Nov. 22, 1960 F. LUTZ ET AL 2,960,946

PORTABLE SEWING MACHINES

Filed Sept. 20, 1955 7 Sheets-Sheet 1

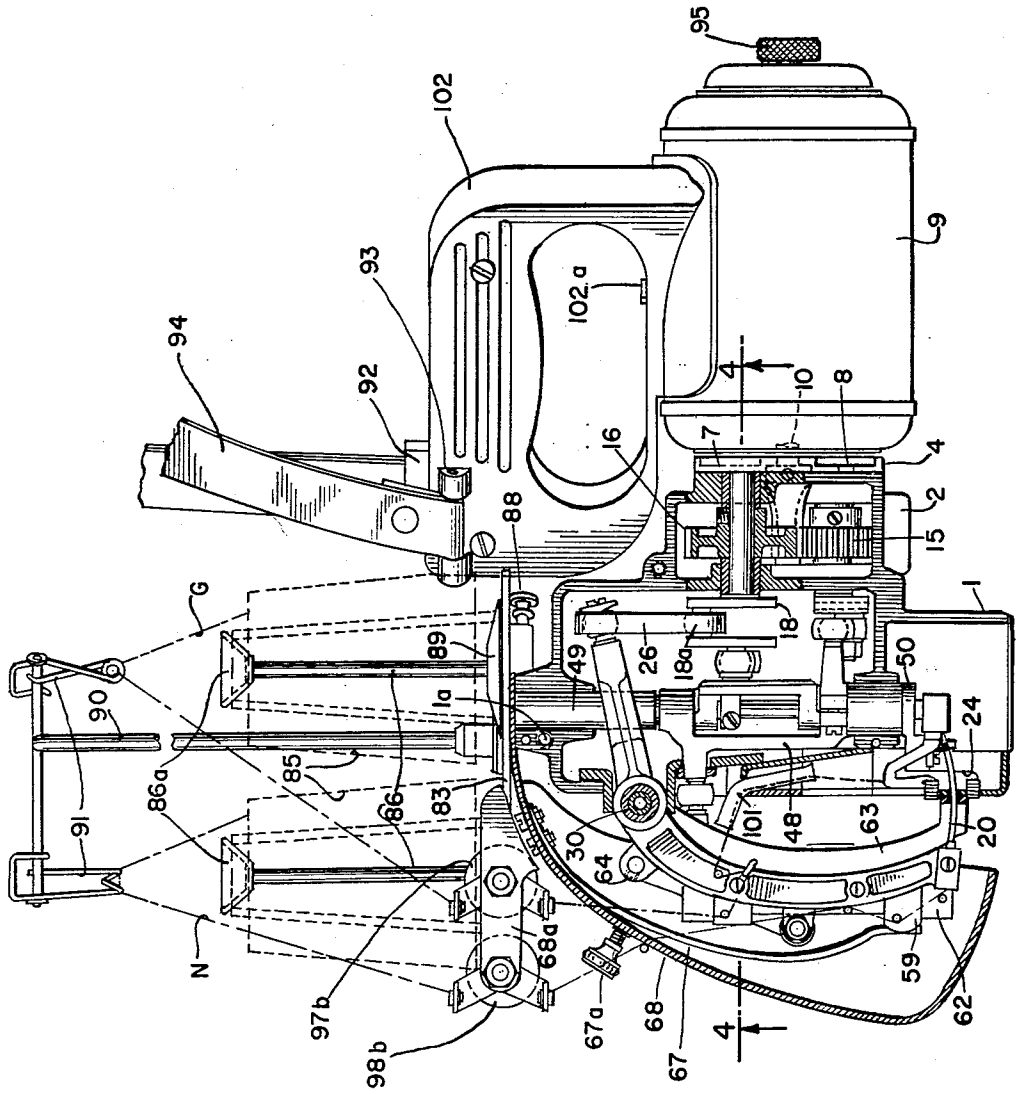


FIG. 1

Nov. 22, 1960 F. LUTZ ET AL 2,960,946

PORTABLE SEWING MACHINES

Filed Sept. 20, 1955 7 Sheets-Sheet 2

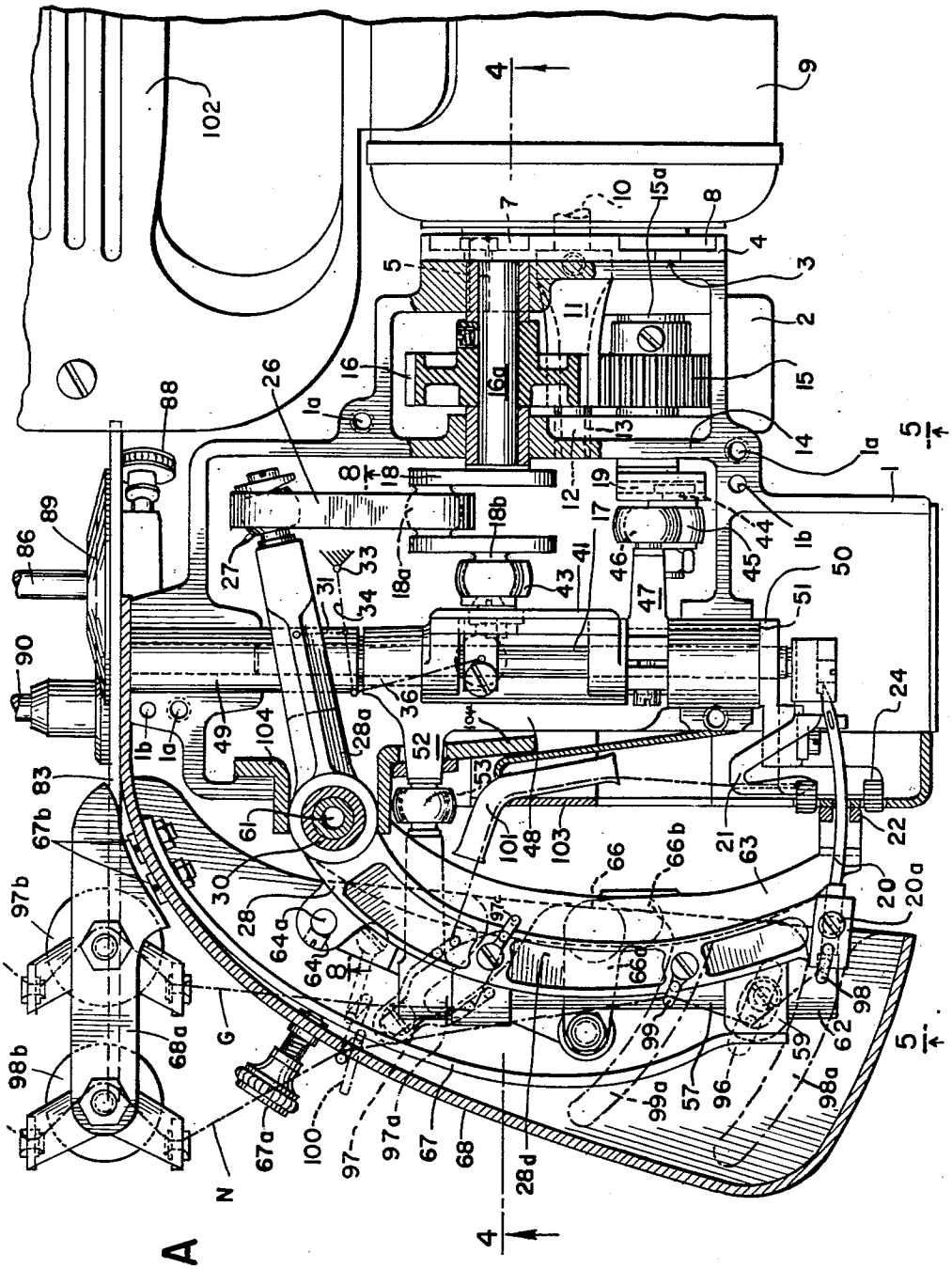


FIG. 1A

Nov. 22, 1960 F. LUTZ ET AL 2,960,946

PORTABLE SEWING MACHINES

Filed Sept. 20, 1955 7 Sheets-Sheet 3

FIG. 2

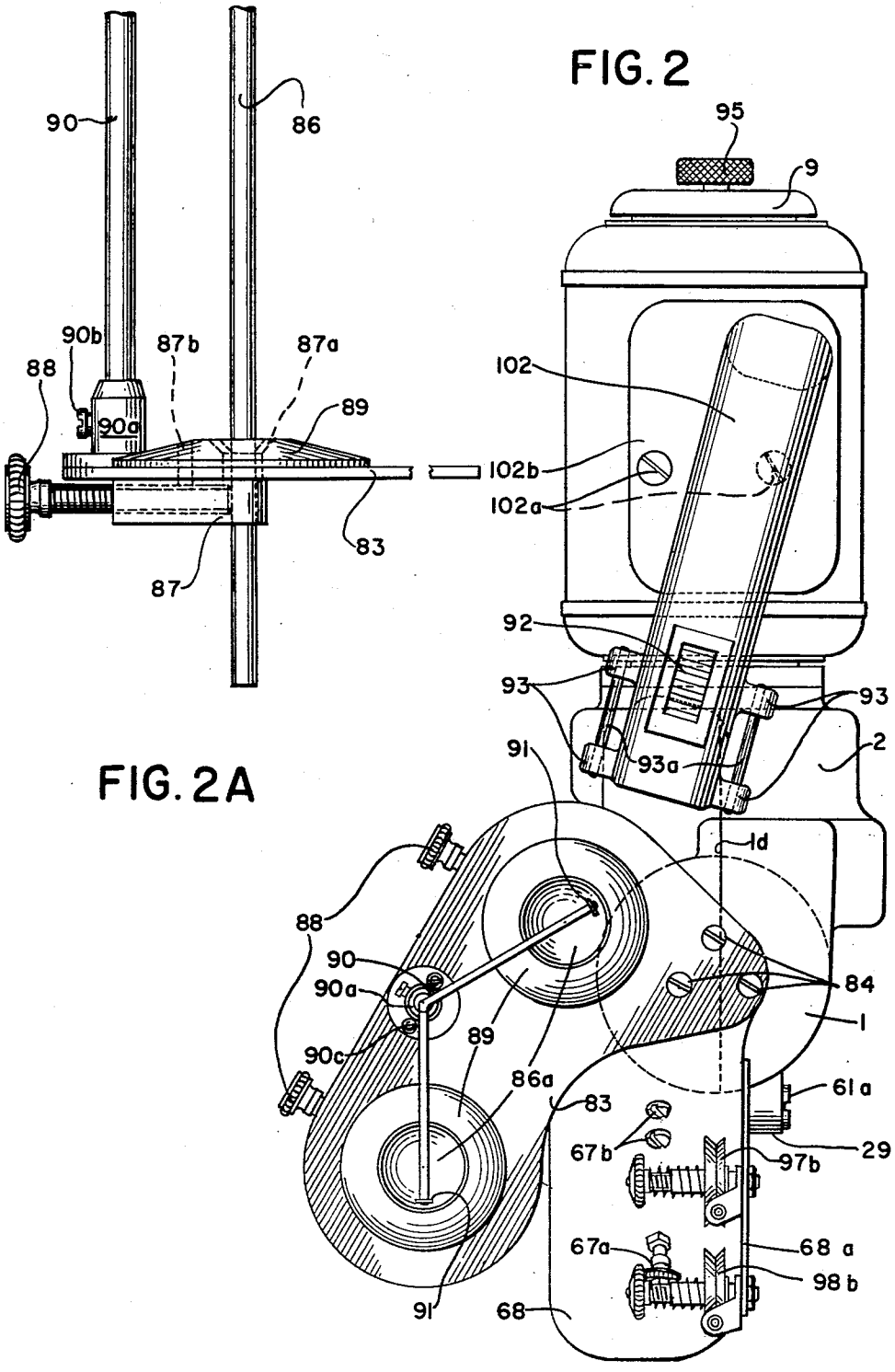


FIG. 2A

FIG. 3

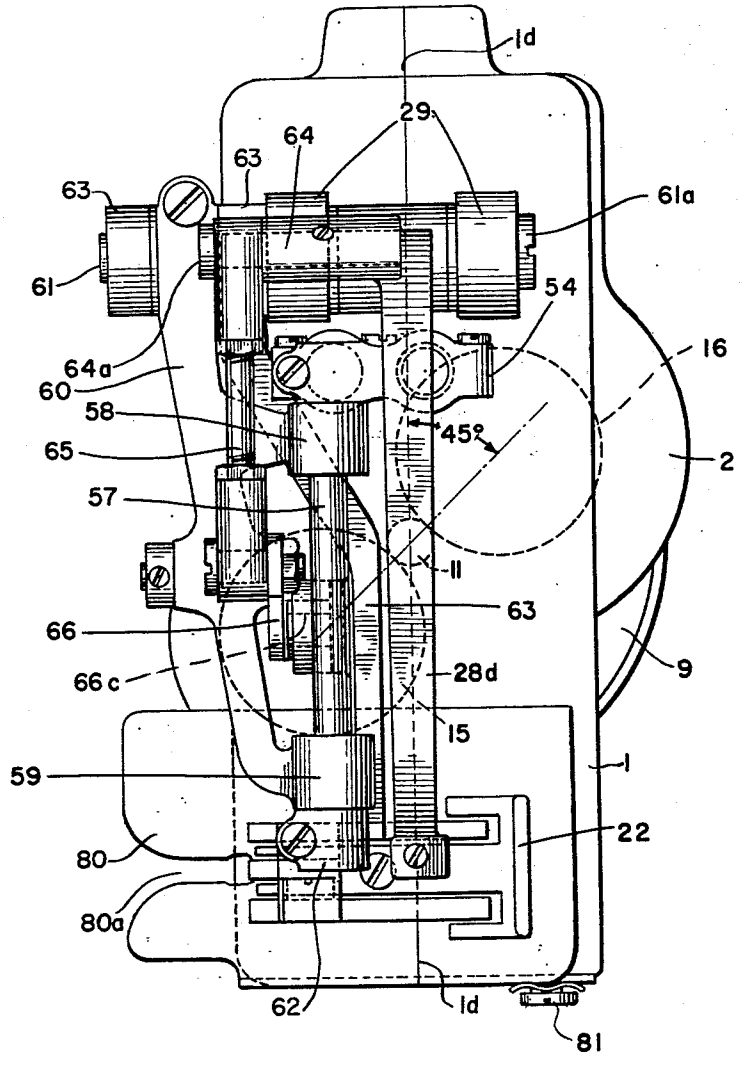

1d
29
64
63
63
61a
61
54
64a
16
60
58
45°
65
2
57
11
63
66
9
66c
28d
15
59
1
22
80
80a
62
1d
81

FIG. 4

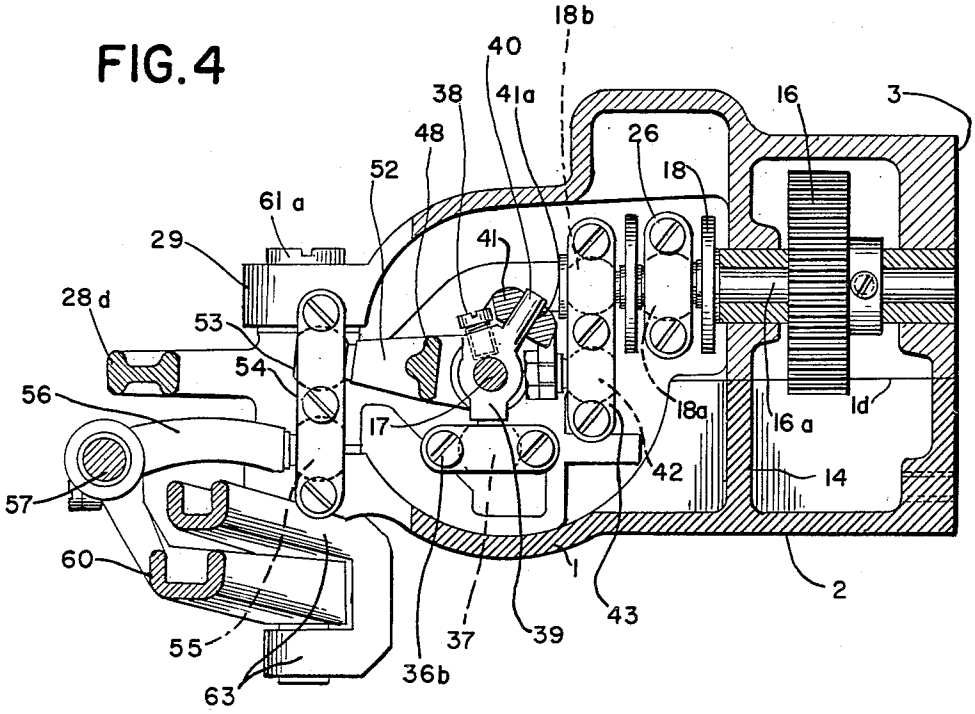

18b
40
38
41a
16
3
48
26
52
18
61a
29
41
28d
53
54
56
17
18a
16a
1d
42
14
57
60
1
2
43
55
37
39
36b
63

FIG. 5

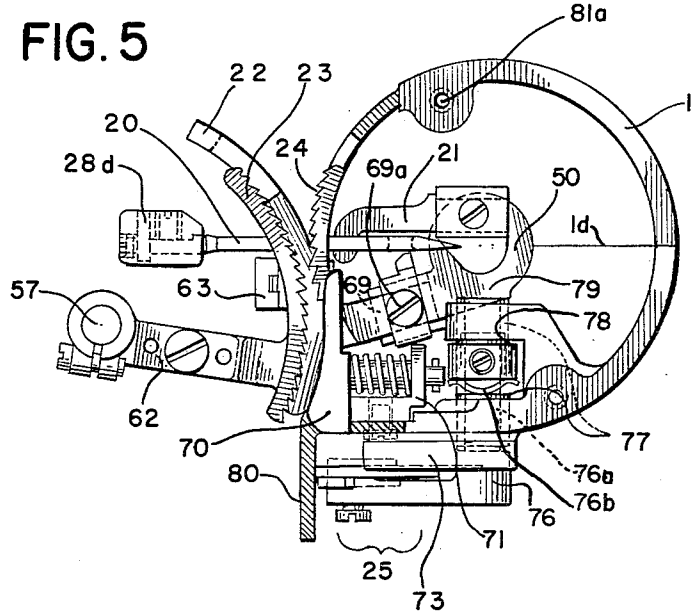

81a
22
23
1
20
24
28d
69a
21
50
1d
57
63
69
79
78
62
77
70
76a
80
76b
76
71
25
73

FIG. 6

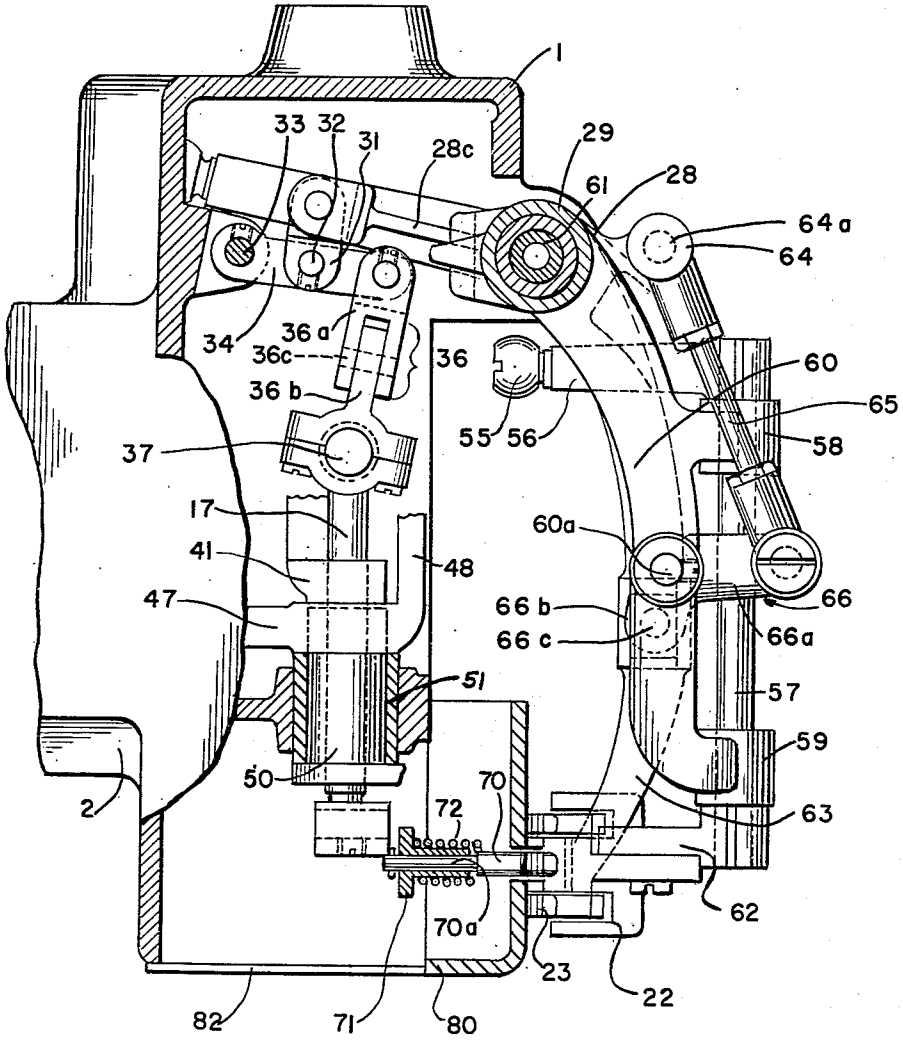

1
33
32
31
28c
29
61
28
64a
64
34
36a
36c
36
36b
60
65
55
56
58
37
17
60a
41
48
47
66b
66
66c
66a
51
57
59
50
70
72
63
2
62
70a
23
22
82
71
80

FIG. 7

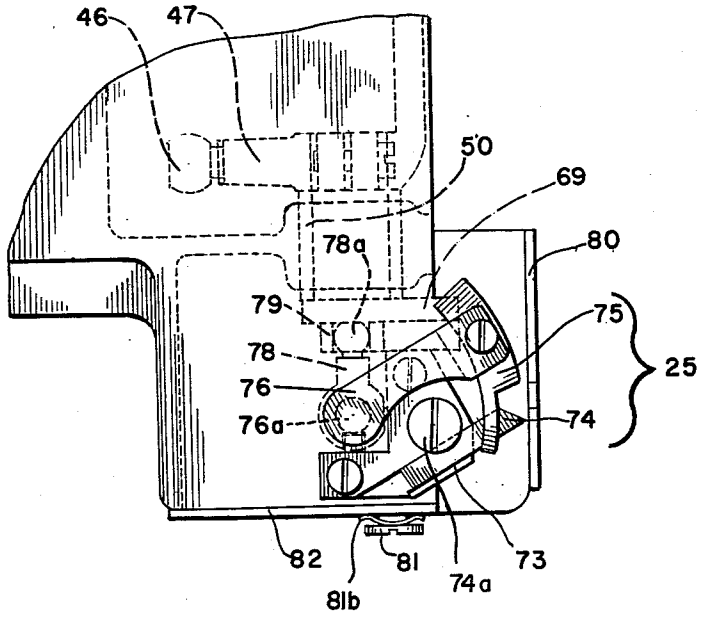
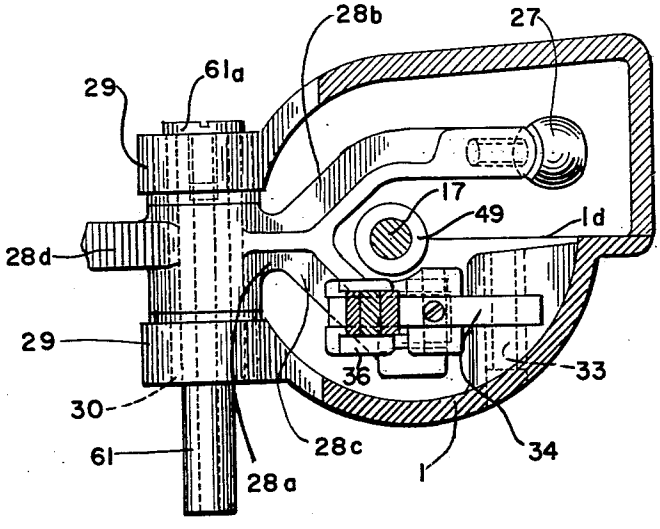

46
47
50
69
80
78a
79
75
78
25
76
76a
74
82
81
73
74a
81b

FIG. 8


28b
27
61a
29
17
49
1d
28d
29
36
33
30
28c
34
61
28a
1

United States Patent Office 2,960,946
Patented Nov. 22, 1960

2,960,946

PORTABLE SEWING MACHINES

Friedrich Lutz, Stuttgart-Degerloch, and Hermann Daniel, Stuttgart, Germany, assignors to Union Special Maschinenfabrik, G.m.b.H., Stuttgart, Germany

Filed Sept. 20, 1955, Ser. No. 535,316

Cliams priority, application Germany Oct. 21, 1954

24 Claims. (Cl. 112—11)

This invention relates to a portable electrically operated sewing machine particularly adapted for the seaming of filled bags to close the same. It is, however, capable of a variety of other uses for which a portable sewing machine may be found desirable. The machine is of sufficiently lightweight construction to be carried by the hand of the operator and guided by the operator across the tops of filled bags or other articles to be seamed, without causing undue fatigue of the operator. The weight of the machine is such that it may be readily borne entirely by hand of the operator, but, if desired, suitable means may be provided for suspending the machine either from the neck and shoulders of the operator or from some overhead support, so that the hand of the operator is required primarily for guiding the machine properly along the edges of the work to be seamed. For example, the machine may be supported primarily by an elastic strap carried around the neck and over the shoulders of the operator, or it may be suspended by a chain or the like from the ceiling of the room in which the machine is being operated. A top lock balancer of known construction may, for example, be employed to suspend the machine and carry its weight, while permitting the machine to be readily lowered into cooperation with the edges to be seamed.

Portable machines of a character adapted to be carried and guided by the hand of the operator have heretofore been developed but in seeking to meet the necessary restrictions upon the weight and size of such machines they have heretofore been suitable primarily only for the production of single thread chain stitch seams. They have not heretofore been adapted for the production of a two-thread chain stitch, involving a needle thread and an interlocked looper thread, as is the machine of the present invention.

A primary object of the present invention has been to provide a portable sewing machine of the general character indicated above, which is electrically driven and is of lightweight, compact, and sturdy construction, small in its overall dimensions and which has substantially the same capacity as and is adapted to perform all of the operations normally performed by relatively heavy stationary machines of the type heretofore employed in the closing of bags and the like.

Toward the foregoing ends, the machine of the present invention has rigidly but detachably connected an electric motor and a sewing head, there being constructed and arranged in such a way that a minimum of parts is required to perform the various desired functions. The sewing head is equipped with stitch forming devices including a needle and a four-motion looper, i.e. one having loop seizing and shedding movements and needle avoid movements, adapted to produce a two-thread chainstitch. It is also equipped with work feeding devices arranged to grip the work between the feed dogs which engage the opposite faces of the work to advance the same in relation to the machine. Moreover the machine is equipped

with an automatic thread chain cutter. By a novel arrangement of the various devices adapted to perform the foregoing functions and of the connections for operating the same from the electric motor, it has been found possible to provide a machine which is sufficiently light in weight and small in size to be readily handled in the manner explained above. The new machine is capable of producing a two thread chainstitch seam of uniform character at relatively high speed. However, if desired, the machine may be adapted to produce only a single thread chainstitch and many of the novel features of its construction are such as to provide a greatly improved machine of this character.

The new machine, which is capable of seaming both fabric and paper bags of the ordinary sizes and thicknesses, incorporates a variety of features, some of which are novel per se and others of which are novel in their particular combination and arrangement which has made possible the achievement of the various objects of the invention.

One important feature of the invention is the provision of feed mechanism which includes an arcuate feed dog movable back and forth along an arcuate path at one side of the work supporting or guiding surface of the machine frame, a carrying arm for this feed dog having only oscillatory movement about a fixed axis. Cooperating with the opposite face of the work is another arcuate feed dog which is arranged for four-motion movements, i.e. work advancing and return movements along an arcuate path and movements toward and away from the work. A presser foot is also provided to cooperate with said opposite faces of the work to hold the latter against a throat plate but not directly against the first mentioned feed dog, while the latter is being retracted. The arrangement is such that a good feeding action is imparted to the work by the alternate action of the four-motion feed dog and the presser foot on one side of the work and the feed dog movable simply back and forth along an arcuate path on the other side of the work. It should be understood that in referring to the feeding of the work it is actually the relative movement between the sewing machine itself and the work which is contemplated. Normally in the use of the new machine it is the latter which is advanced along the work which remains stationary.

A special feature of the machine in relation to the work feeding mechanism is the provision for adjustment of the extent of feed upon each cycle of operation of the machine so as to vary the stitch length of the seam produced.

Another important feature of the invention is the relationship between the driving motor and the sewing machine proper and the relationship within the sewing machine of the various operating devices. A variety of novel relationships are involved in this phase of the invention. Thus the electric motor is arranged to be readily connected with and disconnected from the frame of the sewing machine proper by the employment of a bayonet type connection between these parts. The motor shaft has a pinion on the end thereof adjacent the bayonet type connection with is adapted to be meshed with or removed from a pair of gears carried by the sewing machine proper and each adapted to drive its own supporting shaft. Each of these shafts carries a crank member, one being of double construction and the other of single construction and these constitute the only driving means within the machine for imparting all of the required movements to operate all of the devices mentioned above, namely, the needle mechanism, the four-motion looper, the two feed mechanisms for engaging the opposite sides of the work, the presser foot, and the thread chain cutter.

A further important feature of the machine is the novel

relationship between various shafts incorporated in the structure. Thus the main shaft of the motor is at right angles to a looper carrying shaft or rod which is given both reciprocatory movements in the direction of its axis and oscillatory movements about its axis to impart the various motions to the looper. The motor shaft and looper carrying shaft are in the same vertical plane and the frame of the sewing machine is divided along this plane into two sections which are secured together by screws. Perpendicular to the vertical plane mentioned is another shaft which rockably carries a needle lever that serves to reciprocate a curved needle through the throat plate of the work guiding surface of the machine for cooperation with the looper. A special feature of the construction, in this connection, is the arrangement of the two shafts which carry the gears and crank members, mentioned above, on axes which are parallel with the axis of the main motor shaft and which are so disposed that the axes of all of these shafts are in a single plane inclined at an angle of about 45° to the vertical plane containing the axes of the motor shaft and of the reciprocatory and oscillatory looper carrying shaft. An important advantage of this particular arrangement is that it enables the housing of the sewing maching proper to be divided, as indicated above, along a plane containing both the axis of the lopper shaft and the axis of the motor shaft. Each of the crank bearing shafts is journaled completely in one of the sections of the housing so that only tensile forces and no shearing forces are applied through the operation of the cranks to the screws which secure the two sections of the housing together.

In connection with the foregoing, it may be pointed out that the double or two throw crank member carried by one of the shafts mentioned above, serves to operate both the needle and the looper and also to bring about the movements toward and away from the work of the four-motion feed dog mentioned and the coordinated but inverse movements of the presser foot. The single crank member carried by the other shaft is of adjustable construction to vary its throw and this imparts feeding and return movements to both of the feed dogs, which engage the opposite sides of the work. Both of the feed dogs are of arcuate form and swing along a circular path, the four-motion feed dog also receiving the indicated movements toward and away from the work. The single crank also serves to operate the automatic thread chain cutting device.

Still another feature of the invention is the construction and arrangement of the various driving mechanisms from the two crank members to the driven devices so that they are grouped around two main axes. Thus the driving mechanisms for the looper, the two feed dogs and the chain cutter are grouped around the looper carrying shaft which extends vertically within the vertically disposed cylindrical portion of the frame. Similarly a common axis is provided for the rocking needle lever and certain supporting arms for the outer or four-motion feed dog and the presser foot, and these arms are given rocking movements, to carry the outer feed dog and the presser foot alternately into and out of engagement with the work, by connections from the needle lever.

The foregoing features contribute importantly to the production of a compact and lightweight machine. In fact it is such that the entire unit with its far greater capabilities than prior portable single thread chainstitch machines is smaller and lighter than most of those machines even taking into account the provision of the two thread supplying cones on the frame structure of the new machine.

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

Fig. 1 is a side view of the machine with half of the frame of the sewing head removed and various parts shown in section for clearer illustration of the mechanism;

Fig. 1A is a view similar to Fig. 1, on an enlarged scale, but omitting a portion of the electric motor and carrying handle;

Fig. 2 is a top plan view of the machine;

Fig. 2A is a detail view of a portion of the thread stand and associated thread guide carrying rod mounted on the machine frame;

Fig. 3 is an elevational view of the machine taken from the left in Fig. 1 with a cover member or hood and various other elements removed;

Fig. 4 is a horizontal sectional view through the machine taken along the line 4—4 of Fig. 1A;

Fig. 5 is a view partly in bottom plan and partly in horizontal section through a portion of the machine, taken along the line 5—5 of Fig. 1A, with certain cover members removed;

Fig. 6 is an enlarged view of a portion of the machine, partly in elevation as seen from the side opposite to that shown in Fig. 1 and partly in vertical section;

Fig. 7 is an elevational view of a portion of the machine as seen from the same side as Fig. 6, illustrating the thread chain cutting mechanism; and

Fig. 8 is a horizontal sectional view through a portion of the machine taken along the line 8—8 of Fig. 1A and shows the forked needle lever operating arm.

Referring now to the drawings, the machine is provided with a frame forming an enclosed housing for certain of the operating parts. The housing comprises a substantially cylindrical portion **1** which is vertically disposed and a substantially cylindrical lateral extension **2** which is horizontally disposed. These portions of the housing are of split construction and divided along a vertical plane indicated at **1*d*** in Figs. 2, 3 and 8. The lateral extension **2** of the frame has an annular end surface **3** adapted for connection with a flange **4** of an electric motor **9** of conventional form, but of relatively light weight. The flange **4** of the motor is connected with the end surface **3** of the housing by a bayonet type connection. For this purpose two small hexagonal head screws **5**, only one of which is shown in Fig. 1A, are threaded into the annular end surface **3** of the housing and these screws are arranged to pass through key shaped openings into recesses **7** and **8** in the flange **4** of the motor frame. By a small relative twisting motion between the machine housing and the flange **4** of the motor frame the machine and motor may be connected together and locked in assembled relation, and by an opposite twist they may be readily disconnected.

The motor **9** has a driven shaft **10** (Fig. 1A) suitably journaled in the motor frame and projecting into the portion **2** of the machine housing when the parts are assembled. Secured to the end of the shaft **10** is a pinion **11** which has an outer reduced end portion **12** providing a shaft-like extension which is journaled in a bearing sleeve **13** carried by a partition wall **14** which separates the portions **1** and **2** of the machine housing. Meshing with the pinion **11** within the portion **2** of the housing are two gears **15** and **16** carried, respectively, by shafts **15*a*** and **16*a*** journaled in bushings carried by the walls of the portion **2** of the housing. The gears **15** and **16** and their supporting shafts are so disposed that the axes of these shafts are in a plane which passes through the axis of the pinion **11** and this plane is inclined at an angle of about 45° to the vertical plane containing the axis of pinion **11**, as best shown in Fig. 3. A looper carrying rod or shaft **17** which, as will be explained hereinafter, is mounted for reciprocatory axial movement and also oscillatory movement about its axis, has its axis disposed in the same vertical plane which contains the axis of the pinion **11**. The two portions **1** and **2** of the housing are divided along the vertical plane which contains the axes of both the pinion **11** and the rod or shaft **17**. This plane is indicated by the line **1*d*** (Figs. 2, 3, 4, 5

and 8). The two sections of the housing are secured together by screws 1*a* (Fig. 1A) and held properly aligned by these screws and by dowel pins 1*b*.

The shafts 15*a* and 16*a* which carry the spur gears 15 and 16, respectively, are journaled in bushings carried by the partition wall 14 and the annular end wall 3 of the portion 2 of the housing. These shafts extend through the wall 14 into the interior of the portion 1 of the housing and within the latter carry crank members arranged to operate the various driven parts of the machine. Shaft 16*a* carries a crank member 18 having two spherical crank elements 18*a* and 18*b*. Shaft 15*a* carries within the portion 1 of the housing an adjustable crank 19. This may be of any suitable construction enabling the eccentricity of a spherical crank pin 44 (Fig. 1A) to be varied as desired in relation to the axis of the shaft 15*a* As will be explained in some detail hereinafter, the double crank 18 serves to reciprocate a curved needle 20 and to impart the axial and oscillatory movements to the looper rod or shaft 17 thereby giving to the looper 21 its loop seizing and shedding movements and its needle avoid movements. The active end of the looper is thus carried through an elliptical path. Double crank 18 also serves to impart alternate outward and inward movements to a presser foot 22 and, in inverse timing, to an outer feed dog 23 (Fig. 5). The presser foot and outer feed dog are thus carried alternately away from and toward the work which is advanced relative to a vertically disposed work supporting or guidance surface on the portion 1 of the frame. The adjustable crank 19 serves to impart swinging movements to the outer feed dog 23 and an inner feed dog 24 to give these feed dogs their work advancing and return movements. Also the adjustable crank 19 serves to drive an automatic cutting device 25 (Figs. 5 and 7). The two cranks 18 and 19 are the sole drive members for all of the sewing instrumentalities.

Needle 20 is given its reciprocatory movements along an arcuate path by connections from the crank pin 18*a* of the crank member 18. For this purpose a pitman 26 has a spherical strap at its lower end cooperating with the crank pin 18*a*, while the upper end of the pitman has a similar strap cooperating with a ball pin 27 extending outwardly from the end of a needle lever 28. This lever is of bell crank construction and has a long downwardly extending arm 28*d* to the lower end of which is clamped the arcuate needle 20. The shank of the latter fits into a socket at the lower end of arm 28*d* and is held by a set screw 20*a*. Lever 28 also has a substantially horizontally extending arm 28*a* which is forked to provide a relatively long extension 28*b* and a relatively short extension 28*c* (Fig. 8). These are positioned within the portion 1 of the housing. The ball pin 27 projects outwardly from the outer end of the arm 28*b*. Needle lever 28 is rockably supported by a bearing sleeve 30 carried by lugs 29 projecting from the portion 1 of the machine housing (Figs. 4 and 8). Through the connections described the needle lever will be rocked about the axis of the sleeve 30 and will serve to reciprocate the arcuate needle lever 20 along an arcuate path.

In connection with the foregoing, it should be observed that since the housing portion 1 of the machine is divided along a plane which contains the axis of the shaft 17 and also the axis of the pinion 11, the driving connections from the crank pin 18*a* to the ball pin 27 carried by the needle lever 28 and also one of the bearing lugs 29 in which the bearing sleeve 30 is journaled lie in the same half of the housing. This has the advantage that the forces involved in the driving of the needle lever are primarily taken up by the same half of the housing and are transmitted to only a small extent, if any, to the other half of the housing. Accordingly, the screws 1*a* which serve to connect the two halves of the housing are stressed only in tension and not in shear as would be the case if the forces involved in the driving of the needle were required to be transferred from one half of the housing to the other.

Looper 21 which cooperates with the needle 20 in the formation of stitches is secured to the lower end of the shaft 17 (Figs. 1A and 5). As previously stated, shaft 17 is given both axial or longitudinal movements and oscillatory movements about its axis to impart to the active end of the looper a substantially elliptical path of movement. In Fig. 1A the looper is shown as of the thread carrying type and is adapted, in cooperation with the needle, to produce a two-thread chainstitch of the type designated a 401 stitch in the Federal Specifications. If desired, a non-thread carrying looper may be substituted for the looper 21 and this, as is known in the art, may be adapted to produce a single thread chainstitch of the 101 type. The four-motion movement imparted to an appropriate looper of this character will serve to seize the needle thread loop and retain it for a re-entry by the needle on its next stroke.

The axial or longitudinal movements of the shaft 17 serve to impart loop-seizing and shedding movements to the looper 21, while the oscillatory movements of the looper shaft about its axis serve to impart the needle avoid movements to the looper. Connections for imparting the axial movements to the shaft 17 are provided from the arm 28*c* of the needle lever 28. The linkage for this purpose is indicated schematically by dot and dash lines in Fig. 1A. As best shown in Figs. 6 and 8 the free end of arm 28*c* is connected by a short link 31 with a pin 32 carried by a lever 34 rockably mounted by means of a stud 33 on a portion of the housing 1 of the machine. Link 31 is pivotally connected with both the arm 28*c* and the lever 34. At the free end of the lever 34 there is pivotally connected a two-part link 36. The upper part 36*a* of this link is pivotally mounted on the lever 34 by means of a pin. The lower end of part 36*a* is forked to straddle an upwardly extending arm of the lower part 36*b* of the link. The two parts of the link are pivotally connected by means of a pin 36*c*. Part 36*b* of the link carries at its lower end a spherical strap arranged to cooperate with a ball pin 37 extending laterally from the rod or shaft 17. This ball pin is secured to the shaft, as best shown in Fig. 4, through a collar 39 fastened to the shaft by a set screw 38. It will be seen that through the connections described the shaft 17 is given its axial or longitudinal movements in coordination with the rocking of the needle lever and the reciprocation of the curved needle in the manner explained. Moreover, the connections are such that the shaft 17 may partake of the oscillatory movements about its axis. The two part links 36 and the spherical strap portion of part 36*b* cooperating with the ball pin 37 makes this possible.

Collar 39 is provided with a tongue 40 which projects at right angles from the shaft 17 in a direction substantially opposite to that in which the ball pin 37 extends. Tongue 40 extends into and is guided by a vertical slot 41*a* in a yoke member 41 which extends vertically along the shaft 17 and has hub portions surrounding the shaft and adapted to swing freely about the shaft (Figs. 1A and 4). The yoke member 41 has a ball pin 42 projecting laterally from a portion thereof and this ball pin cooperates with a spherical strap on pitman 43. The other end of this pitman also carries a spherical strap which cooperates with the spherical crank pin 18*b* hereinabove described. Upon operation of the crank 18 the yoke member 41 is thus subjected to a swinging movement about the axis of the shaft 17 and this swinging movement is transmitted to the shaft itself by means of the tongue 40 of the collar 39 secured to the shaft. The guide slot 41*a* in the yoke member is vertically elongated to enable the shaft 17 and its connected parts to move in an axial direction in relation to the yoke member. By the connections described the looper is given its needle avoid movements through the oscillation of the shaft 17,

Feed motions are imparted to the feed dogs **23**, **24** by connections from the adjustable crank **19**, Fig. 1A. This adjustable crank has a crank pin **44** which may be shifted radially outwardly in relation to a disc-like support secured to the end of the shaft **15***a* which, as previously noted, is driven by the gear **15** from the pinion **11** on the motor shaft **10**. By shifting the pin **44** closer to the axis of the disc the extent of feed may be reduced and vice versa. Crank pin **44** has a portion of spherical formation which cooperates with a spherical seat provided at one end of a pitman **45**. The opposite end of this pitman has a spherical seat cooperating with a ball pin **46** extending outwardly from the free end of an arm **47** projecting laterally from a yoke member **48**. The latter bridges across the yoke member **41** and has a collar or hub portion at its upper end that is freely turnable about a reduced lower end portion of a bushing **49** in which the upper end of the looper shaft **17** is held and guided during its sliding and turning movements along and about its axis. The lower end of the yoke member **48**, which is directly beneath the lower end of the yoke member **41** has a split collar formation which is clamped about and thus secured to the upper end of a bushing **50**. This bushing has a radially extending flange at its lower end and it is journaled within a bearing sleeve **51** carried by a boss provided on a partition wall extending horizontally across the housing **1** some distance upwardly from the lower end thereof. Bushing **50** is inserted within the bearing sleeve **51** from the lower end and is free to turn within the bearing sleeve. Looper rod or shaft **17** is in turn journaled within the bushing **50**. This arrangement is such that any bearing pressures imparted to the yoke member **48**, due to the driving of the feed dogs, is transmitted to the bearing sleeve **51** and from the latter to the frame of the machine rather than to the shaft **17**.

Yoke member **48** has a second laterally extending arm **52** (Figs. 1A and 4) adjacent its upper end. Arm **52** extends in the opposite direction from the axis of shaft **17** to the direction in which the arm **47** extends from said axis. Mounted in the free end of the arm **52** is a ball pin **53** which cooperates with a spherical seat provided at one end of a pitman **54**. The opposite end of this pitman has a spherical seat which cooperates with a ball pin **55** (Fig. 4) extending outwardly from the free end of a lever arm **56** which is secured to a rock shaft **57**. This rock shaft is journaled in bearing lugs **58** and **59** formed integrally with a lever **60** having a split hub formation which is clamped upon a hollow shaft **61** journaled within the bearing sleeve **30** which carries the needle lever **28** (see also Fig. 8). Hollow shaft **61**, which is thus supported in the bearing sleeve **30**, is held in proper relation to the bearing sleeve and associated parts by means of a screw **61***a* having a large slotted head (Figs. 3 and 4) which cooperates with the right bearing lug **29** (Fig. 3). As the yoke member **48** is rocked about the axis of the shaft **17**, through the action of the adjustable crank **19**, the shaft **57** will be rocked through the connections described about its longitudinal axis which is substantially parallel with the shaft **17**.

As has already been mentioned the special arrangement of the spur gears **15**, **16** in relation to the pinion **11** and the looper carrying shaft **17** is such that particularly favorable driving connections are obtained for the several crank drives. One feature of importance is the fact that the pitmen which connect the crank elements with the parts to be operated are arranged to act at very favorable angles. In this connection it should also be noted that the pitmen **43**, **45** and **54** can be made of the same length, shape and general dimensions with resulting advantage from the standpoint of manufacture of the machine. All of these pitmen are of split construction, being divided along a plane which contains the axes of the ball pins or crank elements with which they cooperate. This enables them to be assembled over the spherical surfaces of the pins or crank elements and be secured firmly together by the screws shown. Furthermore the favorable compact disposition of the various connections from the crank elements is made possible by the fact that the axes of the crank elements, which are parallel to the axis of the pinion **11** and of the motor shaft, are at right angles both to the axis of the looper carrying shaft **17** and to the axis about which the needle lever **28** swings. These latter axes are also at right angles to each other. By this arrangement of the various axes in relation to each other there is obtained the further advantage that the various operating connections from the cranks within the machine housing are grouped largely around the axis of the looper carrying shaft **17** and are swung about that axis. This enables the production of an extremely compact and light construction of the entire mechanism of the sewing machine.

To the lower end of the rock shaft **57** (Fig. 3) there is secured, by a split clamping collar or the like, an arm **62** which, as shown in Fig. 5, carries the outer feed dog **23**. The latter is curved along an arc about the axis of the shaft **57**. As the yoke member **48** is caused to swing, by the connections described, its motion is transmitted by means of the pitman **54** to the arm **56** which is rigidly connected with the rock shaft **57**. Thus there is imparted to the outer feed dog **23** a bodily movement along an arcuate path having the axis of the shaft **57** as its center. As will be explained hereinafter, the axis of the shaft **57** is shifted bodily toward and from the work by rocking of the lever **60**. This permits the feed dog **23** to be engaged with the work during the work advancing movements of the feed dog and to be retracted from the work during the return movements of the feed dog.

Also mounted upon the hollow shaft **61** and free to turn about the latter is a lever arm **63** (Figs. 1A, 3, 4, 5, and 6). The upper end of this lever arm is yoked to straddle the clamping portion of the arm **60**. At its lower end the arm **63** has secured thereto the presser foot **22** which is curved along substantially the same arc as the feed dog **23**. The arrangement is such that the feed dog and the presser foot are alternately, and in reverse timing relation, brought into and out of engagement with the work to be sewed. This alternate movement of the presser foot and the outer feed dog **23**, into and out of engagement with the work, is brought about by connections from the needle lever **28**. The latter has an outwardly extending ear or lug **64** (Figs. 1A, 3 and 6) carrying a pin **64***a* by which the upper end of an extensible link **65** is pivotally connected with the lug **64**. The other end of link **65** is pivotally connected with an arm **66***a* of a bell crank lever **66** which is rockably mounted on a bolt or stud **60***a* carried by the arm **60**. A downwardly extending arm **66***b* of the bell crank lever **66** carries adjacent its lower end a pin **66***c* which cooperates with a groove or channel in the lever arm **63**. This groove or channel extends generally in the direction of the length of the arm **63**. The lever arm **60** is urged by a leaf spring **67** in a counterclockwise direction (Fig. 1A). This leaf spring has its lower free end engaged with the bearing lug **59** and its upper end firmly secured by bolts **67***b* to the inner surface of a sheet metal hood **68** which serves largely to enclose the needle lever **28** and the lever arms **60** and **63** and connected parts. The leaf spring **67**, whose force may be varied as desired by adjusting a thumb screw **67***a*, urges the outer feed dog **23** toward the work supporting surface. By virtue of the link connection **65** between the arm **28***d* of the needle lever and the bell crank lever **66** the pin **66***c* of which is engaged with the groove or channel in the lever arm **63** carrying the presser foot **22**, the lever arm **63** is moved outwardly to carry the presser foot away from the work supporting surface as the needle

20 is carried away from the work. This is the interval during which the feeding of the work takes place. Conversely, the pin 66c of the bell crank lever 66 and the lower end of the lever 63 are shifted toward the work supporting surface as the needle 20 is shifted toward and through said surface. As the presser foot 22 is brought into engagement with the work by such movement of the lever arm 63, the pin 66c becomes a fulcrum about which the bell crank lever 66 turns in a clockwise direction (Fig. 6) upon the further movement of the needle lever which carries the needle through the work. This serves to rock the lever arm 60 in a counter-clockwise direction because of the pivotal connection of the bell crank 66 with the lever arm 60 by means of pin 60a. Since arm 60 carries the bearings 58 and 59 for the rock shaft 57, to the lower end of which the outer feed dog 23 is secured, it will be apparent that this feed dog will be shifted outwardly away from the work support at this time.

The inner feed dog 24 is secured by means of a screw 69a (Fig. 5) to an arm 69 which is integral with the flange at the lower end of the bushing 50. The latter, as has been explained, extends upwardly into the hollow machine housing and has its upper end connected by the clamping action of the split collar, to the lower end of the yoke member 48. Accordingly feed and return movements are imparted in unison to the outer and inner feed dogs through the swinging movements imparted to the yoke 48 in the manner described. Inner feed dog 24 which is of arcuate form, curved about the axis of the bushing 50, swings back and forth along the same arc, with the axis of the bushing 50 as its center of curvature. This, it will be understood, brings about feed and return movements of the inner feed dog along the same path around the axis of the looper carrying shaft 17. No other movements are imparted to the inner feed dog; it is not shifted toward and from the work as is the outer feed dog 23 but rather projects through the opening in the throat plate 80 to the same extent throughout its movement. During its forward or work advancing stroke it cooperates with the outer feed dog 23 in such a manner that the work being stitched is gripped positively in substantially the same manner as if it were gripped by a pair of feed rollers. Upon the return stroke of the two feed dogs the outer feed dog 23 is carried out of engagement with the work in the manner described above. At this time the presser foot 22 engages the work and presses it firmly against the throat plate 80 so that the work does not follow the inner feed dog 24 as the latter swings back to its initial position. In this connection it should be noted that the presser foot 22 does not press the work directly against the inner feed dog 24 but simply against portions of the throat plate along the sides of the openings through which the feed dog 24 swings back and forth.

An auxiliary presser member is provided within the portion 1 of the frame to act upon the thread chain produced by the stitch forming devices, whenever no work is present between the work feeding devices. This is necessary in order to ensure proper chaining-out of the loops of thread when no work is present at the stitch forming point and particularly when relatively heavy or thick work is being fed into the machine. As the work is being introduced between the throat plate and the presser foot or outer feed dog the latter are held spaced from the throat plate to such an extent that no tension could be applied to the thread chain rearwardly of the point of stitch formation, with the result that the threads would fail to produce a chain. The production of a proper chain at the beginning and the end of a seam is required particularly in the closing of bags in order to lock the threads at the two ends and prevent unravelling or opening of the seam.

To ensure the proper chaining-out of the threads, when no work is present at the point of stitch formation and when the presser foot and outer feed dog are carried away from the throat plate by the introduction of the forward end of the work, an auxiliary presser foot or chain retaining foot 70 is provided and arranged to pass outwardly through a suitable slot in the throat plate 80. The foot 70 is relatively narrow but is arranged to cooperate with a central portion of the outer feed dog 23 and also a narrow web portion of the presser foot 22. It will be understood that the action of the foot 70 will alternate as between the outer feed dog 23 and presser foot 22, depending upon which of these is in active position in relation to the throat plate. Foot 70 has a stem 70a which is slidably mounted in a sleeve forming part of an angular support 71 (Figs. 5 and 6) secured to the throat plate 80. A coil spring 72 which bears at one end against the angle support 71 and at its other end against the inner side of the foot 70 serves to urge the latter outwardly into cooperation with the presser foot 22 or the outer feed dog 23, whichever of these happens to be in active position. The thread chain will thus be gripped between the foot 70 and either the presser foot 22 or the feed dog 23 and thus will produce the desired chaining-out.

Along the line of stitch formation and to the right of an extension of the throat plate 80 (Fig. 5) there is mounted on the portion 1 of the machine frame a chain cutter 25 for severing the thread chain between the forward and trailing edges of successive bags or other work pieces stitched by the machine. This cutter embodies a stationary knife blade 74 (Fig. 7) which is adjustably mounted on a bracket 73 secured to the machine frame. The blade 74 is retained in adjusted position by a screw 74a. Cooperating with the stationary blade is a movable blade 75 which is rigidly secured to the outer end of an arm 76 carried by a rock shaft 76a. The latter is journaled in bushings 77 carried by portions of the frame 1. Between the two bushings 77 there is firmly secured to the shaft 76a a lever arm 78 which carries at its outer end a ball pin 78a extending radially outwardly from the arm 78. This ball pin cooperates with a channel or fork formation 79 that is integral with the flange of the bushing 50. It is adjacent the arm 69, which as explained is also integral with the bushing, but extends downwardly in Fig. 5 toward the arm 78 for cooperation with the ball pin 78a. It will be apparent that as the bushing 50 is rocked about its axis, in the manner explained to operate the two feed dogs, the channel or fork 79 will also swing the arm 78 and turn the shaft 76a to impart swinging movements to arm 76, thereby carrying the movable blade 75 downwardly (Fig. 7) into cooperation with the stationary blade 74. To retain the movable blade 75 in proper cutting relation to the stationary blade, a spring washer or resilient disc 76b is mounted on the shaft 76a between one of the bushings 77 and the arm 78 (see Fig. 5). This spring washer serves to urge the shaft 76a inwardly into the frame portion 1 and thus carries the blade 75 yieldingly against the stationary blade 74. Blade 75, as best shown in Fig. 7, has a projecting finger which slides along the outer surface of blade 74.

When the stitching of a bag has been completed the machine may be pushed forwardly to a slight extent by the operator, or it may simply be turned slightly, to cause the trailing thread chain to enter the slot 80a (Fig. 3) in the throat plate extension 80 and come into the path of the movable cutter blade.

A large headed screw 81 (Fig. 7) threaded into an opening 81a (Fig. 5) in an inwardly extending boss on the frame 1 serves as a pivot for a bottom cover plate 82 for the frame portion 1. A spring washer 81b coacting between the head of the screw 81 and the undersurface of the cover plate 82 serves to urge the latter yieldingly against the bottom of frame portion 1. However when it is desired to have access to the parts within the bot-

tom of frame portion 1, the cover plate may be swung outwardly about the axis of screw 81.

A thread stand carrying plate 83 is secured to the machine housing 1 along with the covering hood 68 by means of screws 84 (Fig. 2). This plate extends horizontally across the top of the housing 1 and extends beyond the confines of the latter. Two thread cones 85 (Fig. 1) are adapted to be supported by the plate 83. For retaining the thread cones on the plate there is provided a pair of rods 86 which pass through the interior of the cores of the cones. At the upper end of each rod 86 there is rigidly secured a funnel shaped element 86*a* arranged to be fitted into the upper end of the associated thread cone or to otherwise rest upon the top of the latter. The lower end of each rod 86 is slidably received by an opening in a small block 87 secured to the underside of the plate 83 and extending radially outwardly from the axis of the rod 86. A knurled headed set screw 88 cooperating with a threaded hole extending longitudinally of the block 87 is arranged to have its inner end cooperate with the periphery of the rod 86 to retain the latter in set position and thus maintain the thread cone properly on the carrying plate 83. Block 87 has an upwardly extending collar 87*a* which passes through an opening in the plate 83 and into a frusto-conical opening provided in a circular foot plate 89 which surrounds the rod 86. Plate 89 is of frusto-conical shape so as to present a surface sloping downwardly from a flat circular portion adjacent the rod 86 to an outer edge which substantially merges with the surface of the plate 83. Collar 87*a* of block 87 is flared outwardly by a riveting action to retain the plate 83, block 87, and plate 89 in assembled relation. To assist in maintaining the correct positioning of these parts a dowel pin 87*b* may also be provided. This pin extends through aligned openings in the several parts and has its upper end polished off to conform with the sloping surface of the plate 89. The foot plate 89 serves to support and center the bottom of the thread cone 85 together with its core, while funnel shaped member 86*a* serves to center the top of the cone and hold the cone firmly in proper position around the rod 86. It will be understood that a similar arrangement is provided for each of the two cones. Intermediate the thread cone supporting means described, and preferably outwardly of the plane which contains the axes of the two rods 86, there is provided a third rod 90 (Figs. 1 and 2) having at its upper end a pair of laterally extending arms which serve as supports for thread guides 91 positioned above the thread cones. Rod 90 is slidably received by a collar 90*a* having a radially extending flange at its lower end which is secured by screws 90*c* to the top surface of the plate 89. A set screw 90*b* cooperating with a threaded opening in the collar 90*a* serves to retain the rod 90 with its arms at a proper elevation.

The electric motor 9 has secured to the top of its outer housing a handle 102. This handle extends upwardly from the motor housing and is provided with a base plate 102*b* suitably curved to fit the contour of the motor housing and secured to the latter by a pair of screws 102*a*. As best shown in Fig. 2, the handle 102 has its longitudinal axis disposed at an acute angle to the vertical plane containing the axis of the motor shaft. This permits the handle to be brought somewhat closer to the sewing machine without interference with the frame of the latter and brings the gripping portion of the handle closer to the center of gravity of the combined machine and motor. Thus a minimum of effort is required to prevent the downward tilting of the sewing machine as the complete unit is held normally in the hand. Toward the end of the handle which is close to the sewing machine there is provided a plurality of laterally extending lugs or ears 93 arranged to carry a pair of pins 93*a* adapted to receive clip elements at the ends of a strap or other means by which the machine may be suspended. Thus a shoulder strap 94 (Fig. 1) may have its ends connected with the pins 93*a*, the strap 94 being formed preferably of elastic material such as rubber, rubberized fabric, or the like, and preferably adjustable in length. This type of suspending means by which the machine is primarily supported from the neck and shoulders of the operator has the advantages set forth in the pending application of Friedrich Lutz, Serial No. 505,625, filed May 3, 1955, now Patent No. 2,811,938, granted November 5, 1957. A push-button 92 extends upwardly through the top of the handle in the region of the ears 93 and this push-button is connected with a suitable electric switch for controlling the operation of the motor 9. So long as the push-button 92 is depressed the motor and the machine will be operated. Upon release of pressure on the push-button the motor and the machine will stop. To enable mechanical turning of the shaft 10 of the motor for the purpose of bringing the various driven parts of the sewing machine into a desired position, for threading purposes or the like, there is secured to an outwardly extending end of the shaft a knurled disc or wheel 95 (Fig. 2).

The covering hood 68, which as already explained carries the spring 67 that urges the outer feed dog against the work, also carries a number of other devices. Thus it carries two stationary thread eyes 96 and 97 (Fig. 1A). These and other parts of the thread handling devices of the machine are indicated in dot and dash lines because they are carried by the portion of the covering hood which is outwardly of the plane along which Fig. 1A is taken. The thread guiding eyes 96 and 97 cooperate with movable thread take-up guides or eyelets carried by the arm 28*d* of the needle lever 28. Thus, by swinging of the needle lever an appropriate thread take-up action and thread pull-off action will be imparted to both the needle thread and the looper thread. To explain the arrangement in further detail, the thread guide 96 cooperates with the two movable thread guides 98 and 99 mounted on the arm 28*d* of needle lever 28. These eyelets 98 and 99 extend through arcuate slots 98*a* and 99*a* provided in the apron of the covering hood 68. As the needle lever rocks about the axis of shaft 61 the eyelets 98 and 99 will move along the arcuate slots 98*a* and 99*a* and thus impart the desired take-up action to the needle thread N. The latter may be traced from the left hand cone (Fig. 1) upwardly to the stationary guide 91, then downwardly to a thread tensioning device 98*b*, then downwardly through an eye in a thread guide member 100 secured to the covering hood 68, then to movable eyelet 99 and over to stationary eyelet 96, then down to movable eyelet 98 and finally to the eye of the needle 20. In a similar manner the looper thread G may be traced from the right hand cone 85 (Fig. 1) through the associated stationary eyelet 91, down to thread tensioning means 97*b* and through another eye of guide member 100 down to one of a pair of eyes carried by the forked stationary guide 97. From the latter the thread extends to the movable guide 97*c*, carried by the needle lever, then up to and through the other eye of guide 97 and from here through a guide tube 101 down to the looper 21.

The portions 1 and 2 of the machine frame are substantially completely enclosed. The left hand portion of part 1 of the housing is closed by a removable cover 103 (Fig. 1A). This cover may, if desired, be hingedly attached to the housing so that it may be swung open to provide access to the parts within the housing for the purpose of threading the looper and the like. A gasket or packing member 104, formed of rubber or felt or other similar material, is provided around the opening through which the needle lever 28 extends. This gasket or packing member also has a downwardly extending portion 104*a* through which the arm 52 of yoke 48 extends. The enclosure of portion 1 of the housing is such that little or no lint or dust is permitted to enter the same and any lubricant provided for the bearing surfaces within this part of the housing is effectively retained.

While an illustrative embodiment of the invention has been described in considerable detail it will be understood that various changes may be made in the construction and arrangement of the various parts without departing from the scope of the invention as defined by the appended claims.

We claim:

1. A lightweight, portable sewing unit comprising an electric motor and a sewing machine sufficiently light in weight to enable said unit to be supported and guided by one hand of the operator in the course of stitch formation, said sewing machine having a frame provided with a vertically disposed main base portion and a needle operating member extending outwardly from said portion of the frame and downwardly substantially parallel therewith, said member having secured thereto a thread carrying needle, an electric motor rigidly secured to said frame and extending outwardly from said portion thereof at a point intermediate the ends thereof and having its axis transverse to said portion of the frame and to said needle operating member, complementary stitch forming means in said frame member, and constantly operative connections from said motor extending through the base portion of said frame to said needle operating member and said complementary stitch forming means to form a line of stitching.

2. A lightweight, portable sewing unit of the character set forth in claim 1 in which said complementary stitch forming means comprises a four-motion looper, said constantly operative connections serving to impart loop seizing and shedding movements and needle avoid movements to said looper.

3. A lightweight, portable sewing unit of the character set forth in claim 2 in which said four-motion looper is secured to a rod which is mounted for vertical reciprocation and oscillation about its axis in said vertically disposed portion of said main frame.

4. A lightweight, portable sewing unit of the character set forth in claim 2 in which said constantly operative connections comprise a plurality of crank elements continuously driven by said motor through separate circular orbits having the same axis for driving said needle operating member and said four-motion looper in properly timed relation to produce the desired seam.

5. A lightweight, portable sewing unit of the character set forth in claim 4 having a reciprocatory feed dog for advancing the work in relation to said needle and said complementary stitch forming means, and connections from said motor comprising another constantly driven crank element operated through a circular orbit about a different axis from that of the orbits of the other crank elements for reciprocating said feed dog.

6. A lightweight, portable sewing unit of the character set forth in claim 5 having an arm to which said feed dog is directly secured, and means for mounting said arm to swing about a fixed axis.

7. A lightweight, portable sewing unit of the character set forth in claim 6 having a presser foot and a second reciprocatory feed dog for alternately cooperating with the first-mentioned feed dog to grip the work therebetween.

8. A lightweight, portable sewing unit of the character set forth in claim 7 in which connections are provided from the needle operating member for shifting said presser foot and said second feed dog alternately into and out of engagement with the work.

9. A lightweight, portable sewing unit of the character set forth in claim 7 in which the opposing surfaces of said feed dogs are arcuate, each of said feed dogs being mounted for swinging movement about an axis corresponding to substantially the center of curvature of its arcuate surface, said feed dogs being driven from the same crank element.

10. A lightweight, portable sewing unit of the character set forth in claim 2 having a rod to which said looper is secured, said rod being arranged for reciprocation and oscillation along and about a vertically disposed axis within said main portion of the frame, reciprocation of said rod imparting loop seizing and shedding movements to said looper, and oscillation of said rod imparting needle avoid movements to said looper.

11. A lightweight, portable sewing unit of the character set forth in claim 10 having connections from said needle operating member to said looper carrying rod for reciprocating the latter.

12. A lightweight, portable sewing unit of the character set forth in claim 11 in which said needle operating member is a bell crank lever one arm of which carries a needle and the other arm of which has forks disposed in spaced parallel planes, connections from one fork of said arm and said motor for driving said lever and connections from the other fork of said arm to said looper carrying rod for reciprocating the latter.

13. A lightweight, portable sewing unit of the character set forth in claim 5 in which at least two of said crank elements are driven through separate direct gear connections with said motor.

14. A lightweight, portable sewing unit of the character set forth in claim 13 in which said frame is formed of two parts joining each other along a vertical plane extending through the axis of the vertically extending portion of said frame, one of said crank elements being journalled in one of said parts and another of said crank elements being journalled in the other of said parts, said parts being connected by screw means.

15. A lightweight, portable sewing unit of the character set forth in claim 5 in which the frame of said machine comprises a main substantially cylindrical, vertically extending portion and a second substantially cylindrical, horizontally extending portion with its axis in a vertical plane containing the axis of said main portion, said motor being secured to said second portion and having a shaft with its axis in said vertical plane, a pinion secured to said motor shaft, and gears meshing with said pinion and connected with said crank elements for driving the latter.

16. A lightweight, portable sewing unit of the character set forth in claim 13 in which said motor has a shaft provided with a pinion, a trunnion at the free end of said pinion extending into and journalled in said frame, and in which said gear connections comprise a plurality of parallel shafts to which said crank elements are secured, and gears secured to said shafts arranged to mesh with said pinion.

17. A lightweight, portable sewing unit of the character set forth in claim 7 having a thread chain engaging element adjacent said first-mentioned feed dog, together with means for urging said thread chain engaging element outwardly into alternate engagement with said second feed dog and said presser foot along the line of stitch formation.

18. A lightweight, portable sewing unit of the character set forth in claim 9 having a thread chain cutter including at least one movable blade in rear of said feed dogs, and connections to said movable blade from said means for swinging said first-mentioned feed dog for operating said movable blade.

19. A lightweight, portable sewing unit of the character set forth in claim 18 in which the connections from the motor to the feed dogs and movable blade comprises an oscillatable sleeve, and connections from said sleeve to said feed dogs for swinging said feed dogs and to said movable blade for operating said movable blade.

20. A lightweight, portable sewing unit of the character set forth in claim 7 having a protective hood secured to said frame extending over said needle lever, said presser foot and said second feed dog, and a spring carried by said hood arranged to urge said presser foot against the first-mentioned feed dog.

21. A lightweight, portable sewing unit of the character set forth in claim 9 having means for retaining said axis

about which the first-mentioned feed dog is swung in fixed position, and means for maintaining the axis about which said second feed dog is swung to move toward and from the axis about which the first-mentioned feed dog is swung.

22. A lightweight, portable sewing unit of the character set forth in claim 9 in which the connections from said crank element for driving said feed dogs comprise a sleeve member that surrounds said looper carrying rod and is oscillatable about the same.

23. A lightweight, portable sewing unit of the character set forth in claim 2 which comprises a protective hood secured to said portion of the frame adjacent the upper end of the latter and extending downwardly over said needle operating member, means for supplying threads to said needle and looper, fixed guides for said threads carried by said hood, and movable thread guides carried by said needle operating member cooperating with said fixed guides to impart a take-up action to said threads.

24. A lightweight, portable sewing unit of the character set forth in claim 23 which comprises a thread stand secured to said main portion of the frame and extending over said hood, and thread tensioning means carried by said hood, said threads being delivered from said thread stand to said tensioning means, then to said fixed and movable guides and then to said needle and said looper.

References Cited in the file of this patent

UNITED STATES PATENTS

590,132	Coan et al.	Sept. 14, 1897
1,655,066	Long et al.	Jan. 3, 1928
1,738,559	Bowman	Dec. 10, 1929
2,051,117	Weber et al.	Aug. 18, 1936
2,065,413	Zimmermann	Dec. 22, 1936
2,252,356	Seaman	Aug. 12, 1941
2,291,129	Zeier	July 28, 1942
2,434,158	Herr	Jan. 6, 1948
2,484,495	Fischbein	Oct. 11, 1949
2,630,086	Kindseth et al.	Mar. 3, 1953
2,637,288	Cerioni	May 5, 1953
2,678,010	Pinkvoss	May 11, 1954