The general object of the present invention is to provide an improved light-weight portable sewing machine which is of the small size commonly referred to as a "little girl" sewing machine, and is characterized by its mechanical simplicity and its inherently low cost of production, and by its sewing capacity which is approximately equal to that of a domestic sewing machine of standard size.

A specific object of the invention is to provide a belt drive connection between an electric motor mounted in the frame base of a chain stitch sewing machine and the lower hook shaft of the machine, which includes an intermediate shaft and separate belts connecting the intermediate shaft to the motor and hook shafts, which will permit of a speed reducing factor large enough to permit the motor to be of a relatively high speed inexpensive type, and which will permit the hand wheel of the sewing machine to be carried by the intermediate shaft and located at a convenient distance above the base portion of the sewing machine frame.

In a preferred form of the invention, grooved pulleys carried by the motor shaft and said intermediate shaft, are connected by a rubber belt, and a sprocket wheel carried by the intermediate shaft is connected by a sprocket chain belt to a sprocket wheel carried by the underbed hook shaft, and a crank pin carried by the last mentioned sprocket wheel is connected by a link to a crank arm carried by an oscillating needle bar shaft mounted in the lower arm portion of the frame. Each belt connection, however, may comprise a rubber or analogous belt running over grooved pulleys or sprocket chains running over sprocket wheels.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, however, its advantages and specific objects attained with its use, reference should be had to the accompanying drawing and descriptive matter in which I have illustrated and described a preferred embodiment of the invention.

Of the drawings:

Fig. 1 is a sectional elevation of the improved sewing machine, the section being taken on the line 1—1 of Fig. 5;

Fig. 2 is a plan view of a portion of the machine shown in Fig. 1;

Fig. 3 is an elevation in section on the line 3—3 of Fig. 1;

Fig. 4 is a partial plan section on the line 4—4 of Fig. 1; and

Fig. 5 is an elevation in section on the line 5—5 of Fig. 1.

The frame of the sewing machine shown in the drawings comprises a hollow base A open at its bottom, a hollow standard B extending upward from the base at one end of its work bed portion A', and a hollow arm portion C. Preferably and as shown, the base, standard and arm portions of the frame are integrally connected portions of a light weight metal casting. The frame metal is advantageously aluminum in the form known as hard aluminum. The arm portion C is formed with an opening C' comprising a main portion extending along the entire upper side of the arm and depending portions at the front side of the needle head portion of the arm and at the opposite end of the arm. The opening C' is normally closed by a detachable cover plate C" having a horizontal body portion and depending end portions C' and C". Screws extending through the lower ends of the portions C' and C" may be employed to detachably secure the cover part to the frame. An electric motor D is mounted in the hollow base of the sewing machine frame and has its frame connected to the work bed portion of the base by screws D'. The base portion A is provided at its end remote from the standard B with a work bed extension A'. The extension A' may be a steel plate connected to the base A by screws A.

As shown, most of the frame of the motor D is beneath the work bed portion A' of the frame, but the motor shaft D' carries a small pulley E located beneath the portion of the standard B remote from the work bed portion A'. The pulley E drives an intermediate pulley F through a belt G, ordinarily made of rubber. The pulley F is secured to an intermediate, or counter shaft H which extends horizontally through the standard B at a level shown as about midway between the top side of the base A and the underside of the arm C. The shaft H is journaled in integral internal boss portions B' and B" of the frame standard B. The boss B' projects away from the inner side of the left hand portion of the standard B. The boss B" is carried by an integral web portion B' of the standard B intermediate its right and left hand side portions, as seen in Fig. 1. The pulley F is at the inner side of the sewing machine hand wheel F" which may be formed integrally with said pulley. Advantageously and as shown, however, the hand wheel F" is detachably clamped against the end of the hub of the pulley.
The hand wheel \( F \) has a rim portion extended to the standard B and a portion of smaller diameter which extends through a round opening \( G \) in the adjacent wall of the standard B. With the hand wheel \( F \) disconnected from the pulley \( F \), the belt \( G \) after being moved laterally off the pulleys \( E \) and \( F \), can be moved out of the frame through the opening \( B \).

The shaft \( H \) is shown as connected through a sprocket chain belt \( I \) with the underhook hook \( J \) of the sewing machine type. In the preferred construction shown, the belt \( I \) runs over a small sprocket wheel \( K \) carried by the shaft \( H \) and a larger sprocket wheel \( L \) carried by the shaft \( J \) at its rear end. The wheels \( L \) and pulley \( F \) are detachably secured to the shaft \( E \) by set screws, in positions relative to the boss \( B \) to prevent objectionable longitudinal movement of the shaft \( H \).

In ordinary practice, the motor may well be a 1/50 horsepower motor of a universal, commercially available type adapted to operate when under normal load, at about 5000 revolutions per minute, and to operate at about double that speed when running without load. Such a motor is well adapted for use in driving the sewing machine at the speed required to make about 750 to 800 stitches per minute, when the pulleys and wheels \( F \) and \( L \) and \( K \) are proportioned substantially as indicated in Figs. 1 and 3, so that the relative speed of the motor shaft \( E \) is a little less than seven times the rotational speed of the hook shaft \( I \). Such commercially available motors are relatively small and inexpensive.

The sprocket wheel \( L \) serves as a crank disc carrying a crank pin \( L' \). The latter is connected by a link \( M \) to a pivot or crank pin \( N \) carried by a crank arm \( O \) secured to one end of an oscillating needle bar shaft \( N \) horizontally disposed in the sewing machine frame arm \( C \). In the desirable construction form shown, the shaft \( N \) is coaxial with and pivotally supported by trunnion pivots \( N' \) which are also secured, and are axially adjustable in passages or openings formed in web portions \( O \) and \( C \) of the arm \( C \) adjacent the outer end of the trunnion \( N' \). The shaft \( N \) may be made of a suitable hard steel or steel alloy, and the pivot may be large enough in cross-section to avoid any tendency, due to ordinary operating stresses, of the pivot \( N' \), to enlarge the openings in the portions of the aluminum frame arm \( C \) in which they are mounted. The use of the trunnion pivots \( N' \) thus makes it unnecessary to mount bearing bushings in the aluminum frame for the shaft \( N \).

The needle bar end of the shaft \( N \) carries a crank arm \( O \) connected through a link \( N' \) to a pivot pin carried by a collar or pivot supporting member \( O' \) which surrounds and is adjustable secured by a set screw \( Q \) to the vertical needle bar \( O \). The latter is mounted in aligned openings formed in a thinned bottom wall portion \( C' \) of the needle bar end of the arm \( C \) and in an upper web portion \( O' \) of the arm \( C \). The needle bar \( O \) is provided at its lower end with means for the attachment to the bar of a needle \( O' \). The up and down movement given the needle bar \( O \) is preferably greater than is customary in chain stitch machines, and is sufficient to permit the use of a needle \( O' \) which is a commercially available, lock stitch type, sewing machine needle.

The needle bar \( O \) carries a second vertically adjustable collar member \( P \) above the member \( O' \) which supports a vertical pin \( P' \) parallel to and alongside the needle bar, and axially movable in an aligned passage formed in the boss \( Q \) and in the cover plate \( C' \) between the similarly aligned sets of passages which respectively receive the upper portion of the needle bar \( O' \) and the upper portion of parallel presser bar \( Q \). As is hereinbefore described, the pin \( P' \) controls the operation of a thread clamp \( T \). The presser bar is provided at its lower end with a presser foot \( Q' \), and is biased for down movement to hold the presser foot in engagement with the work. A presser bar lifting lever \( Q' \) is mounted in the needle bar end of the arm \( C \). The presser foot \( Q' \), lever \( Q' \) and means biasing the presser bar for down movement may be conventional in form and arrangement.

The thread clamp \( T \), engaged by the pin \( P' \), is in the form of an elongated piece of sheet metal having its rear end clamped against the upper side of the body of a sheet metal support for thread tension discs \( R \) by the screw \( S' \). The latter extends through the clamp \( T \) and support \( S \) into the removable arm cover member \( C \). The other end of the spring \( T \) extends over the pin \( P' \) secured to the metal bar \( O \). Adjacent its free end the clamp member is formed with a lateral threanding clamping projection \( T' \) which extends over a corresponding portion \( S' \) of the support \( S \). Except when the needle bar is in or near its uppermost position, the clamping projection \( T' \) clamps the thread \( U \) against the part \( S' \). As the needle bar approaches its uppermost position, the pin \( P' \) engages the front end of the clamping member and raises the clamping projection \( T' \) so as to permit the thread \( U \) to move freely in the direction of its length through the space between the part \( T' \) and supporting part \( S' \). The tension support \( S \) is formed with an uprising portion \( S' \) in which one end of a horizontal threaded post or disc support \( R' \) is anchored. The post \( R' \) passes through and supports a pair of apertured tension discs \( R \) which frictionally engage the portion of the thread \( U \) passing between the discs. The tension with which the thread \( U \) is engaged by the discs is due to the action of the helical bias spring \( X \). The latter surrounds the post \( R' \) and acts between the disc \( R \) remote from the supporting portion \( S \), and the adjustable abutment formed by a nut \( R \) threaded on the post \( R' \). As shown, the thread \( U \) passes to the tension discs \( R \) through a thread guide passage \( S' \) formed in a transversely bent part of the uprising portion \( S' \) of the member \( S \). The thread passes to the passage \( S' \) from a thread spool mounted on a spool support \( W \) secured to and extending upward from the cover plate \( C' \) and including a thread guiding disc \( W' \) larger in diameter than the spool and coaxial with the spool at the end of the latter adjacent the tension discs \( R \). The thread clamping mechanism just described is not claimed herein, but is claimed in my copending application, Ser. No. 122,388, filed Oct. 30, 1949, as a division of this application.

The means for advancing the work over the work bed in the sewing operation comprises a feed bar \( X \) carrying a feeding dog \( X' \) and formed at one end with an open ended U-shaped bar \( X' \) through which extends a horizontal supporting shaft \( X' \) anchored in the frame base \( A \). In practice, and as shown, the shaft \( X' \) has a screw head at its outer end and has its other end in threaded engagement with the base \( A \). A spring \( X' \) acting
between the pin X3 and an abutment or feed bar shoulder X2, biases the feed bar for movement in a direction opposite to the direction of its feeding movement. At its end remote from the pin or post X1, the feed bar is bifurcated to form two parallel leg portions X4 spaced away from one another by a distance equal to the diameter of a cam or eccentric disc Y secured to the hook shaft J between the hook J' and adjacent end wall of the frame base A. The rotation of the member Y acts on the feed bar portions X4 to give the latter up and down movements, and acts against a curved bearing surface X5, extending between the legs X4, to give the feed bar movement toward the pin X2 during the feeding stroke of the feed bar, and to permit the bar to move to the right under the action of the spring X5 during the return stroke of the feed bar.

The length of the feeding stroke is controlled by a stop lever Z pivotally connected to the sewing machine frame base A by a pivot pin Z' and having a cam edge surface Z' moved by the angular movement of the lever into, and is then frictionally held in a position in which it is engaged by an abutment portion X6 of the feed bar, earlier or later in each return movement of the feed bar under the action of the bias spring X5. The member X6 is advantageously in the form of a strip of spring metal having its ends attached by screws to the ends of the feed bar legs X4. The spring strip X6 cushions the engagement of the feed bar with the stop lever Z. No claim is made herein on the special form of the feed bar mechanism disclosed, as that mechanism is disclosed and claimed in my co-pending application Ser. No. 19,277, filed concurrently with this application.

As shown, the feed dog X2 comprises two side by side horizontally elongated portions X8 with their upper edges serrated, which are received in slots formed in the work bed extension A'. During the feeding stroke of the feeding bar, the feed dog parts have their serrated upper edges above the level of the upper surface of the work bed extension. During the return or non-feed stroke of the feed bar, the serrated upper edges of the feed dog parts are lowered into the work bed extension slots.

The inherent simplicity of the sewing machine shown and described will be readily apparent to those skilled in the art. The belt drive connection between the motor and hook shafts, both located within the hollow base, permits the intermediate or counter shaft H to be located at a level sufficiently above the work bed level to properly separate the pulley F and wheel K carried by the shaft H from the pulley E and wheel L carried by the motor shaft and hook shafts, respectively, and to permit the hand wheel P' to be located in a convenient position above the base of the sewing machine frame. With the crank and link connection between the needle bar shaft and the wheel L rigidly secured to the hook shaft J, the slipage of the belt G over either of the pulleys E or F cannot interfere with the proper timing of the hook and metal bar movement. The hook J' is of a well known efficient and inexpensive type, formed from sheet metal. The total amount of machining and in particular, the amount of highly accurate machining required in the production of the sewing machine, is reduced to a practical minimum.

The sewing machine disclosed includes fewer parts than any other sewing machine having equal sewing capacity of which I have knowledge, and is adapted to operate at top speed with practically no tendency of the machine to "creep" or "walk" over the supporting surface. In the particular form and design of the machine illustrated, the horizontal distance between the needle and the adjacent side of the standard B is four inches. The machine shown is capable of satisfactory operation in stitching together two piles or layers of fine silk fabrics and in stitching together as many as four piles or layers of heavy canvas. The machine includes no toothed gearing other than the sprocket wheels K and L, and those wheels may be replaced by grooved pulleys, if and when it seems desirable to use a rubber belt connection instead of a sprocket chain connection between the intermediate shaft H and hook shaft J. The removal of the top cover member C with its depending face plate and rear end portions C0 and C1, exposes all of the operating parts of the sewing mechanism above the level of the work bed, and thus facilitates the assembly, inspection, adjustment and repair of the mechanism. Novel features of the frame construction of the sewing machine illustrated but not claimed herein, are claimed in my co-pending application, Ser. No. 19,277, filed concurrently with the instant application.

In the form illustrated, the rotating hook and feed mechanism parts below the workbed extension A' are not enclosed. When desired, they may be normally enclosed by an enclosure or guard member of known type mounted on the sewing machine for movement into and out of the position in which it covers the hook and feed mechanism.

While in accordance with the provisions of the statutes, I have illustrated and described the best form of embodiment of my invention now known to me, it will be apparent to those skilled in the art that changes may be made in the form of the apparatus disclosed without departing from the spirit of my invention, as set forth in the appended claims, and that in some cases certain features of my invention may be used to advantage without a corresponding use of other features.

Having now described my invention, what I claim as new and secure to be desired by Letters Patent, is:

1. A sewing machine comprising in combination, a frame having a base, standard and arm portions, a hook shaft and a high speed motor with a rotating shaft mounted in said base portion, a speed reducing drive connection between said motor and hook shaft comprising a horizontal intermediate shaft mounted in said standard at a level between said base and arm, a speed reducing belt drive connection between said motor shaft and intermediate shaft, and a second speed reducing belt drive connection between said intermediate shaft and hook shaft, each of said belt drive connections having its lower portion in said base and having its upper portion in said standard.

2. A sewing machine as specifically claimed in claim 1, in which said standard is formed with a wall opening substantially coaxial with said intermediate shaft and which includes a hand wheel detachably connected to said intermediate shaft and having a rim portion external to said standard, and in which the belt drive connection between said motor shaft and intermediate shaft is arranged and disposed in said frame to permit the withdrawal of the belt portion of said con-
connection from the frame through said wall opening.

3. A sewing machine as specified in claim 1, in which one at least, of said belt drive connections comprises two grooved pulleys and an elastic belt running over said wheels.

4. A sewing machine as specified in claim 1, in which one, at least, of said belt drive connections comprises two toothed sprocket wheels and a tooth engaging belt running over said wheels.

5. A sewing machine as specified in claim 1, comprising a needle actuating mechanism including a needle bar shaft journaled in said arm portion and a link extending through said standard between the said arm and base portions of the frame and connected to the last mentioned shaft for oscillating the latter, and in which the belt drive connection between said intermediate shaft and hook shaft comprises an element secured to and rotating with said hook shaft and forming a part of said second belt drive connection and a crank pin carried by said element and connecting said element to said link whereby the needle bar shaft is oscillated in timed relation with the rotation of the hook shaft.

RICHARD K. HOHMANN.

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