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(54) IMPROVEMENTS IN OR RELATING TO CIRCULAR KNITTING
 MACHINES

(71) We, MACCHINE TESSILI CIROLARI
 MATFC S.p.A., an Italian Body Corporate,
 of 1 Via Marche, Rome, Italy, do hereby
 declare the invention, for which we pray
 5 that a patent may be granted to us, and the
 method by which it is to be performed, to
 be particularly described in and by the fol-
 lowing statement:—

10 The present invention relates to a knitting
 machine for effecting selectively, Jacquard
 knitting or links-links knitting.

15 There have been proposed circular knitting
 machines for effecting selectively, Jacquard
 or links-links knitting having two
 needle cylinders and three pattern drums,
 one of which is used for links-links knitting,
 while the other two are used for Jacquard
 20 knitting. There have also been proposed
 double cylinder machines intended only for
 links-links knitting and in this case there
 is a single pattern drum for this specific
 type of knitting. There have also been
 proposed, double cylinder machines intended
 25 only for Jacquard knitting and which
 are provided with two pattern drums.

30 According to the present invention,
 there is provided a knitting machine selectively
 operative to effect Jacquard knitting or
 links-links knitting, said machine com-
 prising two opposed needle cylinders,
 35 needles which can be transferred between
 the two cylinders, sliders for taking and
 releasing the needles on the respective
 cylinders, in the lower cylinder interme-
 diate jacks and rocking selectors having
 40 thrust selecting butts and raising and
 lowering butts, two yarn feeds, first second,
 and third raising cams, cam means oper-
 ated by a single pattern drum to act on the
 thrust selecting butts of the rocking selec-
 45 tors the first raising cam being positioned
 immediately downstream of the cam means
 to cooperate with those selectors which
 have been selected by the drum to raise
 same, a lowering cam positioned to act on
 those selectors which were raised by the
 first raising cam to lower same to a posi-
 tion where they will not be raised by the

second raising cam, first and second selec-
 tively operable setting cams located respec-
 tively upstream and downstream of said
 cam means, the first of said setting cams
 being activated for Jacquard knitting and
 the second of said setting cams being acti-
 vated for links-links knitting, the arrange-
 ment during Jacquard knitting being such
 that the needles associated with those selec-
 tors which are raised by the first raising
 cam are active at the first of said two feeds
 and these selectors are moved by the acti-
 vated first setting cam to a selection level
 for subsequent cooperation of their select-
 ing butts with the cam means during the
 next revolution, and the selectors which
 were not raised by the first raising cam
 being raised by the third raising cam such
 that their associated needles are active at
 the second feed, said machine further com-
 prising a thrust came which is only activated
 during links-links knitting, the selectors
 which were not raised by the first raising
 cam being engaged, during links-links knitt-
 ing, by the thrust cam such that these
 selectors cooperate with the second raising
 cam to be raised thereby, the second selec-
 tively operable setting cam acting to raise
 those selectors which were raised by the
 first raising cam to a position such that the
 third raising cam raised all the selectors,
 the arrangement during the links-links
 knitting being such that the needles asso-
 ciated with those selectors which are raised
 by the first raising cam remain in the same
 needle cylinder, and the needles associated
 with those selectors which are raised by
 the second raising cam are transferred to
 the other needle cylinder, the said needles
 remaining in the needle cylinder being
 rendered active at the second feed by the
 raising of all the selectors by the third rais-
 ing cam.

85 An embodiment of the invention, will
 now be considered by way of example only,
 with reference to the accompanying dia-
 grammatic drawings, in which:

90 Figure 1A is a developed view of part of

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the cam shell of the lower and upper cylinders of a double cylinder knitting machine in accordance with the invention; 5 Figure 1B schematically shows the selectors, jacks, and sliders associated with the cam shell; 10 Figure 2 is a section according to line II-II of Figure 1 and showing the radial profiles of some of the cams of the cam shell; 15 Figure 3 is a fragmentary longitudinal section in the working zone of the two cylinders of the double cylinder machine; and 20 Figures 4 and 5 illustrate in a similar manner to Figures 1A and 1B the arrangements of the several cams, to obtain Jacquard knitting and links-links knitting respectively. 25 Before describing in greater detail the structure and operation of the various cams to obtain the two modes of operation, a brief description will be made of the structure of the cam shell and the movable members co-operating therewith. Figure 1A shows in heavy lines the parts modified with respect to a conventional cam shell. 30 In the drawing, 1 and 3 indicate two groups of pattern levers or slider cams, which co-operate with a single pattern drum to obtain the two modes of operation. In contrast to conventional machines for effecting selectively, Jacquard or links-links knitting which are usually provided with two additional drums located in the position indicated by O_1 and O_3 , respectively, in Figure 1A, in the machine under consideration these additional drums 35 are omitted. The levers of the groups 1 and 3 act on small pattern butts 5₁ and 5₂ of rocking selector jacks 5 which are accommodated in the respective grooves of a lower needle cylinder C₁ (see Figure 40 3); an upper needle cylinder is indicated by C_s in Figure 3. Each selector jack 5 is pivotal about an axis intermediate its upper and lower ends and located in correspondence of a butt 5B, each selector 45 jack 5 also having a raising butt 5A at its lower end, a butt 5C at the end of the group of butts 5₁, and an upper butt 5D. When the selector jack 5 is pivoted to cause its butt 5A to project from the groove, the butt 5A co-operates with cams 7A, 9A, 50 11A and 17A, the function of which will be explained in greater detail hereinafter. In advance of the cam 17A (which is a raising cam) there is arranged a thrust cam 55 or lever 13A intended to act on the butt 5D; immediately before the cam 11A (which is also a raising cam) there is arranged a cam or lever 13B intended to act on the butt 5D. 15A and 15B indicate 60 two cams, one of which is activated for 65 Jacquard knitting and the other of which is activated for links-links knitting; in particular, as will be hereinafter described the cam 15B is rendered inoperative and the cam 15A activated for Jacquard knitting, while for links-links knitting, the cam 15A is rendered inoperative and the cam 15B activated. Immediately before the cams 13A and 17A there is provided a first feed, indicated by F1; immediately before the levers 1 and 3, and thus immediately before the cam 7A (which is a raising cam) there is provided a second feed indicated by F2. There is provided in each groove of the lower cylinder, in addition to the selector jack 5, a jack 21 above the selector jack 5 and provided with lower and upper butts 21E and 21F. Above each jack 21 is provided a slider 23 with butts 23H and 23I; each slider 23 is intended to co-operate with a corresponding double hook or beard hook needle 25, typically used in double cylinder knitting machines, the slider 23 being adapted to pass the needle 25 to a corresponding slider 27 arranged in the upper cylinder. This slider 27 has a butt 27A, as well as a butt 27M. 70 75 80 85 90 95 100 105 110 115 120 125 130 Figures 4 and 5 show the various cams under the conditions in which they are used for Jacquard knitting and links-links knitting, respectively. The cams which are fixed for both types of knitting have their periphery shown in a continuous line; the movable cams which are temporarily inoperative are shown in broken outline; the movable cams which are temporarily activated to operate on all the butts which are pertinent thereto are shown with a continuous outline and with a hatched surface, and the movable cams which are activated to operate only on the high butts, are indicated with a continuous outline and dotted surface. Certain of the cams of the cam shell will now be discussed in detail, other cams of the shell being of an already known type. Reference 30 denotes a raising cam which is intended to act on the butts 23I of the sliders 23; 32 denotes a stitch-forming cam for the first feed F1; 34 shows a raising cam for the butts 23I, immediately before the second feed F2; cams 36, 38 serve for lowering the needles and the formation of stitches at the second feed F2. Cams 40 and 42 are intended to operate on the butts 27A of the sliders 27 of the upper cylinder C_s, to form stitches with the yarn which the needles 25 engaged by the sliders 27 take up at the first feed F1 and at the second feed F2, respectively. Cams 44 and 46 are intended to be rendered inoperative or activated partly or totally to co-operate with the butts 21F of the jacks 21; the cam 44 is not present in conventional machines, and the cam 46 is movable, whereas

a cam provided in a similar position in conventional machines—is fixed. The two cams 44 and 46 are intended to co-operate with a fixed lowering cam 48 which is located before the cams 44 and 46; in turn, the cam 48 is intended to co-operate, during links-links knitting, with a cam 50 located immediately downstream of the levers 1 and 3.

10 Cams 52, 54A, 54B and 56 are intended to act on the sliders 23 and 27 during links-links knitting, the cam 52 serving to additionally raise the sliders 23 already raised by means of the jacks 21 by the action of the cam 50. The cam 56 is intended to lower all the needles 25 which have been hooked by the respective sliders 23, while the cam 54A serves to unhook or release the needles from the sliders 27 by acting on the butts 27N, and the cam 54B serves to lower all the sliders 27 towards the lower cylinder. A cam 51 next to the cams 54A, 54B serves to additionally lower the sliders 27 by acting on the butts 27M thereof so that the needles can be taken by those sliders 23 which have been raised by the cam 46.

15 To summarize the above, the machine under consideration differs from conventional machines as follows: the omission of the two additional drums at the positions O_1 , O_3 ; the addition of the movable cams 15A and 15B which are alternately activated for Jacquard knitting and for links-links knitting, respectively; the addition of the cam 50, which is movable to be activated and rendered inoperative; the cam 46 is made movable so as to be wholly or only partly activated; the addition of the cam 4 which can be rendered wholly or partly inoperative; and the addition of the cam 9A.

20 The two modes of operation will now be explained in greater detail, with particular reference to Figures 4 and 5; the description of those operations which are substantially conventional will be very brief, or even omitted, and will be apparent to persons skilled in the art.

25 With reference first to Figure 4, this figure illustrates the procedure for Jacquard knitting a stocking with a 1:1 rib construction, that is knitting alternately with a needle of the upper cylinder and a needle of the lower cylinder; the choice of the rib can be modified, for instance, with 2:2 or 4:2 or 3:1 rib construction depending upon the selection obtained by the butts 5₁ and 5₂ of the selector jacks 5 and by the groups of pattern levers 1 and 3, which in the operative positions and with an appropriate selection act on selected butts 5₁ and 5₂ of the selector jacks 5, these butts also being arranged according to the desired pattern. The selection is obtained by rocking selected ones of

the jacks 5 so that their butts 5A, project from the grooves of the cylinder. More particularly, a cam 1A acting on the butts 5C of the selector jacks 5, rocks the selector jacks so that the butts 5A project according to a selection determined by the levers 3.

20 Those selector jacks 5, which, by the action of the levers 1 and 3, have their respective butts 5A projecting from the cylinder grooves, rise up on the stationary cam 7A; those selector jacks 5, which do not have their respective butts 5A projecting from the cylinder grooves cannot be engaged by the cam 7A and thus are not raised at this stage. The butts 5A of the selector jacks 5 which have been raised by the cam 7A along a trajectory 5A1 are then lowered to a trajectory 5A2 underlying the usual selection track, by means of the stationary cam 9A. Once the lower level has been reached along the trajectory 5A2, the selector jack 5 is rocked by means of the front ramp of the stationary cam 11A acting radially on the butt 5A, so that its lower end portion moves into the cylinder groove. The butts 5D of the selector jacks 5, which have been engaged by the cams 7A, 9A, 11A after having been raised along a trajectory 5D1, travel at a non-active level 5D2 with respect to the thrust cam 13A, and the selector jacks 5 will be raised again to the active level, that is the selection level, for the next revolution of the cylinder by the raising cam 15A which acts on the butts 5B in the zone of the pivotal axis of the selector jacks 5, to bring the trajectory of the butts 5B from the level 5B2 to the level 5B3 and the butts 5A from the level 5A2 to the level 5A3.

25 The selector jacks 5 which have not been engaged by the cam 7A remain with their butts 5A within the cylinder grooves and at the level 5A3, and with their butts 5D projecting from the cylinder grooves at the level 5D3. These projecting butts 5D are engaged by the thrust cam 13A so that the selector jacks 5 are pivoted in a sense to cause their butts 5A to project outwardly from the cylinder grooves so that they can engage the stationary cam 17A and rise along trajectories 5A5 and 5D5.

30 It follows from the above description those selector jacks 5 which engage the cam 7A do not engage the cam 17A, and those selector jacks 5 which do not engage the cam 7A will engage the cam 17A. This selection may be varied, even at each revolution, by modifying the pattern drum acting on the levers 1 and 3.

35 The selector jacks 5 by being raised by the cams 7A or 17A urge the jacks 21 upwardly into contact with the sliders 23 and thus raise the sliders 23.

40 More particularly, those selector jacks 5

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which have been raised by the cam 7A raise the sliders 23—via the jacks 21—so that the butts 23I move along a trajectory 23A1, above the cam 30, and along a trajectory 5 23A2, so that they will take the corresponding needles 24 to form, by the action of the stitch-forming cam 32, a stitch at the first feed with the yarn F1. These needles 25 do not, however, operate at the 10 second feed F2, that is do not take yarn at the second feed, since the butts 23I pass according to the trajectory 23A3.

The selector jacks 5 which have been raised by the cam 17A raise the sliders 23 so that their butts 23I move along a trajectory 23A5 and are raised by the cam 34; the needles thus operate at the second feed F2 the needles being lowered by the cams 33 and 38, and they do not take yarn at the first feed, since their butts 23I move along a trajectory 23A7.

Thus, for each revolution, every needle of the lower cylinder will take yarn only at one of the two feeds.

25 The needles of the upper cylinder which have been engaged by the sliders 27, the butts 27A of which move along a trajectory 27A1, 27A2, 27A3, take yarn at both feeds F1 and F2 and form stitches under the action of the cams 40 and 42.

In the formation of a small 1:1 rib construction, it must be kept in mind that the needles of the upper cylinder—that is the needles connected to the sliders 27—must have their latches controlled by the lower cylinder; thus the sliders 23 corresponding to the needles of the upper cylinder follow a trajectory known as “a latch protection track” or “memory track”. These sliders 30

40 23, irrespective of the action of the levers 1 and 3, follow a separate trajectory determined by the butts 21F of the jacks 21. The butts 21F are in two lengths, i.e. there are longer butts 21F and shorter butts 21F.

45 The movable cams 44 and 46, which follow the cam 48 for lowering the butts 21F, are moved inwardly towards the cylinder, in such a manner as to engage only the longer of the butts 21F so that only the latter are raised by the cams 44 and 46. The longer butts 21F follow a trajectory 21F1, 21F2, 50 21F3, 21F4; thus, the upper ends of the sliders 23 corresponding to the longer butts 21F follow a trajectory 23X which is operative to control the latches of the needles of the upper cylinder. Thus it will be sufficient to arrange such a disposition of butts 21F that to each needle of the upper cylinder there will correspond a jack 21 with a 55 longer butt 21F.

60 With reference now to Figure 5, this figure illustrates the procedure for links-links knitting a stocking. With respect to the arrangement shown for the Jacquard operation, the following modifications are 65

to be noted in particular: the cam 15A is rendered inoperative and the cam 15B is activated; the cam 13B, similar to the cam 13A, is activated; the cam 44 is rendered inoperative, and the cam 46 is fully activated.

70 The pattern levers 1 and 3 in an operative position—using an appropriate selection by means of the drum—act on selected ones of the butts 5₁ and 5₂ of the selector jacks 5, these butts being arranged according to the desired pattern. Those selector jacks 5 which, under the action of the pattern levers 1 and 3 have their butts 5A projecting from the cylinder grooves rise along a trajectory 5A21 on the stationary cam 7A. The selector jacks 5 having butts 80 5A remaining within the cylinder grooves do not engage the cam 7A, and therefore are not raised at this stage.

85 The butts 5A of the selector jacks 5 which have been raised by the cam 7A along the trajectory 5A21 are lowered by the cam 9A onto a trajectory 5A22 underlying a conventional selection track 5A23. Upon reaching the trajectory 5A22, the selector jack 5—by means of the stationary cam 11A acting radially on the butt 5A—is pivoted so that its butt 5A is retracted into the cylinder groove. The butts 5D of the selector jacks 5 which have been engaged by the cams 7A, 9A travel along a trajectory 5D22 at a non-working level with the cam 13B now activated. Immediately afterwards the aforesaid selector 90 jacks will be raised by the activated cam 15B so that their butts 5A, 5B and 5D are raised to a selection level 5A23, 5B23, 5D23.

95 The butts 5D of those selector jacks 5 which have not been raised by the cam 7A, engage the cam 13B, whereby their butts are caused to project and are subsequently raised by the cam 11A.

The butts 5D of all of the selector jacks 105 5 engage the cam 13A and their butts 5A engage the raising cam 17A.

The selector jacks 5 which have been raised by the cam 7A do not effect transfer of needles to the upper cylinder. The 115 selector jacks 5 which have not engaged the cam 7A move, when raised by the cam 11A, the associated jacks 21 so that their butts 21F engage the cam 46. These jacks 21 thus move the associated sliders 23 so 120 that their butts 23I move along a trajectory 23Y whereby these sliders pass the needles 25 to the upper cylinder, the cam 51 having been activated so that the butts 27A of the sliders 27 follow a trajectory 27A21 in order to take up the needles supplied by the action of the selector jacks 5 which have been raised by the cam 11A. For the remainder, the sliders 23 are maintained on the latch protection track or memory track 125 130

23Y, corresponding to the track 23X, as explained above.

In this arrangement for links-links knitting, the butts 5A of all the selector jacks 5

5 rise up along the cam 17A (since all have been urged outwardly and all are at the level 5A23); thus all the needles remaining in the lower cylinder take yarn at the second feed F2, and form stitches under the action of the cams 36, 38.

The butts 21F of the jacks 21 which were not previously raised by the cam 46 are raised by the activated cam 50 so that all of the sliders 23 are raised into a position in which their butts 23I engage the cam 30 so that their butts 23H are raised by the cam 52 to a hooking position for taking the needles 25, which have been received by the upper cylinder, the needles 20 being released or unhooked under the action of the cam 54A and all of the sliders 27 being lowered by means of the activated cam 54B. The cam 56 by acting on the butts 23H lowers all of the sliders 23 together with the respective needles. At this point, sliders 23 in accordance with the selection by the lever 13 are raised by the jacks 21 and selector jacks 5, which have been raised by the cam 11A, whereby the butts 23I move along the trajectory 23Y so that the sliders 23 pass the needles 25 to the sliders 27 of the upper cylinder in a zone 27A21 in which the cam 51 operates while the sliders 23 which have been raised 35 to the level 23Y are lowered again, following the memory track, indicated by 23X in Figure 4.

The machine particularly described can knit patterned stockings either by links-links or Jacquard operation in two colours. The machine can be purpose-built or may be formed by modifying existing three drum machines intended for effecting selectively, Jacquard and links-links knitting. 45 Alternatively existing single drum machines—intended hitherto only for links-links knitting—may be modified to effect also Jacquard knitting or existing two-drum machines hitherto intended only for Jacquard knitting can be modified so as to permit also links-links knitting on the same machine.

WHAT WE CLAIM IS:—

55 1. A knitting machine selectively operative to effect Jacquard knitting or links-links knitting, said machine comprising two opposed needle cylinders, needles which can be transferred between the two cylinders, sliders for taking and releasing the needles on the respective cylinders, in the lower cylinder intermediate jacks and rocking selectors having thrust selecting butts and raising and lower-

ing butts, two yarn feeds, first second, and third raising cams, cam means operated by a single pattern drum to act on the thrust selecting butts of the rocking selectors, the first raising cam being positioned immediately downstream of the cam means to cooperate with those selectors which have been selected by the drum to raise same, a lowering cam positioned to act on those selectors which were raised by the first raising cam to lower same to a position where they will not be raised by the second raising cam, first and second selectively operable setting cams located respectively upstream and downstream of said cam means, the first of said setting cams being activated for Jacquard knitting and the second of said setting cams being activated for links-links knitting, the arrangement during Jacquard knitting being such that the needles associated with those selectors which are raised by the first raising cam are active at the first of said two feeds and these selectors are moved by the activated first setting cam to a selection level for subsequent cooperation of their selecting butts with the cam means during the next revolution, and the selectors which were not raised by the first raising cam being raised by the third raising cam such that their associated needles are active at the second feed, said machine further comprising a thrust cam which is only activated during links-links knitting, the selectors which were not raised by the first raising cam being engaged, during links-links knitting, by the thrust cam such that these selectors cooperate with the second raising cam to be raised thereby, the second selectively operable setting cam acting to raise those selectors which were raised by the first raising cam to a position such that the third raising cam raises all the selectors, the arrangement during links-links knitting being such that the needles associated with those selectors which are raised by the first raising cam remain in the same needle cylinder, and the needles associated with those selectors which are raised by the second raising cam are transferred to the other needle cylinder, the said needles remaining in the needle cylinder being rendered active at the second feed by the raising of all the selectors by the third raising cam.

105 2. A machine as claimed in claim 1, comprising movable cam means activated during Jacquard knitting to act on butts of the intermeditae jacks to cause the jacks to act on the sliders with a selection dependent on the rib construction to be formed.

110 3. A machine as claimed in claim 2, comprising further movable cam means rendered inoperative during Jacquard knitting, and activated during links-links knit-

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ting to receive all the needles from the said other cylinder and to arange them for selection, without the intervention of the first raising cam.

5 4. A knitting machine substantially as hereinbefore described with reference to the accompanying drawings.

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Sheet 1

Fig 1B

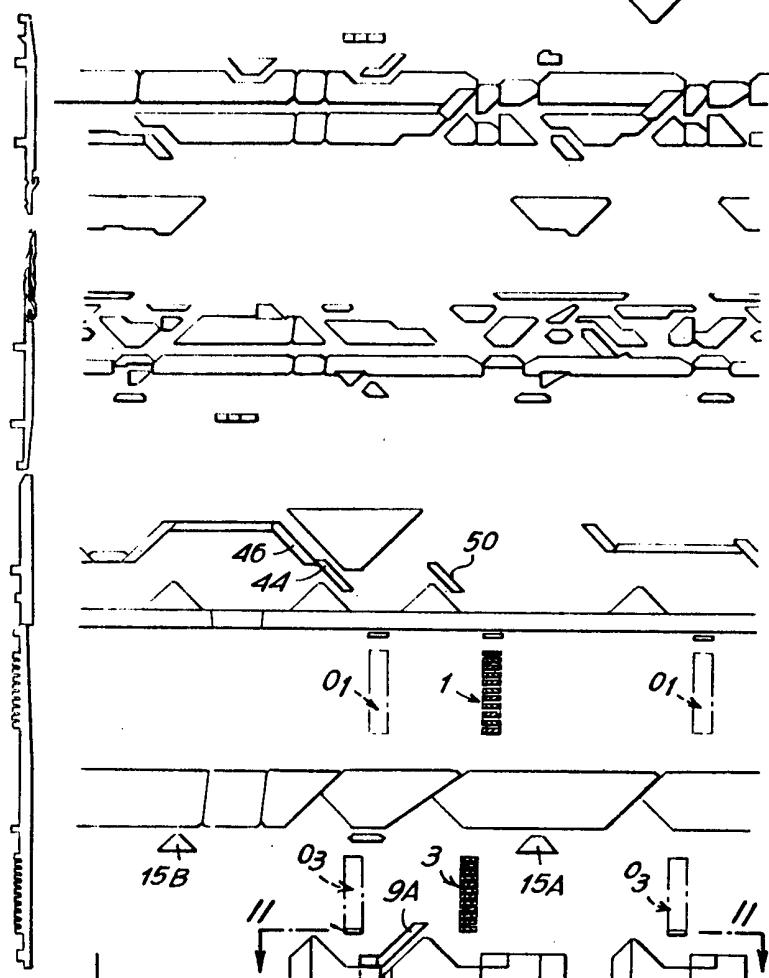
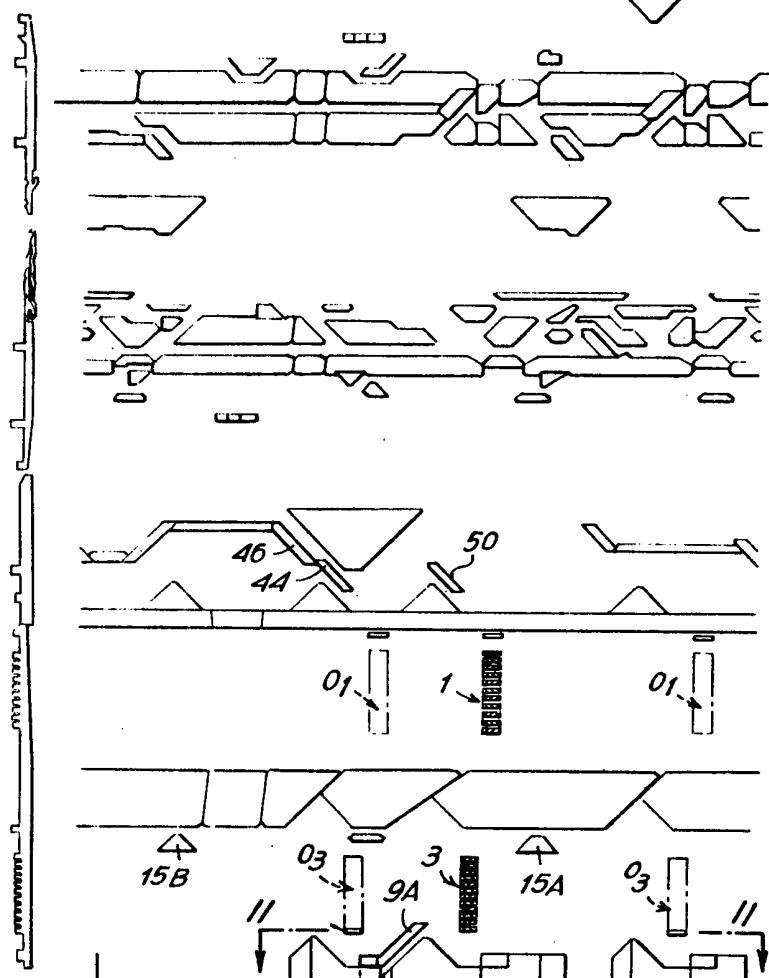


Fig.1A



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COMPLETE SPECIFICATION

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Sheet 2*

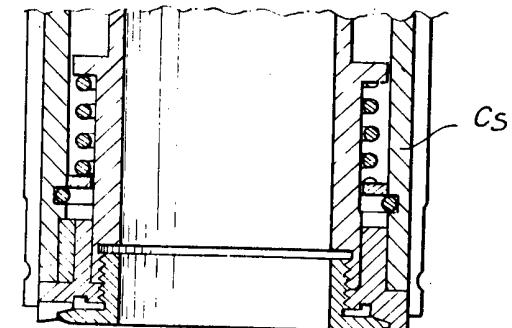


Fig. 3

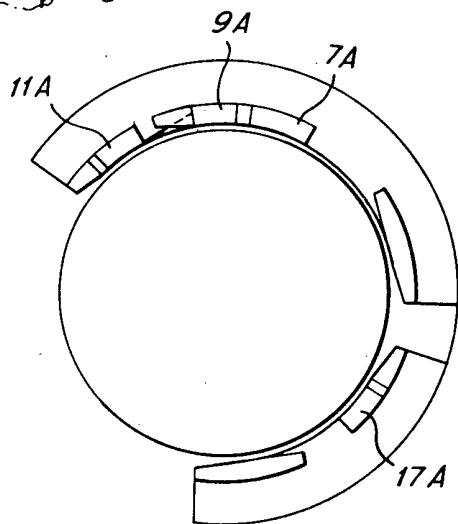
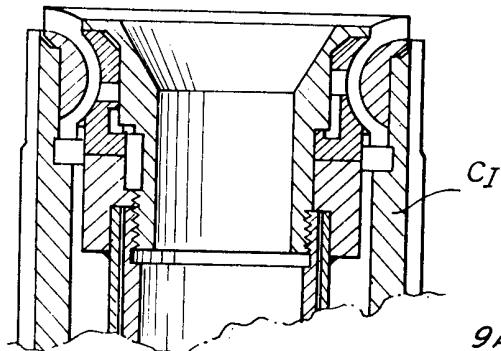


Fig. 2

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Fig. 4

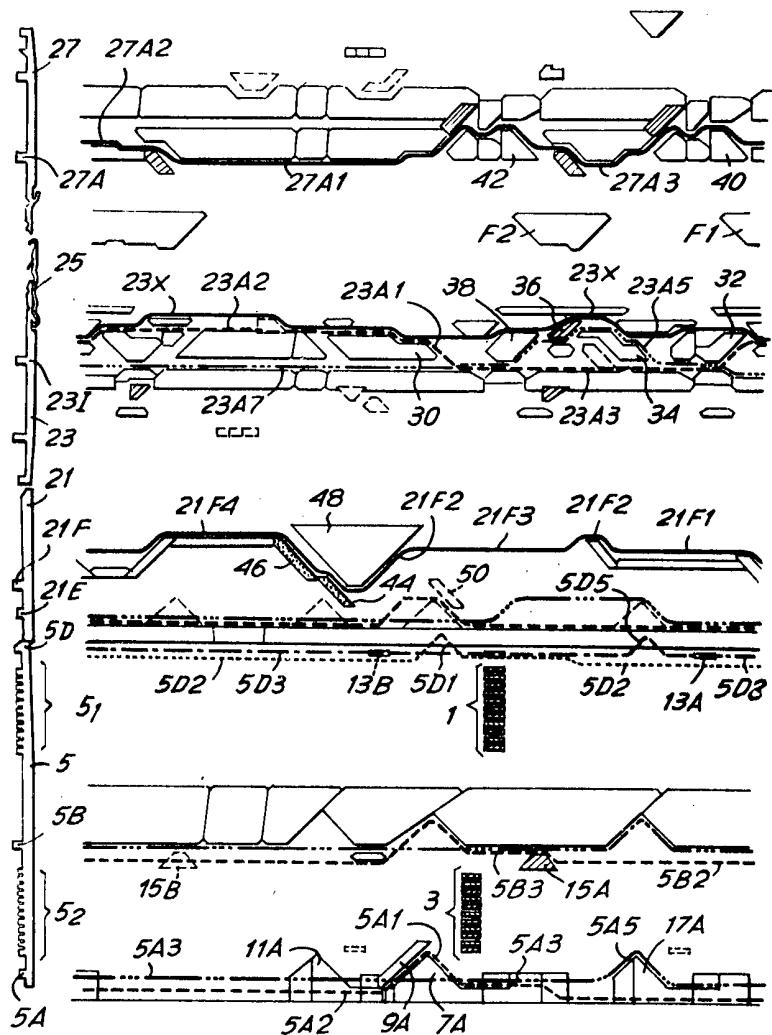


Fig. 5

