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Publication number: **0 436 313 B1**

EUROPEAN PATENT SPECIFICATION

- ④⑨ Date of publication of patent specification: **25.10.95** ⑤① Int. Cl.⁶: **D04B 9/06**
②① Application number: **90313333.8**
②② Date of filing: **07.12.90**

⑤④ **Circular knitting machine.**

③① Priority: **11.12.89 JP 322257/89**

④③ Date of publication of application:
10.07.91 Bulletin 91/28

④⑤ Publication of the grant of the patent:
25.10.95 Bulletin 95/43

⑧④ Designated Contracting States:
DE ES GB IT

⑤⑥ References cited:
EP-A- 0 219 028 EP-A- 0 413 608
DE-A- 1 944 454 FR-A- 682 725
FR-A- 2 306 296 GB-A- 1 256 196

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EP 0 436 313 B1

Description

This invention relates to circular knitting machines and in particular to a double knit circular knitting machine having a dial which can be lifted a sufficient distance for facilitating removal and replacement of the needle cylinder and needle dial.

It is generally known to construct a double knit circular knitting machine in such a manner to facilitate replacement of the needle cylinder and sinker dial. This known type of knitting machine includes a circular dial supported adjacent an opening in the upper end of the needle cylinder and a rotatable support shaft supported at its upper end on a frame support member and extending downwardly to a position adjacent the circular opening in the upper end of the needle cylinder. A vertically extending support sleeve surrounds the support shaft and is supported at the upper end on the frame support member for vertical movement. The lower end of the support sleeve is fixed to the dial for supporting same. A dial control is provided for lifting and lowering the support sleeve along the support shaft to lift the dial and its associated dial cam holder. Such knitting machines are described in patent specifications EP-A-0 413 608 and GB 1256196 in which a circular needle dial has a downwardly facing support shaft engaging face and an upwardly facing dial cam holder engaging surface. The needle dial is urged downwardly onto a flange projecting from a lower region of the support shaft. (EP-A-0 413 608 has a priority date of 18 August 1989 and was published on 20 February 1991). In the case of the knitting machine in EP-A-0 413 608 the dial can be lifted a sufficient distance to permit removal and replacement of the needle cylinder.

It has been found desirable to mount the dial so that the needle cylinder can be more easily removed through the formed space above the needle cylinder. Additionally, after removal and replacement of component parts, the dial must be set to exact specifications. Thus, it is desirable to form the dial so that it may not only be more easily removed, but also readily inserted and positioned in an exact and properly adjusted position.

It is therefore an object of this invention to provide a circular knitting machine which is constructed to facilitate more ready replacement of the needle cylinder and wherein the needle dial can be replaced and reset more exactly than heretofore accomplished.

Thus, according to the present invention there is provided a knitting machine comprising a frame, a needle cylinder, releasably mounted upon said frame for rotative movement relative to said frame during operation of said machine, a generally vertical support shaft carried by said frame, a needle

dial releasably secured to said support shaft, a support sleeve encircling said support shaft, a dial cam holder carried by said support sleeve, control means for lifting and lowering said support sleeve whereby said dial cam holder and said needle dial are vertically moved so as to provide vertical clearance between said needle dial and said needle cylinder, characterised in that said support shaft has a circular stepped portion at its lower end, said needle dial has an opening closely receiving said stepped portion of said support shaft and a support shaft engaging upper surface and an upper dial cam holder engaging surface that are flush with each other, and said vertical clearance is sufficient to permit lateral movement of said needle cylinder into and from said knitting machine.

The knitting machine includes a frame and a bed plate fixed on the frame. A needle cylinder is supported for rotation on the bed plate and includes needles supported for vertical movement therewithin. The needle cylinder has a circular opening at the upper end. A frame support member extends in spaced relationship above the upper end of the needle cylinder. A vertically extending rotatable support shaft is supported at the upper end on the frame support member and extends downward to a position adjacent the opening in the upper end of the needle cylinder. The shaft has a diametral stepped lower end portion.

The needle dial is supported adjacent the opening in the upper end of the needle cylinder. The dial has a shaft engaging upper surface and an upper dial cam holder engaging surface lying substantially flush with each other. The needle dial opening is dimensioned substantially equal to the stepped portion on the support shaft for receiving the stepped portion of the shaft therethrough to aid in positioning same thereat.

Vertically extending support sleeve means surrounds the support shaft and is supported at the upper end on the frame support member for vertical movement. The lower end of the support sleeve is fixed to the dial cam holder for supporting same. Dial control means lifts and lowers the support sleeve means to thereby lift and lower the dial cam holder fixed to the support sleeve. Dial control means is operable to lift the dial a sufficient distance to permit removal and replacement of the needle cylinder.

Sliding removal of the needle dial is facilitated because the shaft engaging upper surface and upper dial cam holder engaging surface lie substantially in the same plane, i.e. flush with each other. Additionally, resetting of the needle dial is facilitated because the needle dial aperture is dimensioned substantially equal to the stepped portion of the shaft to aid in positioning the needle dial thereat.

In order that the present invention may be more readily understood, reference will now be made to the accompanying drawings, in which:-

Figure 1 is a front, somewhat schematic vertical sectional view of the upper portion of a knitting machine in accordance with the present invention;

Figure 2 is an enlarged sectional view of component members of the needle cylinder and needle dial;

Figure 3 is an enlarged somewhat schematic sectional view of the pneumatic air control means which detachably secures to the support shaft; and

Figure 4 is a horizontal sectional view taken along the line 4-4 in Figure 1 and showing the direction of removal of the needle cylinder and dial laterally therefrom.

Referring now to the drawings, and more particularly to Figure 1, there is illustrated a double knit circular knitting machine in accordance with a preferred embodiment of the present invention. A bed plate 1 is supported on the upper ends of preferably three equally spaced support legs 2 and 3 only two of which are illustrated. A knitting unit, broadly indicated at 12, is affixed on the bed plate 1 and operates to knit tubular fabric which typically is wound flattened onto a roll or other take-up apparatus (not shown) positioned below the knitting unit 12.

A first large, annular driven gear 4 is rotatably held in the bed plate 1. The needle cylinder 6 is positioned on the upper side of the driven gear 4 and rests on a replaceable intermediate rest 5 positioned between the driven gear 4 and bed plate 1. The provision of the intermediate rest 5 between the driven gear 4 and the bed plate 1 facilitates replacement of the needle cylinder 6. In more conventional knitting machines, several component parts, including the first large driven gear and an intermediate gear are replaced when the needle cylinder 6 is changed. In the structure of the present invention, the needle cylinder 6 and intermediate rest 5 only have to be changed when changing the needle cylinder 6 for a cylinder of different diameter. In the present invention the large driven gear 4 meshes with a driving gear 8 secured on the knitting machine drive shaft 7. A power source (not shown) conventionally positioned in the knitting machine, provides the necessary force for rotating the drive shaft 7. A second driven gear 10 is positioned at the top of the drive shaft 7 and meshes with a second large annular gear 9. The drive shaft 7 is covered with a cylindrical protective member 11 for protection of the shaft against contaminants and other harmful effects.

As illustrated, the knitting unit 12 includes a cylinder needle area 13, dial needle area 14, and

the usual yarn carriers (not shown). The cylinder needle area 13 includes a plurality of needle grooves formed in the outer periphery of the needle cylinder 6 and includes a circular opening at the upper end thereof. Cylinder needles (not shown) are mounted for vertical sliding movement along the formed grooves. Needle activating cams are mounted on the inner surface of a cam holder 15 for controlling movement of the needle cylinder 6 during knitting. The cam holder 15 is supported on the upper part of a circular cam ring 16 which is fixed to the bed plate 1.

The dial needle area 14 includes dial element means including a dial 17 having dial grooves therein. Dial needles (not shown) are mounted in the dial grooves for radially sliding along the formed dial grooves. Dial needle activating cams are supported on the lower surface of a dial cam holder 18 and control movement of the dial needles. The needle cylinder 6 and dial 17 are rotated at the same speed. As illustrated in figure 2, the dial 17 is fixed to the planar underside surface of a diametrically enlarged, portion 20a of a hollow support shaft 20 by bolts 21. The dial 17 includes a shaft engaging upper surface 17a which engages the lower end of the stepped portion 20b on the lower end of the support shaft 20 and a dial cam holder engaging surface 17b. The surface 17a of the needle dial 17 which engages the lower portion of the support shaft 20 is constructed flush with the upper dial cam holder engaging surface 17b defining the upper surface. Precise positioning of the needle dial 17 occurs when the dial 17 is fixed to the support shaft 20. The needle dial aperture is approximately equal to that of the diametrically small stepped portion of the support shaft 20. The size of the small stepped portion 20b of the support shaft 20 is about 10 mm regardless of nominal size.

As illustrated in Figure 1, the support shaft 20 is rotatably supported by upper and lower bearing assemblies 22 and 23 which are held on upper and lower portions of vertically extending support sleeve means in the form of a cylinder support sleeve member 19b which surrounds the support shaft 20. The second large gear 9 is fixed at the upper end of the support shaft 20 by a lock nut 25 having a key 24 extending therethrough. The upper end of the support sleeve 19b member is supported for vertical movement relative to the frame support member 27. The lower end of the support sleeve member 19a is fixed to the dial cam holder 18.

As illustrated, the support sleeve member 19b is vertically slidable in an outer cylinder 27a extending downwardly from a frame support member 27. The frame support member 27 is diametrically enlarged at an upper portion and is fixed to an

outer cylinder support frame 28. The outer cylinder support frame 28 is held by three supports 31, 32 and 33 engaging the bed plate 1, only two of which are shown in Figure 1.

Dial control means 29, 26 with a retainer 26a for preventing vertical movement is provided for lifting and lowering the support sleeve member 19b. Such movement lifts and lowers the dial 17 fixed to the support shaft 20 and the dial cam holder 18 fixed to the support sleeve member 19b, so as to lift the dial 17 a sufficient distance to permit removal and replacement of the needle cylinder 6. The dial control means includes a driving gear 29 which meshes with a gear 26 and a vertical shaft 30 supported by the frame support member 27. The gear 26 is supported on the upper end of the support sleeve member 19b and operates to raise and lower the support sleeve member.

Power air introducing means indicated generally as 35 (Figure 3) is provided for introducing air into the support shaft 20. As illustrated, the support shaft 20 is hollow and includes a hollow formed portion 20c (Figure 2) in which air can be forced therethrough. As illustrated in greater detail in figure 3, the power air introducing means 35 comprises a stationary vertical shaft 36, an upper housing 37 for containing electrical terminals, a bearing assembly 38 positioned at an air introducing-end port, and a lower bearing housing 39 having an air introducing-out port. The shaft 36 is supported at its upper end by the bearing assembly 38. The bearing assembly 38 is fixed to a cover 34. The lower bearing housing 39 includes a bearing 40. The upper housing 37 contains an electrical terminal member 42 which is biased by a spring 41. The electrical terminal member 42 communicates with the top of the stationary vertical shaft 36. As shown in figure 1, a lamp 43 and transformer 44 are positioned in the lower portion of the stationary vertical shaft 36. The transformer 44 is fixed to the stationary vertical shaft 36. As the drive shaft 20 rotates, the bearing housing 39 rotates around the stationary vertical shaft 36. Catching number 45, (Figure 3) prevents the vertical shaft 36 from rotating.

When the gauge or nominal size of the knitting machine is to be changed, the needle dial 17 is raised upward for allowing clearance to remove the needle cylinder. This is accomplished by turning the vertical shaft 30 by means of a tool, such as a hexagonal wrench. As the vertical shaft 30 is turned, it rotatively drives the cylinder gear 26 meshing with the driving gear 29. As the gears turn, needle dial 17 is moved upward about 10 mm and a space is provided above the needle cylinder 6.

The bolts 21 retaining the needle dial 17 to the support shaft 20 then are removed, and the needle

dial 17 and needle cylinder 6 are removed as one unit (Figure 4). Additionally, the air introduction assembly 35 is removed beforehand by loosening the nut 46 at the air introducing-out port and removing the assembly downward (Figure 3).

The present invention offers several benefits over other prior art apparatus. Not only is the needle cylinder 6 and needle dial 17 removed without the need of using chain block, but the needle dial 17 can be reset with little difficulty. Because both the shaft engaging upper surface 17a and upper dial cam holder engaging surface 17b are substantially flush with each other, removal of the needle cylinder 6 is facilitated. Additionally, the needle dial 17 is positioned readily without difficulty during reassembly because the needle dial orifice is dimensioned substantially equal to the stepped portion of the support shaft 20 for receiving the stepped portion of the shaft 20 there-through to aid in positioning the needle dial 17.

Claims

1. A knitting machine comprising:
 - a frame (1, 27, 28),
 - a needle cylinder (6), releasably mounted upon said frame for rotative movement relative to said frame during operation of said machine,
 - a generally vertical support shaft (20) carried by said frame,
 - a needle dial (17) releasably secured to said support shaft (20),
 - a support sleeve (19b) encircling said support shaft (20),
 - a dial cam holder (18) carried by said support sleeve (19b),
 - control means (26, 29) for lifting and lowering said support sleeve (19b) whereby said dial cam holder (18) and said needle dial (17) are vertically moved so as to provide vertical clearance between said needle dial (17) and said needle cylinder (6),
 - characterised in that:
 - said support shaft (20) has a circular stepped portion (20b) at its lower end,
 - said needle dial (17) has an opening (17c) closely receiving said stepped portion (20b) of said support shaft (20) and a support shaft engaging upper surface (17a) and an upper dial cam holder engaging surface (17b) that are flush with each other, and
 - said vertical clearance is sufficient to permit lateral movement of said needle cylinder (6) into and from said knitting machine.
2. A knitting machine as in claim 1, wherein said control means (26, 29) for moving said support sleeve (19b) includes a gear (26) encircling

said support sleeve (19b), which is rotatable to raise or lower said support sleeve (19b).

3. A knitting machine as in claim 2, wherein said control means (26, 29) includes a driving gear (29) meshing with said first-mentioned gear (26) and at desired times imparting rotation to said first gear (26). 5
4. A knitting machine as in claim 3, further including a retainer (26a) for preventing vertical movement of said first-mentioned gear (26). 10
5. A knitting machine as in claim 1, wherein said releasable needle cylinder mounting includes a ring gear (4) mounted on said frame, and a rest (5) connected to and projecting inwardly from said ring gear (4) toward the center thereof. 15
6. A knitting machine as in claim 5, wherein said needle cylinder (6) is supported by and extends upwardly from said rest (5). 20
7. A knitting machine as in claim 1, further including air conducting means (36) for conducting lint-removing compressed air downwardly through and from said support shaft. 25

Patentansprüche

1. Rundstrickmaschine mit
 - einem Rahmen (1, 27, 28),
 - einem Nadelzylinder (6), der zur Ausführung einer Drehbewegung gegenüber dem genannten Rahmen während des Betriebs der genannten Maschine lösbar an dem genannten Rahmen montiert ist, 35
 - einer von dem genannten Rahmen getragenen, im wesentlichen senkrechten Trägerwelle (20), 40
 - einer lösbar an der genannten Trägerwelle (20) befestigten Nadelscheibe (17),
 - einer die genannte Trägerwelle (20) umgebenden Trägerhülse (19b), 45
 - einem von der genannten Trägerhülse (19b) getragenen Scheibennockenhalter (18), und
 - Steuermittel (26, 29) zum Anheben und Absenken der genannten Trägerhülse (19b), 50
 - wodurch der genannte Scheibennockenhalter (18) und die genannte Nadelscheibe (17) senkrecht bewegt werden, um ein senkrechtbewegtes Spiel zwischen der genannten Nadelscheibe (17) und dem genannten Nadelzylinder (6) zu schaffen, 55
 - dadurch gekennzeichnet,
 - daß die Trägerwelle (20) an ihrem unteren

Ende einen runden abgesetzten Abschnitt (20b) aufweist,

daß die Nadelscheibe (17) eine den abgesetzten Abschnitt (20b) der genannten Trägerwelle (20) fest aufnehmende Öffnung (17c) und eine obere trägerwellenstützende Fläche (17a) und eine an oberen Scheibennockenhaltermitteln angreifende Fläche (17b) aufweist, wobei beide Flächen bündig zueinander stehen, und daß das senkrechte Spiel eine seitliche Bewegung des Nadelzylinders (6) in die Strickmaschine hinein und aus ihr heraus zuläßt.

2. Rundstrickmaschine nach Anspruch 1, in der die Steuermittel (26, 29) zum Bewegen der Trägerhülse (19b) einen die Trägerhülse (19b) umgebenden Mechanismus (26) aufweisen, der zum Anheben und Absenken der Trägerhülse (19b) drehbar ist. 20
3. Rundstrickmaschine nach Anspruch 2, in der die Steuermittel einen Antriebsmechanismus (29) umfassen, der mit dem erstgenannten Mechanismus (26) in Eingriff steht und zu den gewünschten Zeiten eine Drehbewegung auf den erstgenannten Mechanismus (26) überträgt. 25
4. Rundstrickmaschine nach Anspruch 3, die des weiteren eine Rückhaltevorrichtung (26a) zur Vermeidung einer senkrechten Bewegung des erstgenannten Mechanismus (26) einschließt. 30
5. Rundstrickmaschine nach Anspruch 1, in der der lösbare Nadelzylinderaufbau einen auf dem genannten Rahmen montierten Zahnkranz (4) und eine Auflage (5), die mit dem Zahnkranz (4) verbunden ist und von diesem nach innen zu dessen Mittelpunkt vorspringt, aufweist. 35
6. Rundstrickmaschine nach Anspruch 5, in der der Nadelzylinder (6) von dem genannten Auflager (5) gehalten wird und sich von diesem aufwärts erstreckt. 40
7. Rundstrickmaschine nach Anspruch 1, die des weiteren eine Luftleitvorrichtung (36) zum Ableiten von Druckluft für das Entfernen von Fasern durch die genannte Trägerwelle hindurch bzw. aus dieser heraus einschließt. 45

Revendications

1. Métier à tricoter comprenant :
 - une structure (1, 27, 28),
 - un cylindre à aiguilles (6), monté de manière démontable sur ladite structure pour se

- déplacer par rotation par rapport à ladite structure pendant le fonctionnement dudit métier,
un arbre de support généralement vertical (20) porté par ladite structure,
un disque à aiguilles (17) fixé de manière démontable sur ledit arbre de support (20),
un manchon de support (19b) entourant ledit arbre de support (20),
un teneur de came de disque (18) porté par ledit manchon de support (19b),
des moyens de commande (26, 29) pour monter et abaisser ledit manchon de support (19b),
ledit teneur de came de disque (18) et ledit disque d'aiguilles (17) étant déplacés verticalement de manière à fournir un jeu vertical entre ledit disque d'aiguilles (17) et ledit cylindre à aiguilles (6),
caractérisé en ce que :
ledit arbre de support (20) a une partie circulaire étagée (20b) à son extrémité inférieure,
ledit disque d'aiguilles (17) a une ouverture (17c) recevant étroitement ladite partie étagée (20b) dudit arbre de support (20) et une surface supérieure (17b) en prise avec l'arbre de support et une surface supérieure (17b) en prise avec le teneur de came de disque qui sont alignées l'une avec l'autre, et
ledit jeu vertical est suffisant pour permettre un mouvement latéral dudit cylindre à aiguilles (6) dans et hors dudit métier à tricoter.
2. Métier à tricoter selon la revendication 1, dans lequel lesdits moyens de commande (26, 29) comprennent une roue (26) entourant ledit manchon de support (19b) qui est rotative pour monter et abaisser ledit manchon de support (19b).
3. Métier à tricoter selon la revendication 2, dans lequel lesdits moyens de commande (26, 29) comprennent une roue menante (29) en prise avec ladite roue (26) mentionnée en premier et imprimant à des temps souhaités une rotation à ladite première roue (26).
4. Métier à tricoter selon la revendication 3, comprenant en outre un arrêt (26a) pour empêcher un déplacement vertical de ladite première roue mentionnée (26).
5. Métier à tricoter selon la revendication 1, dans lequel ledit assemblage démontable du cylindre à aiguilles comprend une roue annulaire (4) montée sur ladite structure, et un appui (5) connecté à et faisant saillie vers l'intérieur à partir de ladite roue annulaire (4) vers son centre.
6. Métier à tricoter selon la revendication 5, dans lequel ledit cylindre à aiguilles (6) est supporté par et s'étend vers le haut à partir dudit appui (5).
7. Métier à tricoter selon la revendication 1, comprenant en outre des moyens de conduction d'air (36) pour conduire de l'air comprimé d'enlèvement de peluches vers le bas à travers et à partir dudit arbre de support.

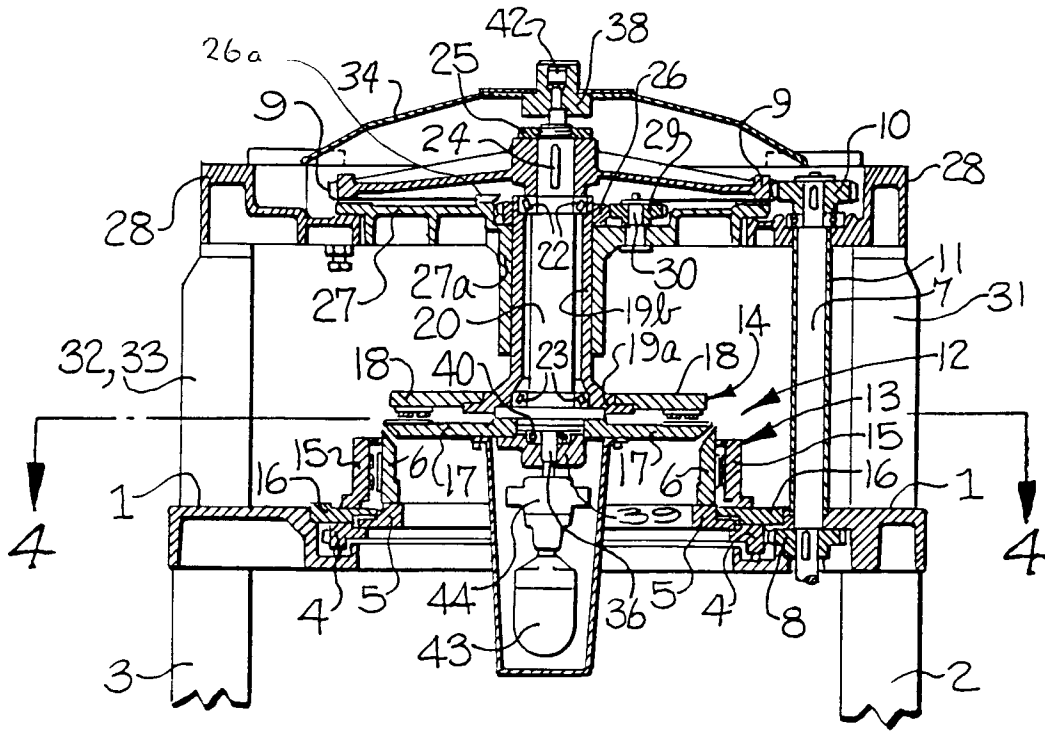


Fig-1

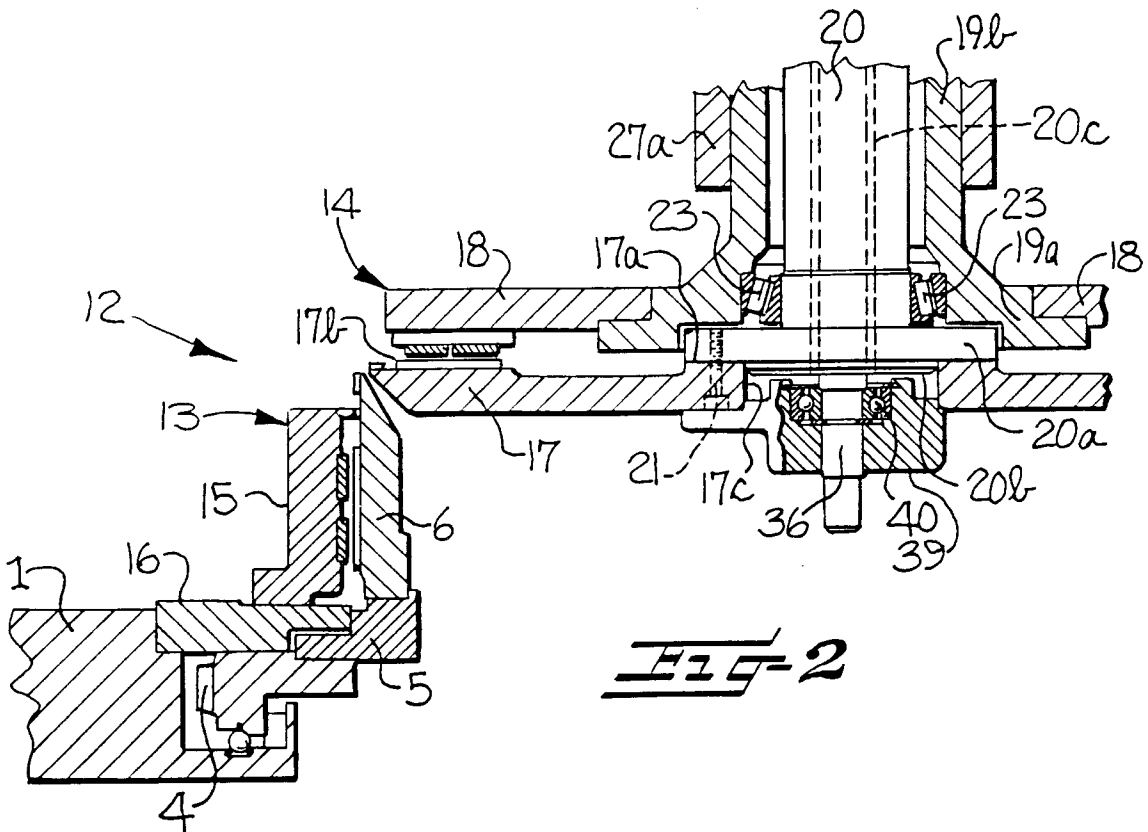


Fig-2

