March 21, 1967 C. C. SMITH 3,310,013

ROTARY CAM OPENER MECHANISM

Filed Oct. 16, 1963 3 Sheets-Sheet 1

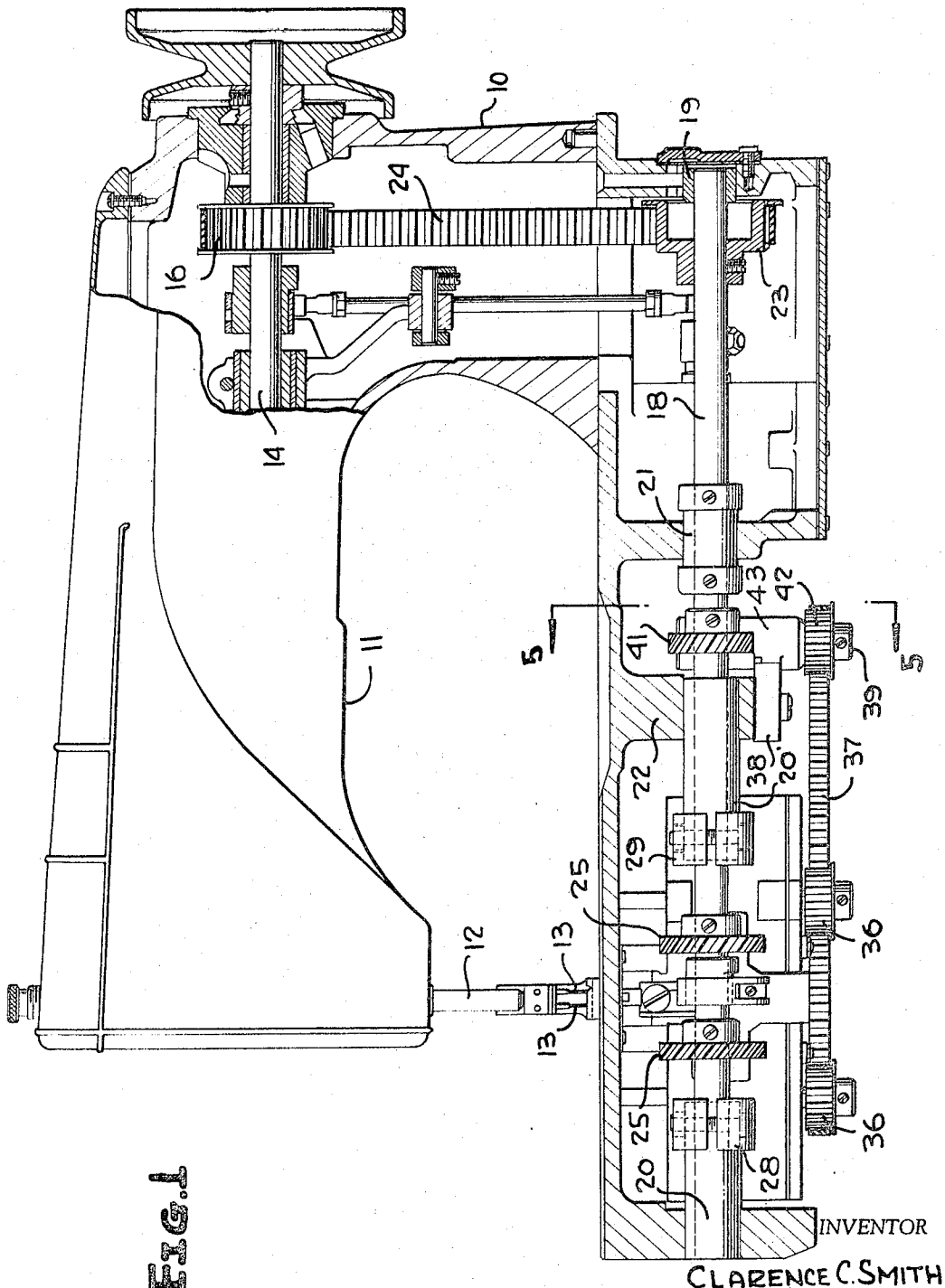


FIG. 1

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ROTARY CAM OPENER MECHANISM

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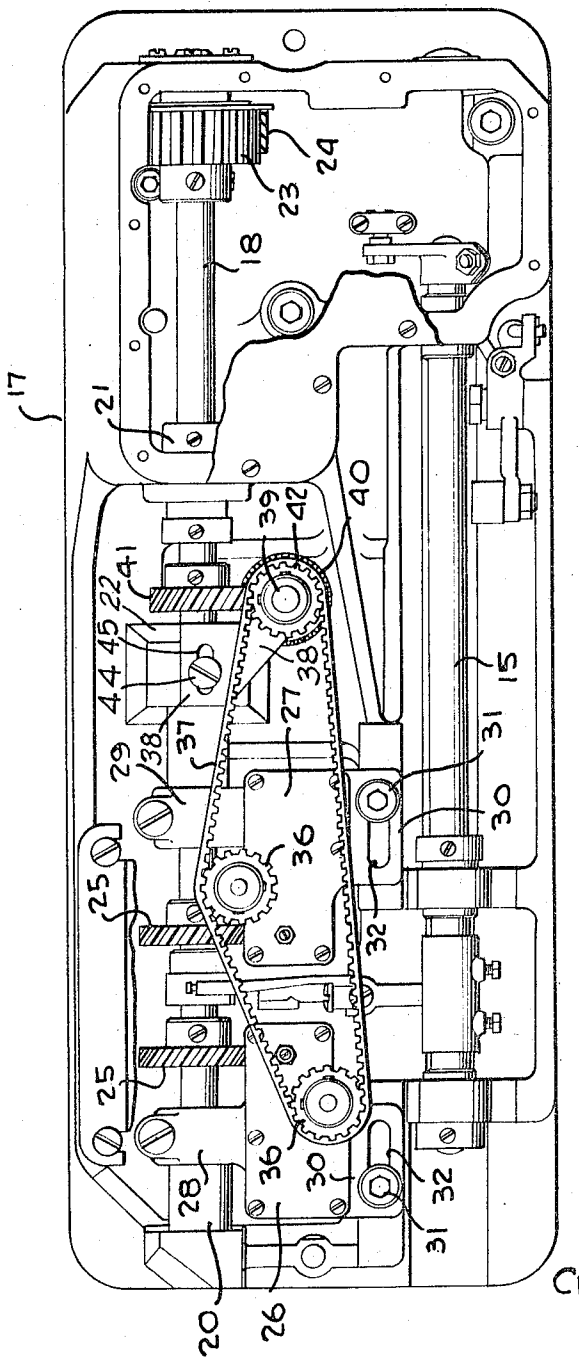


FIG. 2

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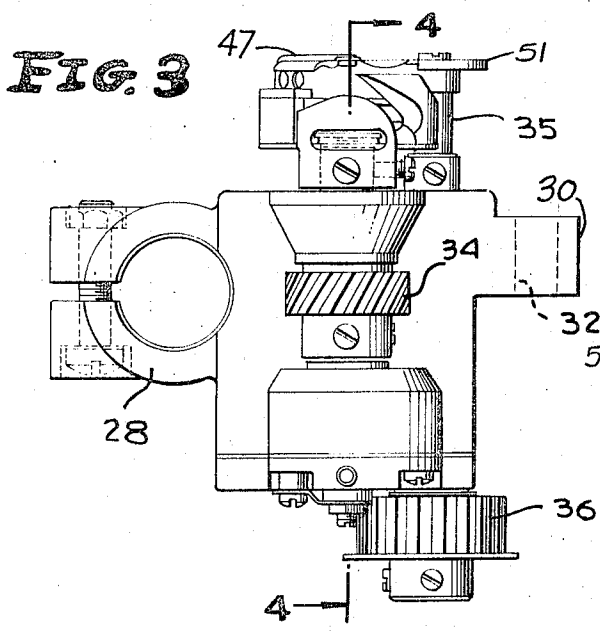
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ROTARY CAM OPENER MECHANISM

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FIG. 3



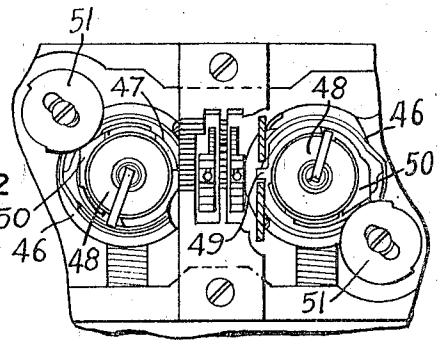
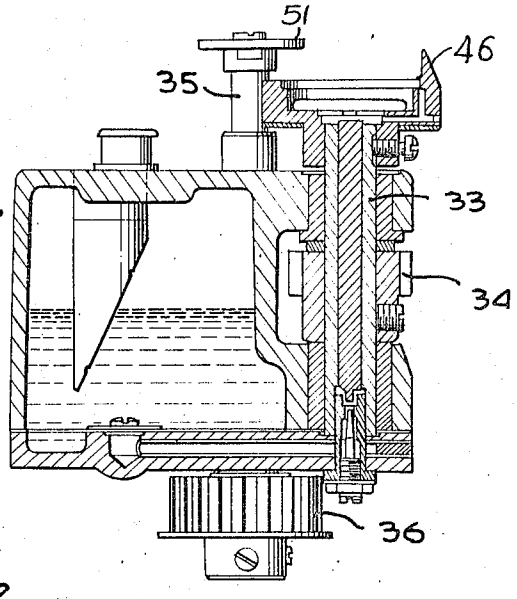


FIG. 6

FIG. 4



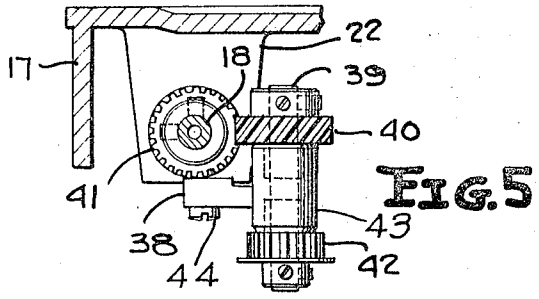


FIG. 5

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3,310,013

ROTARY CAM OPENER MECHANISM

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9 Claims. (Cl. 112—184)

The invention described in this specification relates to a rotary cam opener mechanism for use on high speed industrial sewing machines. Machines of this character are provided with one or more vertical axis rotary hooks, each having a loop seizing rotary hook component within which is mounted a substantially stationary bobbin carrier. The latter retains a bobbin which provides the stitch locking thread around which the needle thread loop is carried by the rotary hook component. In a machine of this type, there is usually provided a fixed shoulder or abutment on the underside of the throat plate of the machine cooperating with a shoulder provided on the bobbin carrier to prevent undue rotation of the latter with the rotary hook component. Means are also provided for turning the bobbin carrier through a small angle, at the proper time, counted to the frictional drag of the rotary hook. This is to open up a gap between the aforementioned shoulders and thus permit the free passage of the needle thread loop around the bobbin carrier and between those shoulders which normally prevent rotation of the bobbin carrier with the rotary hook component.

This new mechanism is primarily concerned with the provision of improved means for turning the bobbin carrier at the proper time counter to the frictional drag of the rotary hook so that the shoulder on the bobbin carrier is shifted slightly away from the fixed shoulder carried by the underside of the throat plate of the machine to thus allow free passage of a leg of the needle thread loop between those shoulders.

One of the objects of this invention is to reduce the noise consequent to the rotation of the mechanical opener element from the revolution of the rotary hook.

It is also an object of the invention to minimize vibration and wear on the hook driving gears and associated parts.

A further object of the invention is to reduce materially the load or effort required of the gearing for the hook driving means.

A still further object of the invention is to provide a common belt drive for both cam opener shafts independent of the train of gearing for the rotary hooks.

Among the objects of the invention is to provide shock-absorbing properties for the rotary cam opener mechanism.

Among the objects of the invention is to design a drive which should be of convenient size and well adapted for withstanding rigorous use at the high speeds of industrial sewing machines.

A still further object of the invention is to provide adjustment for the tension of the driving belt where change in position of the hook saddles warrants it, or where change is made in the feed dog, throat plate, pressure foot and needle clamp to serve wide gauge parts.

The preferred form of the invention has been illustrated on the accompanying drawings by way of example, on these drawings:

FIGURE 1 is a side elevation of the improved sewing machine, partly in vertical section;

FIGURE 2 is a bottom plan view of the same;

FIGURE 3 is a side elevation of the drive unit for the hook shaft;

FIGURE 4 is a vertical cross-section on the line 4—4 of FIGURE 3, the bobbin and bobbin holder shown in FIGURE 3 being omitted in this illustration;

FIGURE 5 is a vertical cross-section on the line 5—5 of FIGURE 1; and

FIGURE 6 is a fragmentary plan view showing a conventional arrangement of rotary hook units, the bobbin holders, the bobbins, restrainer means, and the counter direction bobbin moving rotary cams also being shown.

In brief, the invention consists in providing a separate and independent drive for each cam opener shaft which is separate from that driving the two rotary hook units and has been designed so that the drive may be adjusted in accordance with the particular space arrangement of the unit. In this way the power required for operating the rotary hook units is reduced.

There is also a material improvement in absence of noise, vibration and wear. Finally the drive is particularly adapted for operation at the customary high speeds of industrial sewing machines.

The invention has been shown as applied to an industrial high speed sewing machine with two needles. However, this invention is also well adapted to a sewing machine as shown, but using only a single needle. The machine comprises a vertical standard **10** with an overhanging arm **11**. The usual vertical needle bar **12** with two needles **13**, **13** is operated from the main drive shaft **14**.

The usual feed drive rock shaft **15** is operated from the main drive shaft with appropriate linkage in the well known manner.

The main drive shaft also carries a toothed sprocket **16**.

The work supporting base **17** has a main lower drive shaft **18**, as clearly shown in FIGURES 1 and 2. This drive shaft is carried in the bearing **19** beneath the near end of the vertical standard **10**. There is also a journal bearing **20** for the shaft in the opposite side wall of the work supporting base. An intermediate bearing **21** is provided for the shaft in a partition of the work base. Spaced from the bearing **21** is a dependent lug **22** which also carries a journal bearing **20'** for the shaft **18**.

The toothed sprocket **16** on the upper main drive shaft is connected by cog belt **24** to a sprocket **23** on the lower drive shaft **18**.

Beneath the needle bar, the drive shaft **18** is provided with the usual spiral gears **25**, **25** for the rotary hook shafts.

Use is made of the same hook units **26**, **27** as are used in existing sewing machines, for example, as shown in the Cottrell patent, July 12, 1955, No. 2,712,802, to which reference is made for operating details.

Each hook unit **26**, **27** has a clamp **28**, **29** respectively on the journal bearings **20** and **20'**.

The opposite sides of the hook units **26** and **27** have slotted flanges **30** and these are adjustably fastened to a part of the frame by bolts **31** and slots **32**.

Each hook unit has a vertical hook shaft **33** with a spiral gear **34** in mesh with the respective gears **25**, **25** on the drive shaft **18**.

Each hook unit **26**, **27** is also provided with a rotary cam shaft **35**. For more detailed illustration of the conventional cam and bobbin holder relation attention also is directed to FIGURES 12 to 15 and 18 of the patent to Pryor, 2, 949, 873, issued Aug. 23, 1963. The lower end of each cam shaft shaft terminates in a toothed sprocket **36**.

The sprockets **36**, **36** are in the same horizontal plane as shown in FIGURE 1.

A common drive for sprockets **36**, **36** is provided by means of a common belt **37**. This belt is driven by means independent of the gearing for the hook shafts.

For this purpose the lug **22** carries a bracket **38**. This bracket is longitudinally adjustable on the lug **22**, by reason of the provision of the bolt and slot means **44**, **45**, and mounts a journal bearing **43** wherein the shaft **39** is

rotatably supported, as best shown in FIGURES 2 and 5. A spiral gear 40 on the upper part of the shaft 39 is in engagement with a spiral gear 41 carried on the drive shaft 18. The position of the spiral gear 41 is adjustable to follow the longitudinal adjustment of the bracket 38.

The lower end of the shaft 39 carries a toothed sprocket 42 in the horizontal plane with the sprockets 36, 36.

The sprocket 42 drives the belt 37 travelling around the toothed sprockets 36, 36 on the lower ends of the cam shafts 35, 35.

Suitable re-design of the hook shaft units will permit the hook shafts 33 and the cam shafts 35 to be arranged in horizontal planes.

The separation of the driving means for the cam shafts from the driving means for the hook shafts relieves the latter of excess load. The driving of the cam shafts independently and from a remote point on the drive shaft 18, allows freedom of vibration, quietness and precise adjustment. Where variation in spacing between the hook units is desired, corresponding longitudinal movement of the bracket 38 and the gear 41 along the drive shaft 18 maintains proper driving tension for the sprockets.

The arrangements of parts illustrated and described above minimizes vibration and wear on the hook driving gears and associated parts, reduces materially the load on the driving means and quiets the operation of the machine. The separate mounting for the drive of the cam shafts allows greater flexibilities in adjustment and reduction in over-all space requirements.

In FIGURE 6, conventional cooperative relations of rotary hook units, bobbin holders, restraining means and counter direction bobbin moving rotary cam means are shown, these being known to workers in the art from the previously mentioned United States Letters Patent 2,949,873, issued to Pryor on Aug. 23, 1960. In this conventional showing the rotary hooks are shown at 46—46, the bobbin carriers or holders within the hooks at 47—47, and the bobbins within the carriers at 48—48. As is well known in the art, the arrangement is such that the bobbin case holders are restrained under the frictional drag of the hook bodies as the latter are revolved at high speed. The conventionally known restrainer means is shown at 49 and the conventional continuously rotating cam means arranged to act upon the projections 50—50 on the bobbin holders at proper times in cycles of switch formation in order to turn the bobbins in a direction counter to the mentioned drag or frictional force are indicated at 51—51.

While the preferred form of the invention has been set out above, numerous changes in material properties and minor structural details are possible within the scope of the appended claims.

What I claim is:

1. In a lock-stitch sewing machine having a work supporting base, a rotary drive shaft journalled longitudinally in said base, a hook shaft mounted in said base, gears connecting said drive shaft to said hook shaft, a rotary cam shaft mounted parallel to said hook shaft, a sprocket on the cam shaft, a gear adjustably carried by the drive shaft, a bracket, a journal bearing carried by said bracket separate and apart from the hook shaft mounting and mounted on the base, means for adjusting said bracket longitudinally of the drive shaft, an independent shaft revolvably mounted in the journal bearing, a gear on one end of the last named shaft in engagement with the adjustable gear on the drive shaft, a sprocket on the opposite end of the independent shaft and a drive belt connecting said last named sprocket with the sprocket on the cam shaft.

2. In a lock-switch sewing machine having a work supporting base, a rotary shaft journalled longitudinally in said base, two parallel hook shafts mounted in the base, gears connecting said drive shaft to each hook shaft, a rotary cam shaft mounted parallel to each hook shaft, a sprocket on each cam shaft, an independent gear adjustably carried by the drive shaft, a bracket, a journal bearing carried by said bracket mounted on the base, means for adjusting said bracket longitudinally of the drive shaft, a shaft revolvably mounted in the bearing, a gear on one of the last named shaft in engagement with the adjustable gear on the drive shaft, a sprocket on the opposite end of said shaft, and a drive belt connecting the three sprockets.

3. In a lock-switch sewing machine having a work supporting base, a rotary drive shaft journaled longitudinally in said base, a hook shaft mounted in the base, connections from said drive shaft to said hook shaft for rotating the latter, a rotary hook carried by the hook shaft, a bobbin carrier journaled in said rotary hook, means for restraining said carrier against rotation with the rotary hook in its normal stitch forming operation, a rotary cam shaft parallel and adjacent said hook shaft, a rotary cam secured to one end of said rotary cam shaft adjacent said bobbin carrier, said bobbin carrier having a surface thereon to be engaged by said cam to oscillate the bobbin carrier oppositely to the direction of rotation of the rotary hook, a bracket mounted in said base, said bracket being separate and apart from the hook shaft mounting and longitudinally adjustable relative to said cam shaft, an independent shaft revolvably mounted in said bracket, gearing connecting said independent shaft with said drive shaft and driving means connecting said independent shaft with said cam shaft for rotating the latter.

4. In a lock-stitch sewing machine having a work supporting base, a rotary drive shaft journaled longitudinally in said base, a hook shaft mounted in the base, connections from said drive shaft to said hook shaft for rotating the latter, a rotary hook carried by the hook shaft, a bobbin carrier journaled in said rotary hook, means for restraining said carrier against rotation with the rotary hook in its normal stitch forming operation, a rotary cam shaft parallel and adjacent said hook shaft, a sprocket on said cam shaft, a cam secured to one end of said cam shaft adjacent said bobbin carrier, said bobbin carrier having a surface thereon to be engaged by said cam to oscillate the bobbin carrier oppositely to the direction of rotation of the rotary hook, a bracket separate and apart from the hook shaft mounting and mounted on said base, means for longitudinal adjustment of said bracket relative to said cam shaft, and independent shaft revolvably mounted in said bracket, gearing connecting said independent shaft with said drive shaft, a sprocket on the independent shaft and a drive belt connecting said sprocket with the sprocket on the cam shaft.

5. In a lock-stitch sewing machine having a work supporting base, a rotary drive shaft journaled longitudinally in said base, two hook shafts mounted in spaced relation in the base, connections from said drive shaft to each hook shaft for rotating the latter, a rotary hook carried by each hook shaft, a bobbin carrier journaled in each rotary hook, means for restraining each carrier against rotation with the rotary hook in its normal stitch forming operation, a rotary cam shaft parallel to and adjacent each hook shaft, a cam secured to one end of each cam shaft adjacent the bobbin carrier, said bobbin carriers each having a surface thereon to be engaged by the cam to oscillate the bobbin carrier oppositely to the direction of rotation of the hook, a bracket mounted in said base, an independent shaft revolvably mounted in said bracket, gearing connecting said independent shaft with said drive shaft and driving means connecting said independent shaft with each cam shaft for rotating the latter in unison.

6. In a lock-stitch sewing machine having a work supporting case, a rotary drive shaft journaled longitudinally in said base, two hook shafts mounted in spaced relation in the base, connections from said drive shaft to each hook shaft for rotating the latter, a rotary hook carried by each hook shaft, a bobbin carrier journaled in each

rotary hook, means for restraining each carrier against rotation with the rotary hook in its normal stitch forming operation, a rotary cam shaft parallel to and adjacent each hook shaft, a sprocket on each cam shaft, a cam secured to one end of each cam shaft adjacent the bobbin carrier, said bobbin carriers each having a surface thereon to be engaged by the cam to oscillate the bobbin carrier oppositely to the direction of rotation of the hook, a bracket mounted in said base, an independent shaft revolvably mounted in said bracket, gearing connecting said independent shaft with the drive shaft, a sprocket on said independent shaft and a drive belt connecting said last named sprocket with the sprockets on both cam shafts for rotating the latter in unison.

7. Sewing machine structure as defined in claim 5 wherein each hook shaft, hook, bobbin carrier, cam shaft and cam comprise a unit assembly, said bracket being mounted on the base and including means for adjustment relative to said unit assemblies.

8. Sewing machine structure as defined in claim 7 wherein said unit assemblies are adjustably mounted on the base for movements of adjustment toward and from each other.

9. Sewing machine structure as defined in claim 6 wherein each hook shaft, hook, bobbin carrier, cam shaft and cam comprise a unit assembly, said bracket being mounted on the base and including means for adjustment relative to said unit assemblies, one said unit assembly cam shaft being disposed in the particular unit assembly toward one outer side of the base and the cam shaft of the other unit assembly being disposed therein toward the other outer side of the base, and said belt being passed about the portions of the three sprockets on the cam shafts and the independent bracket mounted shaft which are remote from each other.

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