United States Patent

Hanyu et al.

[15] **3,705,562**

[45] **Dec. 12, 1972**

[54] **ROTARY SHUTTLE FOR SEWING MACHINES**

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[73] Assignee: **Janome Sewing Machine Co. Ltd.,** Tokyo, Japan

[22] Filed: **April 27, 1971**

[21] Appl. No.: **137,764**

[30] **Foreign Application Priority Data**

April 28, 1970 Japan 45/35952

[52] **U.S. Cl.** **112/232**

[51] **Int. Cl.** **D05b 57/10**

[58] **Field of Search** 112/231, 232, 181, 185, 228, 112/229, 230

[56] **References Cited**

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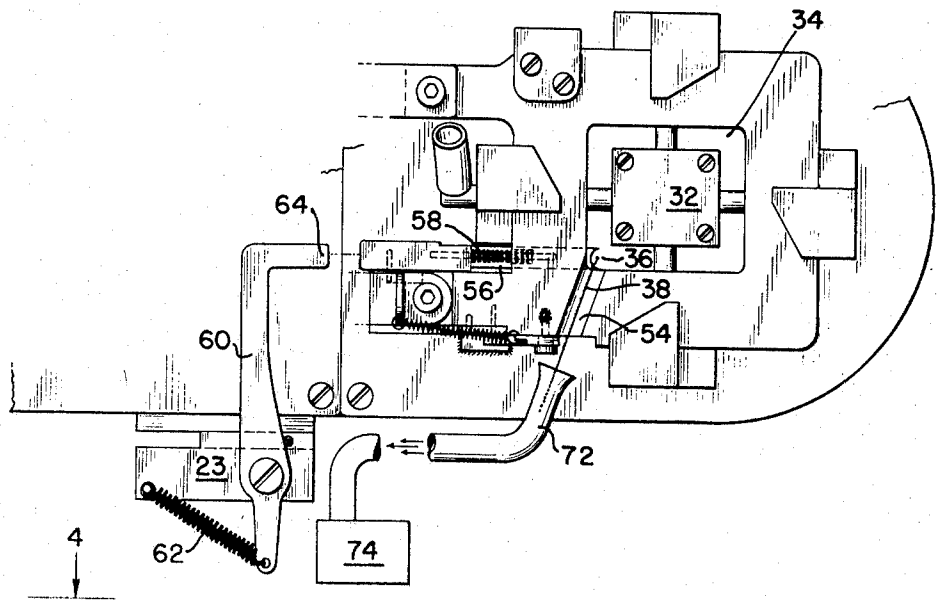
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Primary Examiner—Alfred R. Guest
Attorney—Michael S. Striker

[57] **ABSTRACT**

A rotary shuttle for a sewing machine is made of two plates which are press-formed to have dished wall portions and part-circular flanges circumferentially abutting each other, and being brazed or welded together. The plates are cut out to form a recess for the passage of a sewing needle, and a hook for catching a thread.

9 Claims, 7 Drawing Figures



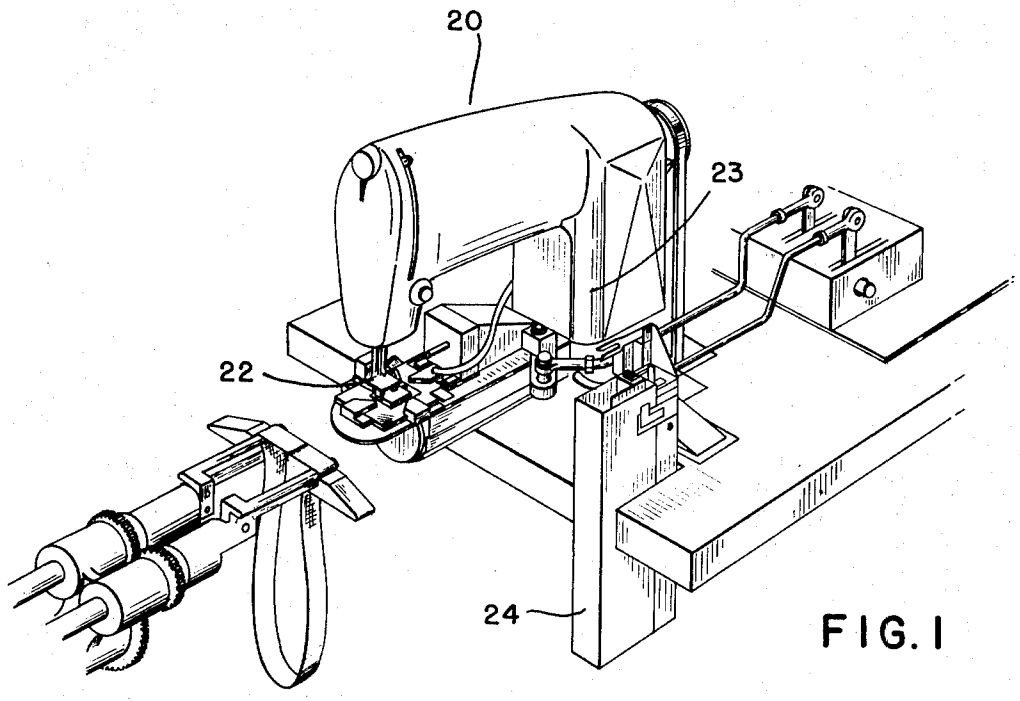


FIG. 1

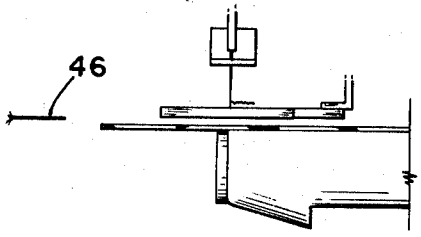


FIG. 3

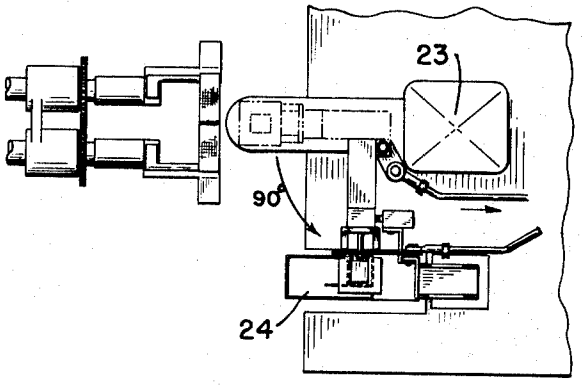


FIG. 2

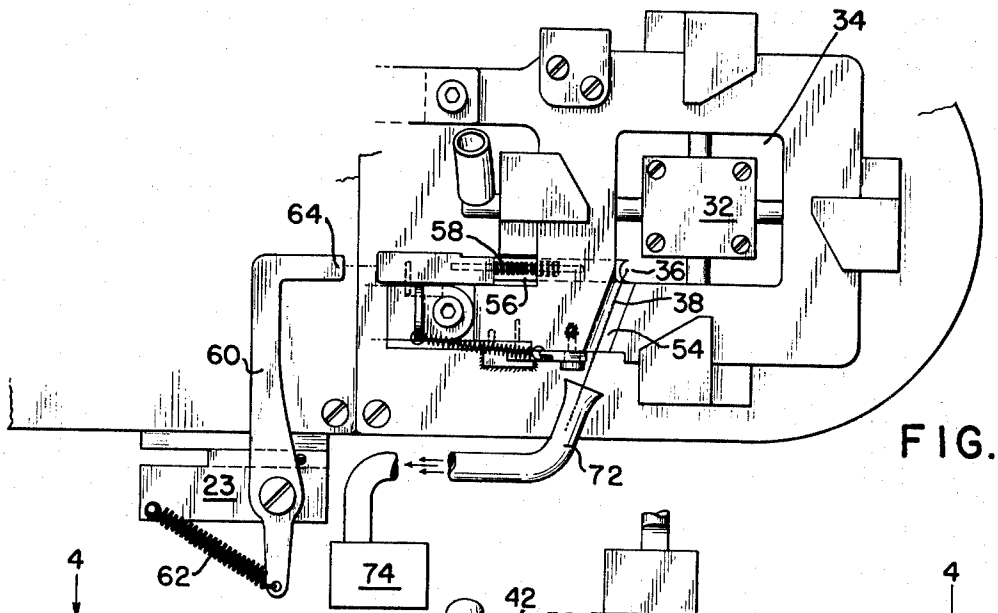


FIG. 4

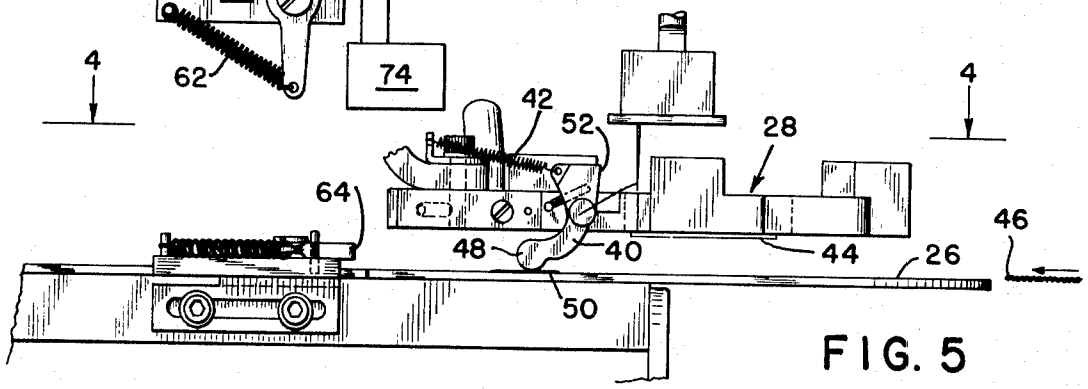


FIG. 5

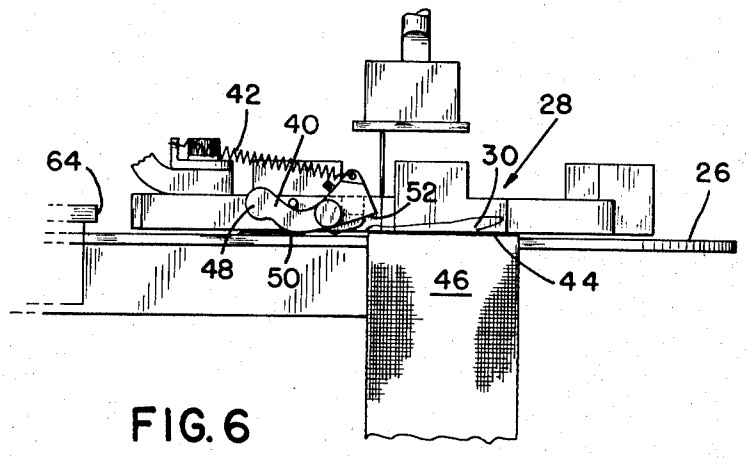


FIG. 6

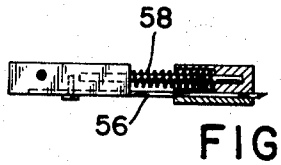


FIG. 8



FIG. 9

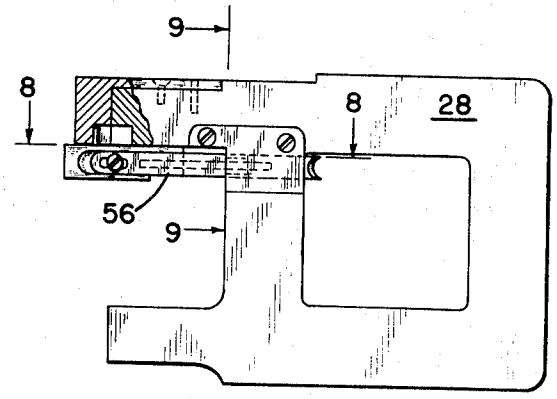


FIG. 7

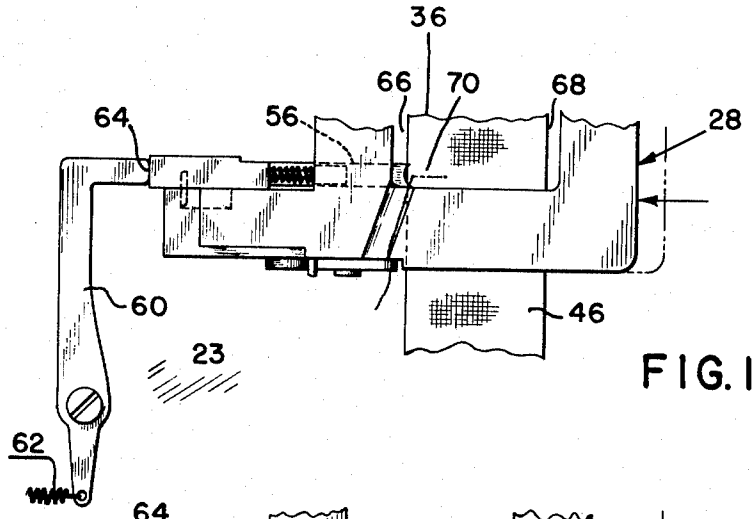


FIG. 10

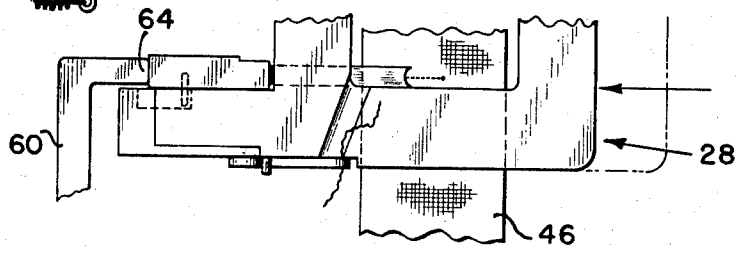


FIG. 11

ROTARY SHUTTLE FOR SEWING MACHINES

BACKGROUND OF THE INVENTION

It is known to provide sewing machines with rotary shuttles for catching a thread loop and for enlarging the same. It is necessary to manufacture a rotary shuttle with great precision to assure even rotation in the shuttle holder, and reliably guiding a thread loop. In accordance with the prior art, rotary shuttles are made by cutting, shaping and like machining operation of a tempered material, or by founding a deformable material in a mold. For cutting and machining a rotary shuttle, more than 21 operational steps are required, and moreover, highly skilled operators have to carry out the necessary precision work. Since there are losses due to cutting, which causes dust and scraped off particles, a greater amount of expensive material is required. Furthermore, cutting operations cause burrs and grates on the shuttle so that the same will vibrate or oscillate when rotating at high speed, having the disadvantage of great wear due to abrasion, and also of a noisy operation.

When a shuttle is made of precision casting, special material has to be used, and the making of the casting die is very expensive so that the price per unit is fairly high, so that the method of casting rotary shuttles has not been actually put into practice.

It has been proposed to use plates for making a rotary shuttle, but is is difficult to provide in this manner a reliably operating shuttle hook, and furthermore, the shuttle hook requires a joint which frequently creates a crack which renders the shuttle inoperative.

SUMMARY OF THE INVENTION

It is one object of the invention to make a rotary shuttle for a sewing machine by sheet metal processing operations.

The main object of the invention is to produce a rotary shuttle which is suitable for mass production.

In accordance with the invention, sheet metal parts are deformed by a press, so that cutting operations required for the shuttles of the prior art, are almost completely eliminated. Consequently the production is increased several times as compared with the prior art. The required shape of the shuttle can be easily produced by press forming, and only few trimming, cutting and grinding operations are required for finishing the shuttle of the invention. The most difficult steps of the prior art need not be carried out, and the shuttle can be manufactured by less skilled operators. Particularly, difficult manual operations are almost completely eliminated, and the production of the shuttle can be carried out by machines.

Another object of the invention is to reduce losses of material during the manufacture of the shuttle.

Since the prior art requires more than 20 operational steps, evidently high losses of material occur. In the present invention, steel plates are stamped out of sheet material, and subjected to press forming to obtain such a shape that only few cutting and drilling operations are required for the finishing of the shuttle, and accordingly, the losses of material are low. As compared with the prior art, the loss of material is reduced by one-third.

Another object of the invention is to provide a rotary shuttle of great mechanical strength and accurately performing the required functions, such as catching a thread and opening a thread loop.

Irrespective of the fact that the shuttle of the invention is made of steel plates, and by a few operations, the present invention provides a mechanically strong shuttle since flanges of the steel plates are placed in abutting positions and brazed or welded to form a strong arcuate rib along a plane of symmetry of the shuttle and serving for engaging the race of the shuttle holder. The reinforced preferably circular rib extends along the periphery of the finished shuttle, and provides structural rigidity which is superior to shuttles of the prior art.

It is well known that a rolled steel plate has a grain composition which is stronger than a cut part. The hook of the rotary shuttle of the invention is formed at one end of the rigid flange so that no cracks form, and no breakage takes place.

Another object of the invention is to provide a lightweight shuttle. The rotary shuttle of the invention is hollow for mounting a bobbin in the cavity of the shuttle, and has other required parts at the periphery or outside thereof. When a rotary shuttle according to the prior art is cut in many operations, grates and burrs inevitably remain on the finished shuttle so that the weight of the same is unnecessarily increased. Since in accordance with the invention, steel plates are press formed, all parts of the finished shuttle are of uniform thickness, and there will be no grates or burrs. As a result, the shuttle of the invention is lighter than shuttles of the prior art, by about 10 to 20 percent compared with shuttles made by cutting operations.

Another object of the invention is to provide a rotary shuttle which reliably operates in a standard sewing machine.

The rotary shuttle of the invention has a low weight, and will rotate smoothly without vibration or noise.

Although the peripheral rib of the shuttle consists of two abutting flanges, it does not detrimentally effect the inertial rotation of the shuttle.

The shuttle of the invention is made of a main body and a front body, both of which have flanges and dished portions on both sides of the rib of the shuttle, so that the shuttle can take and enlarge a thread loop, and release it smoothly. The hook of the shuttle of the invention is rigid enough to perform its function indefinitely.

The rotary shuttle according to one embodiment of the invention comprises a main body having a central wall portion through which the axis of the shuttle passes, a first dished wall portion on one side of the central wall portion continuing the same, a peripheral hook portion, and an arcuate flange projecting parallel to the axis in one direction from a part of the periphery of the first dished wall portion; and a front body having a second dished wall portion confronting the first dished wall portion, and an arcuate second flange projecting parallel to the axis in the opposite direction from a part of the periphery of the second dished wall portion.

The first and second flanges have first and second circumferential surfaces abutting each other and bonded together, for example by brazing or welding, to form an arcuate, preferably part-circular rim along and between the first and second dished wall portions so

that the same form a cavity for a bobbin case, while the outer surfaces of the same can guide and enlarge a threaded loop. A bobbin case supporting pin is secured to the central portion of the main body, projecting from the same through the cavity in the shuttle. The front body is formed with a cutout slot for the passage of the needle.

The main body and the front body are first and second plates, preferably steel plates punched out of sheet material, and then shaped in a press to form the first and second flanges and the first and second dished wall portions, respectively. The first flange has a cutout adjacent the hook, which is formed of a portion of the first flange of the main body.

The novel features which are considered as a characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** is a elevation illustrating a pair of steel plate blanks of which the main body and front body of the rotary shuttle are, respectively, formed;

FIG. **2** is a front elevation having portions A and B respectively illustrating the steel plate blanks of FIG. **1** after a forming operation in a press;

FIG. **3** is a rear view having portions A and B illustrating the steel plate blanks of FIG. **1** after the forming operation in the press;

FIG. **4** is a plan view having portions A and B illustrating the main body and front body of a shuttle according to the invention after cutting operations;

FIG. **5** is a side view, partially in section, illustrating a shuttle assembled of the parts shown in FIG. **4**;

FIG. **6** is a perspective view of the assembled shuttle shown in FIG. **5**; and

FIG. **7** is an exploded perspective view illustrating the main body and front body of the shuttle separated from each other.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, and particularly to FIG. **1**, a first steel plate blank A is about 1.2 mm. thick, and a steel plate blank B, whose thickness is about 1 mm., are shown. Blanks A and B are punched out of sheet material.

Blank A has a semi-circular peripheral portion A_5, and has on a projection A_2 adjacent the circular portion A_5, separated by a recess A_4 from another projection A_1 which is separated by a recess A_3 from a central rounded projecting portion A_6.

The blank plate B is substantially crescent-shaped, and has a part-circular peripheral edge B_5, a curved inner edge B_2, and a projection B_1 formed by the inner edge B_2 and another transverse curved edge B_3.

The punched out blank plate A, and the punched out blank plate B are subjected to independent press forming operations to obtain the shapes shown in FIGS. **2** and **3** at (A) and (B), respectively. A main body **10** is formed by press forming the blank A, and a front body **20** is formed by press forming the blank B.

Main body **10** has a flat central portion **13** into which a bore **16** is drilled later on. A dished wall portion **14** continues one side of the flat central portion **13**, and has a substantially frusto-conical shape, as best seen in FIG. **4**. A part circular flange **12** has a center coinciding with the center of the bore **16**, and projects parallel to an axis which is perpendicular to the flat portion **13**. At one end of flange **12**, an outwardly projecting portion is formed which includes portions **15***a* and **15***b* which are slanted to the flange **12**. The projecting portion **15** is connected with an arcuate shoulder **12***b* of constant radial width located between flange **12** and the dished wall portion **14**, as best seen in FIGS. **4** and **5**. Another flange portion **12***a* projects from flange **12** in a direction opposite to the projecting portion **15**, and is formed of edge portions of the projections A_1, A_2, and of the recess A_4 of blank A shown in FIG. **1**. The projecting portion **15** is connected with flange **12***a* by the portion **15***b*. The flange **12***a* is of trapezoidal shape in the plan views of FIGS. **2** and **3**, and has an end portion **18** formed of blank projection A_2, and a tongue **19** formed of projecting blank portion A_1.

The front body **20** has after press forming the shape shown in FIGS. **2** and **3** in views (B). The circular peripheral edge B_5 of blank B shown in FIG. **1**, is deformed into a part-circular flange **22** which matches flange **12** of main body **10**, so that the main body **10** and front body **20** can be assembled in the position shown in FIG. **5** in which the outer circular surface of flange **22** abuts the inner circular surface of flange **12** and forms together with the same, after brazing or welding, a part-circular rib **40**.

Flange **22** has an inner surface connected at one end with a slanted wall portion **24** which is an extension of an arcuate shoulder **23** provided between the dished wall portion **24** and flange **22**. The outer surface of the dished wall portion **24** has its highest point at the projecting portion **27**, which is formed of projection B_1 of blank plate B. The arcuate shoulder **23** is enlarged to a substantially triangular shape adjacent the blank projection B_1, as clearly shown in FIGS. **2** and **3**.

The triangular extension of shoulder **23** is connected with the dished wall **24** by a flat wall **25** which is substantially perpendicular to the dished wall portion **24**, and to the extension of shoulder **23**.

Shoulder **23** of front body **20** is narrower than shoulder **12***b* of the main body **10**. The part-circular shoulder **12***b* of the main body **10**, and the part-circular shoulder **23** of the front body **20**, together with the part-circular flanges **12** and **22** form the peripheral rib **40** shown in FIG. **5** which supports the assembled shuttle in the race of the shuttle holder, not shown. The shoulders **12***b* and **23** reinforce the main body **10** and front body **20**, since the rim of the inner flange **22** of front body **20** abuts the inner surface of the shoulder **12***b* adjacent flange **12** of the main body **10**. Due to the fitting of flange **22** into flange **12**, the two parts **10** and **20** of the shuttle can be easily assembled in the position shown in FIG. **5**, whereupon flanges **12** and **22** are bonded together, preferably by brazing or welding.

Before the two parts **10** and **20** of the shuttle are assembled, certain cutting operations are carried out as shown by thin phantom lines in FIGS. **2** and **3**. As noted above, the central portion **13** is provided with a hole **16** concentric with the circular flange **12**. The outwardly projecting portion **15** is cut off along a cutting line **17**

extending along the outer circumference of flange **12** of main body **10**. The cutout **18***a* formed in this manner in flange **12**, is best seen in FIG. **6**. The flange portion **12***a* is formed in such a manner that a sharp point **18** forming the hook of the shuttle remains, as best seen in FIGS. **4**, **6** and **7**.

After the projecting portion **15** has been cut out of flange **12** of main body **10**, hook **18** is bounded by the surface **17***a* shown in FIG. **4**.

The triangular portion **21** of the front body **20**, shown in FIGS. **2** and **3**, is cut out to form a slot **26** of 2.5 mm. to 3 mm. width between flange **22** and projecting portion **27**, the finished slot **26** being best seen in FIG. **4** in which slot **26** is shown to be bounded by two projections **27** and **28** formed of blank portion B_1 and the end of the flange **22**, respectively. Projections **27** and **28** are located at different levels in relation to the axis of the shuttle and to the center of front body **20**.

FIG. **4** shows the parts **10** and **20** of the almost complete shuttle. The projecting portion **15** including part **15***a* shown in FIGS. **2** and **3** at (A) is cut off and leaves a trapezoidal edge surface extending between the cut off flange **12**, and the flange part **12***a*, best seen in FIG. **2** (A), and formed on the recessed edgeA_4 of the blank plate A in FIG. **1**. The flange portion **12***a* is connected with the hook point **18** and reinforces the same, while the other portion of flange **12***a*, which extends along projection A_1 of blank plate A shown in FIG. **1**, projects in the form of a tongue **19**.

The part-circular shoulder **12***b* between flange **12** and the dished wall **14** of the main body **10** has an inner surface on which the circular rim of flange **22** abuts in the assembled condition shown in FIG. **5**. Front body **20** is substantially crescent-shaped, as shown in FIGS. **6** and **7**, but one end portion of the same is divided into the end portion **24***a* of the dished portion **24**, bounded by the inner edge **29**, and the end portion **28** of the flange **22**, as best seen in FIG. **7**. End portion **27***a* is also bounded by the edge **25**, which defines with the end portion **28** of flange **22**, the open slot **26** in which the needle of the sewing machine reciprocates.

Tongue **27** of front body **20** is a counterpart of the tongue **19** of the main body **10** and continues the edge **29** of the dished wall portion **24**. Edge **29** is curved and bounds recess **26** for drawing the lower thread supplied from the bobbin in the shuttle. The outer surfaces of main body **10** and front body **20** are finished by grinding and polishing operations.

As best seen in FIGS. **5** and **7**, a pin **31** is provided for mounting a bobbin case, not shown. Pin **31** has an end portion **36** inserted into the bore **16** of the central wall portion **13** of main body **10**, a flange **35** abutting the same, a shaft portion **32**, a neck portion **33** and a head **34** projecting across the crescent-shaped dished portion **24** of front body **20**.

The main body **10** and the front body **20** are assembled in the position shown in FIGS. **5** and **6** with the outer surface of flange **22** abutting on the inner surface of flange **12** of the main body **10**. The inner surface of the circular planar shoulder **12***b* is in contact with the edge of flange **22** since flanges **12** and **22** extend both at right angles to shoulder **12***b*. The abutting flanges **12** and **22** are brazed or welded to each other so that the part-circular rim **40** assures rigidity of the shuttle.

The outer peripheral surface of the assembled rotary shuttle, and the lateral surfaces thereof, are, if necessary ground to increase the precision of the shuttle, whereupon the surfaces are carburized and tempered to increase the hardness of the steel. After these operations, the shuttle is coated with a suitable finishing material.

As explained above, the two parts **10** and **20** of the shuttle are press formed, and are brazed or welded, or bounded in any other manner to each other to form the rotary shuttle. The rib **40** formed along the circumference of the shuttle, is very rigid so that the shuttle smoothly rotates in the race of the shuttle holder, not shown.

Due to the cutting of a trapezoidal edge forming the recess **18***a*, the hook point is precisely formed and capable of taking up the thread loop. Due to the fact that only a few cutting operations, leaving almost no grates or burrs are carried out, the shuttle is of lightweight, and noise caused by vibration at high speed rotation is eliminated so that the loop forming and stitching operations are reliably carried out. Also, very little metal is lost during the manufacture of the shuttle, due to simplification of the shuttle of the present invention.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of rotary shuttle for sewing machines differing from the types described above.

While the invention has been illustrated and described as embodied in a rotary shuttle composed of two parts shaped by press forming of blank plates stamped out of sheet material, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims:

1. For use with a sewing machine, a rotary shuttle having an axis, and comprising: a main body having a central wall portion through which said axis passes, a first dished wall portion on one side of said central wall portion continuing the same, a peripheral hook portion, and an arcuate first flange projecting parallel to said axis in one direction from a part of the periphery of said first dished wall portion; and a front body having a second dished wall portion confronting said first dished wall portion, and an arcuate second flange projecting parallel to said axis in a direction opposite to said one direction from a part of the periphery of said second dished wall portion, said first and second flanges having first and second circumferential surfaces abutting each other and being bonded together to form an arcuate rim along and between said first and second dished wall

portions so that the same form a cavity for a bobbin case, and have outer surfaces adapted to guide and enlarge a thread loop.

2. A rotary shuttle as claimed in claim 1 comprising a pin secured to said central portion and projecting from the same in said one direction concentric with said axis for supporting a bobbin case for rotation about said axis.

3. A rotary shuttle as claimed in claim 1 wherein said main body includes a supporting wall portion having a tongue located on said first flange for supporting and reinforcing said hook.

4. A rotary shuttle as claimed in claim 1 wherein said front body is formed with a slot for passage of a needle and located adjacent said second flange; and a pair of projections defining said slot and being spaced in axial direction.

5. A rotary shuttle as claimed in claim 1 wherein said main body has a shoulder located between said first dished wall portion and said first flange and being perpendicular to the latter; wherein said second flange is located within said first flange; and wherein the edge of said second flange abuts the inner surface of said shoulder.

6. A rotary shuttle as claimed in claim 5 wherein said front body has a narrow shoulder between said second dished portion and said second flange and being perpendicular to said second flange.

7. A rotary shuttle as claimed in claim 1 wherein said main body and said front body are first and second plates, each of said first and second plates being of uniform thickness.

8. A rotary shuttle as claimed in claim 7 wherein said first flange has a cutout adjacent said hook; and wherein said hook is formed of a portion of said first flange.

9. A rotary shuttle as claimed in claim 1 wherein said first and second flanges extend along circles concentric with said axis.

* * * * *

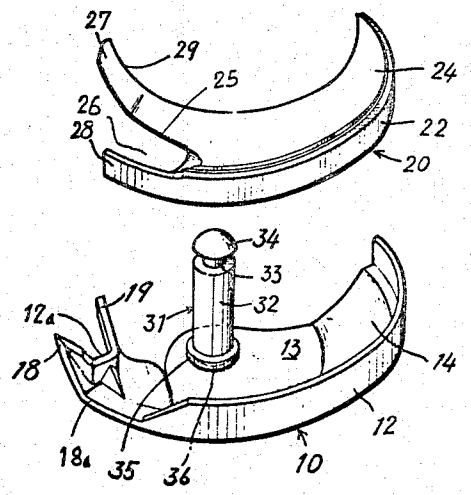
UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,705,562 Dated December 12, 1972

Inventor(s) Susumu Hanyu et al.

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

On the cover sheet the illustrated drawing should appear as shown below:



Cancel sheets 1-3 of the drawings and insert sheets 1-4 as shown on the attached sheets.

Signed and sealed this 5th day of February 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

RENE D. TEGTMEYER
Acting Commissioner of Patents

FORM PO-1050 (10-69)

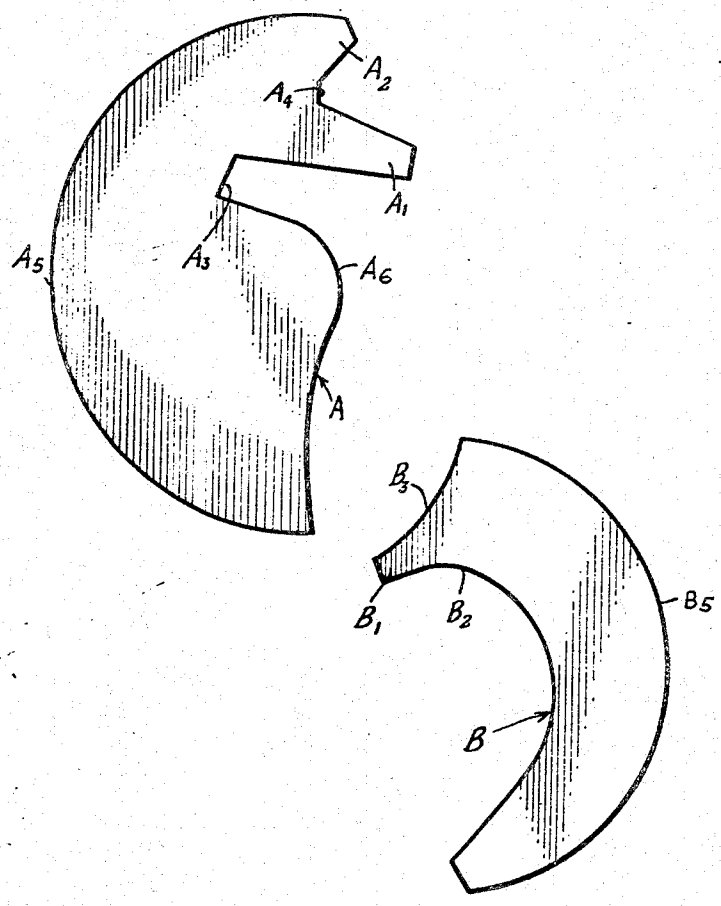
USCOMM-DC 60376-P69
☆ U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.

PATENTED DEC 1 2 1972

3,705,562

SHEET 1 OF 4

FIG. 1



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FIG. 2

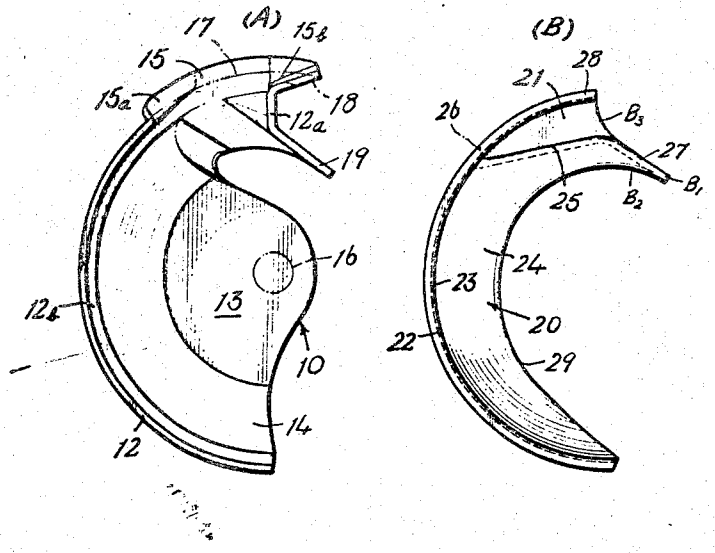
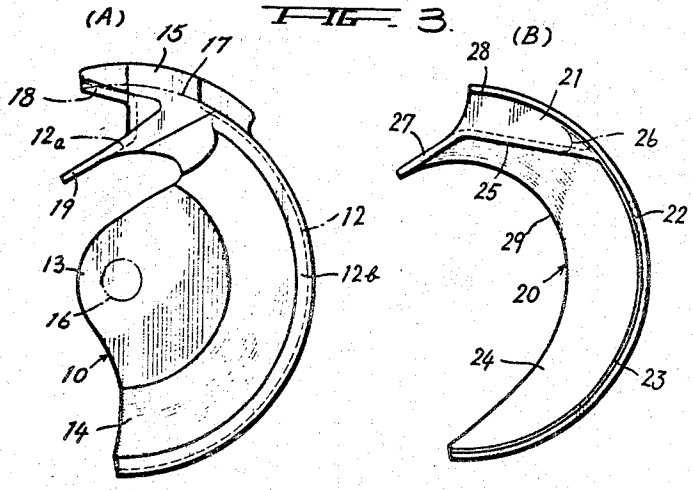


FIG. 3



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PATENTED DEC 1 2 1972 3,705,562

SHEET 3 OF 4

FIG. 4

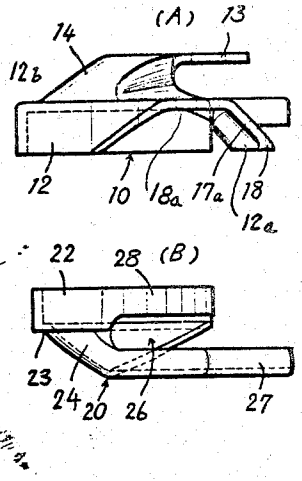
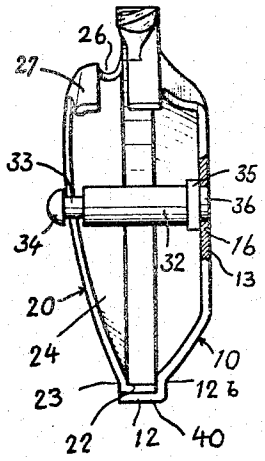


FIG. 5.



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SHEET 4 OF 4

FIG. 6

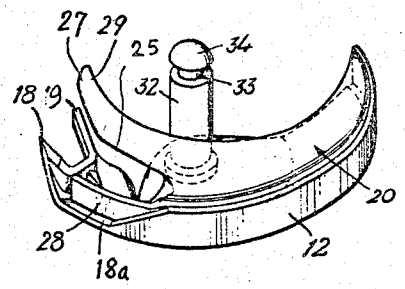
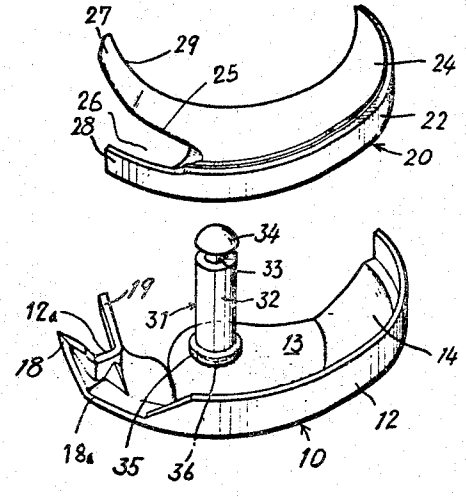


FIG. 7



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