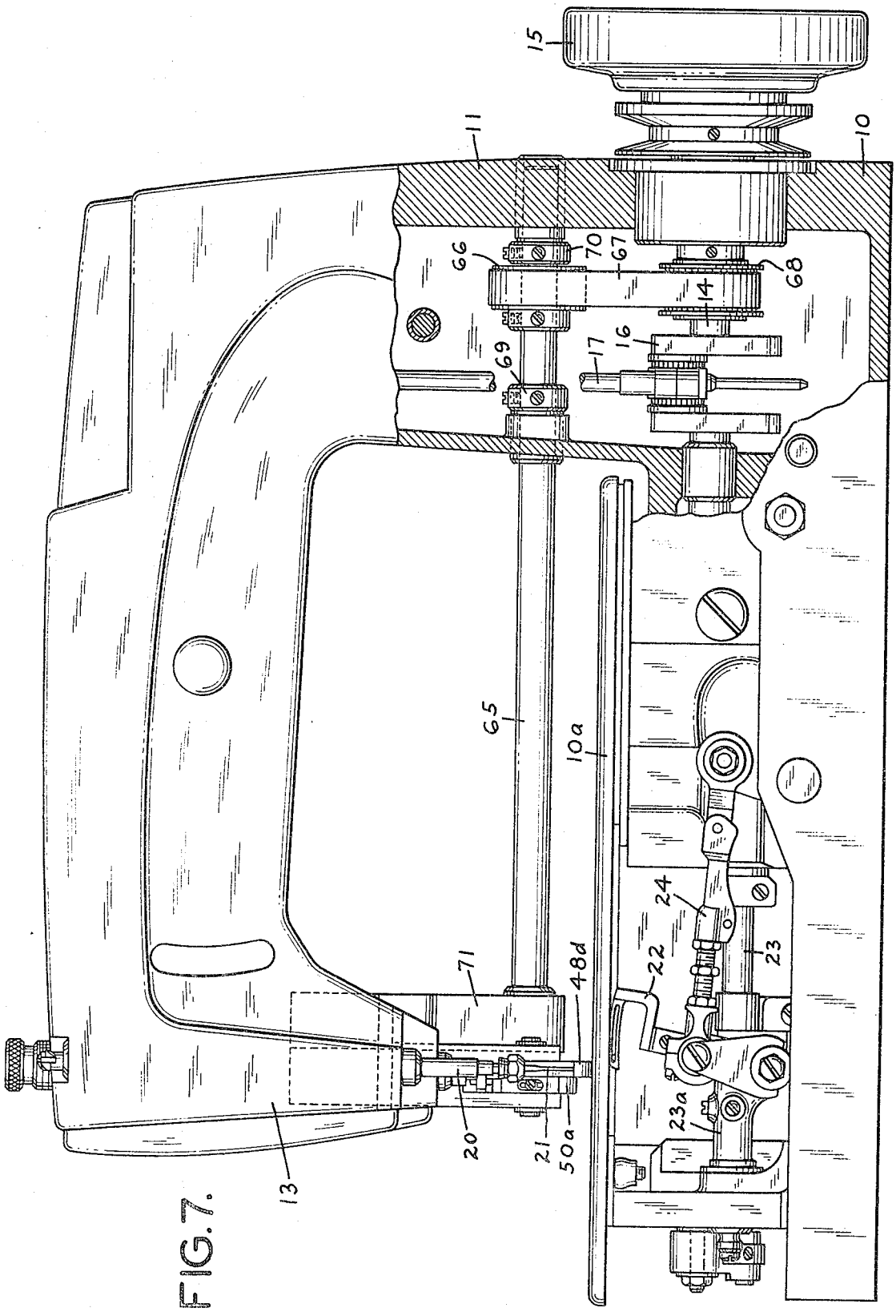
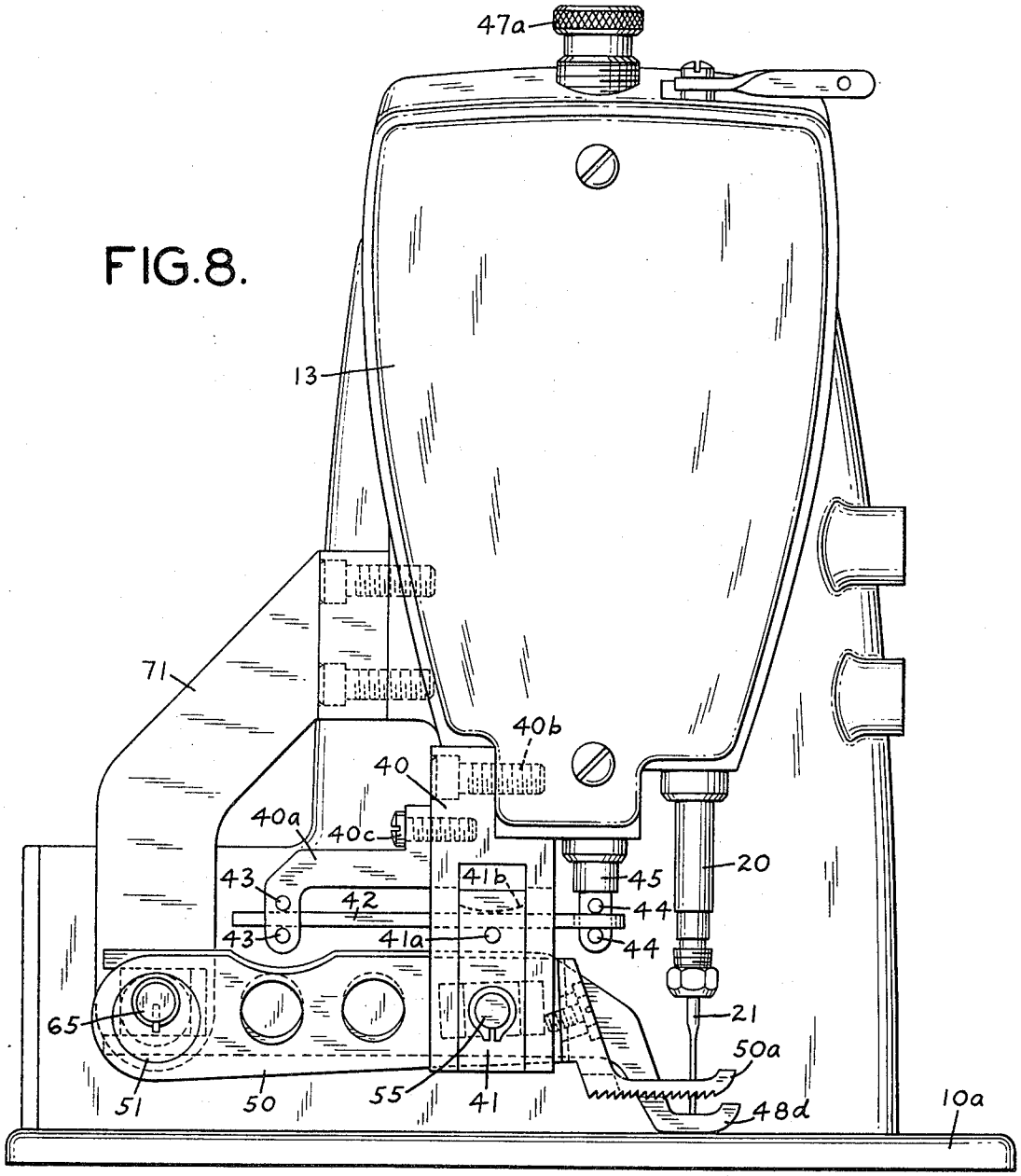

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68
14
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17
69
65
10a
24
22
23
71
48d
23a
20
21
50a
13

FIG. 7.

FIG.8.


47a
13
71
40b
40
40a
40c
43
42
43
41b
41a
45
44
44
20
21
50a
48d
10a
65
51
50
55
41

WORK FEEDING MECHANISM

This invention relates to work feeding mechanism provided in a high speed sewing machine. It is of a character involving feed dogs cooperating with both the top surface and the under surface of a workpiece to insure accurate advance of the latter step-by-step through the stitch-forming zone of the machine.

An object of the invention has been to provide both top and bottom work feeding mechanisms operated in coordination for insuring the uniform step-by-step advance of multiple-layered workpieces through the stitching zone. As is well understood, there are certain types of workpieces which require the gripping of the same on both their top and bottom surfaces in order to insure proper advance of the workpieces through the stitching zone with no slippage of one layer in relation to another. Typical instances of this are the performance of stitching operations on gloves or the like for closing the same, or attaching binding strips, or performing edge stitching operations on the same. A particular problem which the invention deals with most effectively involves two or more layers of material forming the workpiece which have cooperating surfaces that are quite smooth and are readily slidable in relation to each other as they are advanced through the stitching zone in the course of high speed operation of the machine.

The present invention provides work feeding mechanism both above and below the workpiece, each of these feeding mechanisms being directly operated from a related rotary shaft in a manner to insure uniform operation of the two work feeding mechanisms at high speeds with a minimal tendency to produce objectionable vibrations in the machine.

With the foregoing objects, features and advantages of the invention in mind certain embodiments of the same will now be described in detail by reference to the accompanying drawings, in which:

FIG. **1** is a longitudinal, vertical sectional view through a flat bed machine having a main drive shaft in the base, and which embodies one form of the novel connections from said shaft to the top work feeding mechanism;

FIG. **2** is an end view of the machine shown in FIG. **1**, as seen from the left of FIG. **1**, a cover member being removed and portions of the frame being broken away to illustrate the mechanism within the machine;

FIG. **3** is a plan view of a portion of the base of the machine with the work supporting member thereof removed and with certain parts broken away to more clearly illustrate the construction;

FIG. **4** is a vertical sectional view taken through the machine along the line **4–4** of FIG. **1**;

FIG. **5** is an exploded perspective view of the top feed mechanism embodied in the machine;

FIG. **6** is a detail view, partly in elevation and partly in vertical section, showing certain parts of the top feed mechanism;

FIG. **7** is a front elevational view of a modified form of the invention applied to a flat bed sewing machine; and

FIG. **8** is an end elevational view of a machine embodying the modified form of the invention.

The invention has been illustrated in the drawings as applied to a flat bed sewing machine, but it will be understood that it is capable of being applied to other types of sewing machines. The illustrated machine has a frame structure involving a bed portion **10**, a vertical standard **11**, an overhanging arm **12** and a head portion **13** at the outer end of said overhanging arm. Within the base portion of the machine there is provided a main drive shaft **14** which extends outwardly from the frame at the right side thereof (FIG. **1**) and has secured thereto a combined handwheel and pulley **15**. Through the latter the main drive shaft is adapted to be driven by a belt from any suitable power source. Within the vertical standard **11** of the frame, the shaft **14** is provided with a crank member **16**, which, in a well-known manner, serves to impart movement to a pitman **17** which has its upper end connected with one end of a lever **18** rockably mounted on a shaft or stud **19**. The other end of lever **18**, at the left in FIG. **1**, is connected with a needle bar **20** which is mounted for vertical reciprocation

within the head **13** in a conventional manner. At its lower end the needle bar carries a needle **21** which is reciprocated from a position above the work supporting surface of the machine to a position in which its threaded eye is below said surface. As shown in FIGS. **1** and **2** the bed portion of the frame is provided with a conventional work supporting plate **10***a* secured to a top plate **10***b* extending over substantial portions of the top of the bed of the frame. The stitch forming mechanism may be of any of the conventional forms adapted to provide a suitable line of stitching. That illustrated in the drawing includes a four-motion looper **22** which cooperates with the needle, when the latter extends downwardly through the work, to form a two-thread chain stitch, type **401**. Other devices are provided for insuring the proper cooperation of the stitch-forming elements, but these are of conventional form and mode of operation, so that they need not be described. Suffice it to say that the looper is rockably mounted on a sleeve **23***a* which in turn is mounted on a shaft **23**, and is adapted for rocking movement about the axis of that shaft for needle avoid purposes. The rocking of the looper with respect to said sleeve imparts the loop seizing and shedding movements to the looper. For imparting such movements to the looper there is provided a link **24** which is connected with the rockable looper at one end and with connections from the drive shaft at its other end. These connections include a rock member **25** and a pitman **26** which is connected at one end with an eccentric on the drive shaft and at its other end with an arm of the rock member.

Within the base portion of the machine there is provided a conventional form of work feeding mechanism which is best shown in FIG. **4**. It comprises a feed dog **27** which is adjustably mounted upon a member **28** which is pivotally connected with a shaft or stud **29** carried by the upper portion of a feed rocker member **30**. A downwardly extending portion **28***a* of member **28** has its right end pivotally connected with a pitman **34**, the upper end of which surrounds an eccentric **35**. Lifting and lowering movements are imparted to the feed dog **27** by this eccentric. Rocking movements are imparted to the feed rocker **30** by the connections shown in FIG. **2**. These include an arm **31** secured to a stud **30***a* extending laterally from a part of the rocker **30**. At its free end, the arm **31** is connected with a pitman **32**, the upper end of which cooperates with an adjustable eccentric **33**. Conventional means may be provided for varying the extent of eccentricity of eccentric **33** so as to bring about the desired feed stroke of the feed dog **27**.

The present invention is primarily concerned with a special novel mechanism for imparting a feed movement to the top portion of the work in cooperation with the under feed dog **27**. As has been indicated, it has frequently been found necessary or desirable to impart a feeding movement to the top layer of a multiple layer workpiece being advanced through the stitch forming zone. By the present invention such top feeding action is provided in such a way as to eliminate undue noise and vibration, with the machine being capable of operation at very high speeds. To achieve this end it has been found highly desirable to provide a separate drive shaft **36**, above the work supporting plate **10***a* Shaft **36** must, of course, be driven in timed relation with the main drive shaft **14**. For this purpose there is secured a toothed pulley wheel **37** to the shaft **36** at a point intermediate two upstanding members **10***c* and **10***d* integral with or otherwise secured to the top **10***b* of the base of the frame. The pulley **37** is connected by a toothed belt **38** with a toothed pulley **39** secured to the main drive shaft **14**. The arrangement is such that for each revolution of the main drive shaft a revolution will be imparted to the special drive shaft **36**.

Secured to the rear side of the head of the overhanging arm of the machine is a special bracket **40**, the form of which is best shown in FIG. **5**. On its rear side, this bracket has an extension **40***a* secured to it by screws **40***c* shown in FIG. **2**. The bracket itself is secured by screws **40***b* to the head of the machine frame. Within the partially enclosed space formed by the four downward projections **40***d* of the bracket **40** there is

slidably mounted an inverted U-shaped bracket **41**. This has extending through it, adjacent its upper end, a flat spring bar **42**, one end of which is snugly fitted between pins **43** carried by bracket extension **40***a* and at its opposite end it fits snugly between pins **44** carried by a flattened, downward extension **45***a* of a presser bar member **45**. The latter is normally urged downwardly by a spring **46** which surrounds the upper end of the presser bar and exerts a force against a collar **45***b* secured to the presser bar. The upper end of the spring **46** surrounds a downwardly extending pin **47** having a knurled head **47***a* at its upper end. This permits adjustment of the force exerted by the spring **46** against the collar **45***b* and hence the presser bar **45**. It may be mentioned that the present construction is such as to bring about proper operation of the presser foot, to be described, with a smaller force being exerted by the spring **46** than is required in a conventional presser foot structure. The bracket **41** has a curved surface **41***b* provided on the underside of the top of the inverted U, as best shown in FIG. **2**, to facilitate the desired flexing of the spring bar **42** during the operation of the machine. A pin **41***a* extending beneath the spring bar **42** serves to retain the latter against the curved surface **41***b*. Adjacent the lower ends of the downwardly extending arms of the bracket **41**, openings **41***c* are provided for the reception of a pin to be later described.

As best shown in FIGS. **1** and **5**, the top feed assembly includes a substantially horizontally disposed presser bar **48**, the downwardly and outwardly extending end **48***d* of which is adapted to engage the work applied to the top of the cloth plate **10***a*. Alongside of the presser bar **48** is a top feed bar **50** which has one face cooperating in slidable relation with the adjacent face of the presser bar. To minimize the frictional resistance to the relative movement of these parts, the presser bar is provided with a cutout area **48***a* in its midportion, and to reduce the weight of the presser bar and the feed bar they are both provided with relatively large openings in their midregions. To the forward end of the feed bar there is attached a toothed member **50***a* which is adapted to engage the top surface of the work to be stitched.

In FIG. **5** the various parts embodied in the top feed mechanism and presser foot assembly are shown in spaced relation to facilitate a disclosure of the form and relationship of the various elements. The shaft **36** is provided with an eccentric portion **36***a*, the axis of which is disposed a suitable distance above the axis of the main body of the shaft **36**. A threaded portion **36***b* extends outwardly from the eccentric portion **36***a*. A washer **53***b* is mounted on the extension **36***a* of the shaft and is retained against the shoulder **36***d* by the other parts to be described. A slide element **49** is mounted between the forked portions **48***c* of the presser bar **48**, and this slide element is mounted on the extension **36***a* of shaft **36**. Accordingly, it will be clear that upon the rotation of the shaft **36** the element **49** and the forked end **48***c* of the presser bar will be lifted and lowered and the element **49** will also be shifted longitudinally of the passage provided between the forked extensions **48***c*. The top feed bar **50** is then mounted along the side of the presser bar and the slide member **49**, so as to provide an opening **50***b* in alignment with the extension **36***a* of the shaft **36**. Within the opening **50***b* of the feed bar **50** there is mounted an eccentric **51** having an opening **51***a* adapted to fit snugly around the extension **36***a* of the shaft. A key **36***c* cooperating with a slot **36***e* (FIG. **6**) in the extension **36***a* and also fitted in a notch **51***b* in the eccentric element **51** serves to retain the latter in a fixed angular relation to the axis of the shaft **36**. The element **51** provides a cylindrical peripheral surface which has its axis disposed in the opposite direction from the axis of shaft **36** than is the axis of the extension **36***a* Accordingly, at any instant in the course of revolution of the shaft **36** the element **49** and cooperating portion of the pressure bar will be displaced from their normal or central positions in one direction from the axis of shaft **36**, while the eccentric element **51** and the cooperating portion of feed bar **50** will be displaced in the opposite direction from the axis of shaft **36**. Outwardly of the eccentric element **51** there is provided a disc **52** adapted to fit over the threaded extension **36***b* of the shaft, and it is provided with a groove **52***a* which receives and retains the element **36***c*. A washer element **53***a* is provided outwardly of the element **52**, and a nut **54** then applied to the outer end of the threaded extension **36***b* of the shaft serves to retain all of the parts described above in assembled relation. It will be understood that the presser bar **48** and the feed bar **50** are not clamped firmly together by the action of the nut **54** but are retained in close relationship with the ability to shift relative to each other.

The presser bar **48** and the feed bar **50** are further retained in assembled relation, but with the ability to shift in relation to each other by a pin **55**. The latter passes through an opening in a small block **50***d* which is slidably mounted within a rectangular opening **50***c* in the feed bar. Pin **55** also passes through an opening **48***b* in the presser bar so as to maintain the latter against longitudinal shifting. However, it permits pivotal movement of the presser bar about the axis of the pin. The end portions of the pin pass through openings **41***c* in the legs of bracket **41**. Split washers **55***c* and **55***d* cooperating with grooves **55***a* and **55***b*, respectively, serve to retain the pin **55** and the presser bar and feed bar and the bracket **41** in assembled relationship.

It will be seen from the foregoing that upon rotation of the shaft **36**, the eccentric portion **36***a* will impart a lifting and lowering movement to the element **49** and hence to the rearward end of the presser bar. It will also impart some longitudinal movement to the element **49** within the forked extensions **48***c* of the presser bar. The lifting and lowering of element **49** causes rocking of the presser bar about the axis of the pin **55** to lift and lower the forwardly extending foot portion **48***d* of the presser bar, to carry this away from and then downwardly against the work on the support **10***a*. On the other hand, the feed bar **40** is not only rocked about the axis of the pin **55** by the action of the eccentric **51**, but is also shifted back and forth by the action of that eccentric. such shifting is, of course, permitted by the cooperation of the element **50***d* with the rectangular opening **50***c* in the feed bar.

Summarizing the foregoing, the eccentrics **36***a* and **51** will impart certain movements to the presser bar, the feed bar, and related parts to bring about a reliable step-by-step feeding movement of the workpiece being stitched. At the time in a cycle of operation of the machine in which the eccentric **51** is in the position shown in FIG. **2**, the feed dog has been lifted away from the work, while at the same time the eccentric **36***a* has rocked the presser bar into the position in which the end **48***d* thereof engages the work. This will be at a time beginning prior to that in which the feed bar is returned toward the right (FIG. **2**) to prepare it for its next feed stroke. It will be appreciated that during the same time the eccentric **36***a* will have imparted a lifting movement to the slide member **49** and hence the rearward end of the presser bar, while the foot portion **48***d* will have remained in engagement with the work. During this time the bracket **41** will be lifted to a certain extent by the action of the pin **55**, so that the presser foot **48***d* will remain engaged with the work under the action of the spring **46** and the spring bar **42**. However, when the eccentric **51** revolves into a position in which the feed dog is brought into engagement with the work, the eccentric **36***a* will lift the presser foot away from the work and the continued rotation of the eccentric **51** will then cause the feed dog to impart a feed movement to the work. Either the presser foot or the feed dog will thus be engaged with the work during all portions of a revolution of the main shaft in the normal operation of the machine.

One advantage of the construction described above is that is enables the ready substitution of various eccentrics for the one designated **51**. The substitution of a different eccentric disc for the one embodied in the machine at a particular time will enable changing the feed stroke of the upper feed dog to substantially coincide with the feed stroke of the lower feed dog which, as has been explained above, may be varied by adjusting the eccentric **33** of FIG. **2**.

Suitable means may be provided for lifting the presser foot under manual control, as by the operation of a knee press member or a foot treadle. This, of course, is desirable to facilitate the removal and introduction of workpieces. As shown in FIG. 2, a rod **56** extending from a knee press or foot treadle cooperates with a lever **57** secured to a shaft or stud **58** (FIG. 1) extending into the upper end of the vertical standard of the machine frame. A member **59** secured to the inner end of this shaft or stud is connected by a rod **60** with a bell crank lever **61** secured by a shoulder screw **62** to a wall of the overhanging arm **12** of the frame. A spring **63** normally urges the lever **61** in a counterclockwise direction (FIG. 1), but when a knee press or foot treadle is operated to exert a pull on the rod **60**, the lever **61** will act through a connection **64** (FIG. 2) to the presser bar **45** which will then be lifted and will cause the lifting of the U-shaped member **41**, and then also both the presser foot and the top feed dog.

The foregoing embodiment of the invention has been shown as applied to a machine in which the stitching operation is to be performed along a line at or close to the righthand edge of the work as the latter is being fed into and through the machine. In FIGS. **7** and **8**, the invention is shown as applied to a machine in which the stitching operation may be performed at a substantial distance inwardly from righthand edge of the work being fed to and through the stitching zone of the machine. The construction of this embodiment of the invention is substantially the same as that described above in many respects. It comprises a main drive shaft **14** having a combined handwheel and pulley attached to the end thereof which extends outwardly from the base **10** of the machine frame. A crank **16** is provided on this shaft and is arranged to operated a pitman **17** which will drive the needle bar in the manner explained. So also the shaft **14** is arranged to drive a four-motion looper **22** in the manner explained above.

Within the base of the machine and in the vertical standard thereof, there is a different type of connection to a shaft **65** which serves to drive the top feed dog which may be of same character as that designated **50***a* in the embodiment of FIG. **2**. The shaft **65** is suitably journaled in bearings mounted in the vertical standard **11** of the frame and also in a bracket **71** which is secured to the head **13** of the overhanging arm, and which extends downwardly to a point slightly above the top plate **10***a* of the base of the machine frame. Within the vertical standard of the frame there are secured to the shaft **65** two collars **69** and **70**. These cooperate with the bushings which support the shaft **65** within the vertical standard, and they serve to retain the shaft against any substantial axial movement.

The connections for driving the shaft **65** include a toothed pulley **66**, secured to that shaft adjacent the collar **70**, a toothed belt **67**, and a toothed pulley **68** secured to the main drive shaft **14**. This arrangement is such as to drive the shaft **65** at the same speed as the shaft **14**.

The rest of the embodiment of the invention shown in FIGS. **7** and **8** may suitably be of substantially the same form as that illustrated and described in connection with FIGS. **1—6**, inclusive. As will be apparent from FIG. **7**, the main advantage of the modified construction of the machine is that it permits the top feed mechanism to be utilized in connection with stitching operations performed at a substantial distance from the right edge of the work. In fact, the stitching operations may be performed at any distance from the right edge of the work, since if necessary a portion of the latter may be folded over in a way to permit it to be pushed under the shaft **65**.

It has been found that the construction and arrangement of the presser bar and the feed bar and related parts, in accordance with the invention as disclosed, enables the use of a smaller initial spring pressure to be exerted by the coil spring **46** than is conventionally required to insure proper handling of the work being stitched. This has reduced the amount of effort required by the operator to bring about lifting of the presser foot, for the introduction and removal of the work.

While two preferred embodiments of the invention have been described in considerable detail, it will be understood that various changes may be made in the particular form of the top feed mechanism, and also the bottom fed feed mechanism, as well as the stitch forming mechanism and the like, within the scope of the invention, as defined by the appended claims.

I claim:

1. In a high speed sewing machine having a work supporting surface along which multilayered workpieces may be advanced, work retaining and advancing means which comprises a presser foot adapted to engage the top surface of the work being stitched and urge the latter against said work supporting surface, a four motion feed dog arranged to engage the top surface of the work in a region adjacent said presser foot, a drive shaft arranged above and parallel with said work supporting surface, and connections from said drive shaft for operating said feed dog and for lifting said presser foot periodically, said connections including eccentric surfaces carried by said shaft, one of said eccentric surfaces being adapted to cause lifting of said presser foot and another of said eccentric surfaces being substantially simultaneously adapted to lower said feed dog into engagement with the work and to then impart a longitudinal movement to said feed dog to advance the work.

2. In a sewing machine as set forth in claim **1**, said presser foot and said feed dog being mounted on substantially horizontally disposed and longitudinally movable bars.

3. In a sewing machine as set forth in claim **2**, said bar on which said feed dog is mounted having a circular opening which cooperates with the other of said eccentric surfaces on said shaft.

4. In a sewing machine as set forth in claim **2**, said bar on which said feed dog is mounted having one end thereof surrounding said other of the eccentric surfaces on said shaft, and means carried by said bar intermediate the ends thereof adapted for slidable and pivotal movement relative to said bar, said means being mounted for movement in only a direction substantially perpendicular to said work supporting surface, and spring means normally urging said slidable means and the free end of said bar toward said work supporting surface.

5. In a sewing machine as set forth in claim **4**, a guide member fixedly mounted on the frame of the machine, said means carried by said bar cooperating with said guide member for vertical movement in relation thereto.

6. In a sewing machine as set forth in claim **4**, said eccentric surfaces and said spring means cooperating with said presser foot and feed dog bars to retain the presser foot and the feed dog alternately engaged with the work during operation of the machine.

7. In a sewing machine as set forth in claim **5**, said spring means comprising a flat spring bar, said means carried by said bar on which the feed dog is mounted comprising an inverted U-shaped member adapted to receive and retain a portion of said spring bar in a manner to enable ready bending of said spring bar in the region in which it is so retained.

8. In a sewing machine as set forth in claim **7**, said inverted U-shaped member having its downwardly extending portions cooperating slidingly with the outer faces of said bars on which said presser foot and said feed dogs are mounted.

9. In a sewing machine as set forth in claim **7**, a pin extending between the downwardly extending portions of said U-shaped member, said presser foot carrying bar having an opening closely surrounding said pin, and said feed dog carrying bar being slidably connected with said pin.

10. In a sewing machine as set forth in claim **2**, said bar which carries the presser foot having a floating pivotal connection at its rear end, and said bar which carries the feed dog having a floating pivotal connection adjacent its forward end.

11. In a sewing machine as set forth in claim **1**, a main drive shaft mounted in the frame of the machine below the work supporting surface, a toothed pulley secured to each of the two drive shafts mentioned, and a toothed belt interconnecting said toothed pulleys for driving the same in unison at the same speed.

12. In a sewing machine as set forth in claim 11, said toothed pulleys and said belt being disposed in a region close to and at the right of the line of advance of the work through the stitch forming zone.

13. In a sewing machine as set forth in claim 11, said machine having a frame comprising a base portion, a vertical standard portion and an overhanging arm, said toothed pulleys and said belt being disposed in said vertical standard portion of said frame.

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,540,391 Dated May 24, 1971

Inventor(s) Robert A. Hayes

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

On the first page, first line, containing the general information, the inventor's name "Robert A. Haye" should be -- Robert A. Hayes --.

Col. 5, line 25, insert the word -- the -- before "righthand";

Col. 5, line 32, "operated" should be -- operate --.

Signed and sealed this 14th day of September 1971.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Acting Commissioner of Patent