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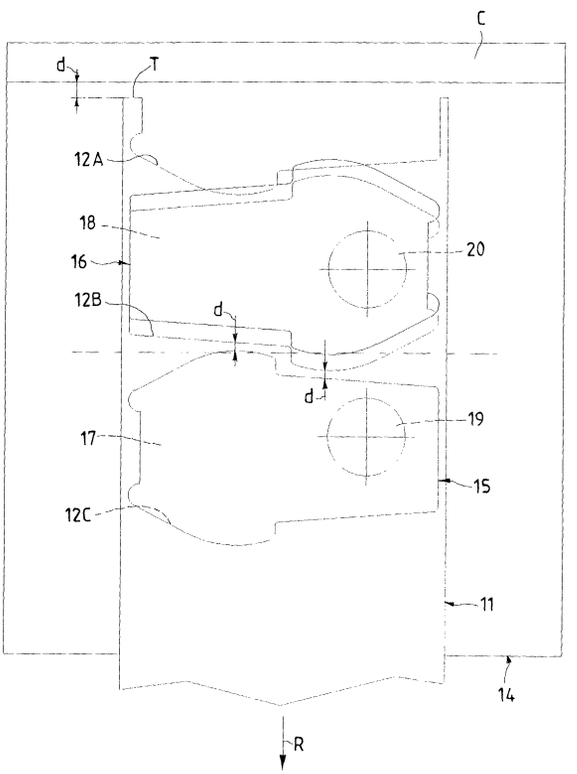
(54) Method and apparatus for die-cutting in succession a semi-finished piece or blank from a metal strip

(57) A method for die-cutting from a metal strip (11) a succession of semi-finished pieces or blanks (10) which interpenetrate with one another, where said strip (11) is fed to a workstation comprising a die (14), which includes a first punch (17)-matrix (17A) assembly (15) and a second punch (18)-matrix (18A) assembly (16), which are set opposite to one another and move with respect to one another, operating in succession and alternately on said strip (11), which is moved in step-like fashion between them. The relative movement between said strip (11) and said assemblies (15, 16) in the course of die-cutting of a number of successive blanks is such as to ensure a significant saving in terms of material employed.

Fig.11



EP 1 316 373 A1

Description

[0001] The present invention relates to a method for die-cutting in succession from a strip of metal a semi-finished piece or a blank, in particular, a plane one, for instance a blank to be used for the production of technical articles for furniture, such as the so-called "leaves" of hinges for pieces of furniture.

[0002] The peculiar characteristic of the method according to the invention is the die-cutting in succession of one blank at a time, with partial recovery of the material of the metal strip, which must necessarily be left between two successive "shapes".

[0003] In this technical sector, by the term "shape" is meant the opening or window identified in the metal strip or sheet after each die-cutting operation to form the blank.

[0004] The invention also relates to an apparatus that enables a particularly advantageous implementation of the method, as well as to the blanks and end components -for example, hinges for pieces of furniture- obtained using said method and apparatus.

[0005] Methods and apparatus for die-cutting blanks in succession from metal strip have been well known for some time and are described, for example, in the following patents: IT-1251869, EP-661118, GB-1138931, GB-1193666.

[0006] The reader is referred to the above prior patents, by way of example, should there prove necessary further clarifications on the general techniques adopted for die-cutting blanks in succession from metal strip, in which the said blanks are to undergo further operations of die-cutting and/or drawing in subsequent processing stations of the same plant.

[0007] Generally speaking, it may be said that large-scale production of pieces starting from a blanking operation carried out on a strip of metal always involves the solution of the technical problem represented by the amount of scrap material, which should be as small as possible, so as not to adversely affect the cost of the finished article.

[0008] In an attempt to achieve the above result, various solutions have already been proposed, which are all based upon the maximum use of the metal strip by seeking to obtain maximum interpenetration between the shapes.

[0009] The systems most widely adopted are the ones in which die-cutting of the blank is performed according to a drawing whereby, on the metal strip, the "shapes", identified via the die-cutting operation, penetrate into one another and in which the operation of die-cutting is performed on the strip, which moves in step-like fashion either in a straight line or following a zigzag path.

[0010] In this way, the scrap material is reduced to a minimum. However, between one blank (shape) and the next, there must always be left a minimum amount of material, which is necessary to enable carrying-out of the blanking operation. The amount of said material also depends upon the configuration of the blank that is to be die-cut.

[0011] The general purpose of the present invention is to provide a method and an apparatus for implementation thereof, whereby it will be possible to recover a large amount of the material of metal strip that is to be left between one blank and the next so as to carry out the blanking operation properly.

[0012] The particular purpose of the invention is to recover the material left between one blank (shape) and the next in the die-cutting of one blank at a time, where the shapes of the consecutive blanks penetrate into one another, being rotated by 180° with respect to one another.

[0013] The method and apparatus according to the present invention are particularly suitable for the production of relatively small series of pieces, where there exists the advantage of die-cutting one blank at a time in succession.

[0014] In fact, the die-cutting of two blanks at each stroke of the press involves the use of costly equipment downstream of the first blanking station, which is not justified by the number of pieces that have to be produced.

[0015] The purposes cited above are achieved by the method and apparatus described in the attached main claim and dependent claims.

[0016] The structural and functional characteristics of the present invention and the advantages thereof as compared to the prior art will emerge as being even more clear and evident from an examination of the ensuing description, with reference to the attached drawings, which are schematic illustrations of the operating steps of the method and an example of apparatus for implementation of said method. In the drawings:

- Figure 1 is a plan view illustrating a semi-finished piece or blank, which is to be produced employing the method and apparatus according to the invention, for example, a blank that is to form a so-called leaf of a hinge for a piece of furniture;
- Figure 2 is a plan view illustrating the prior art, where the blanks of Figure 1 are cut from the strip in succession one at a time, with the shapes (blanks) that do not penetrate into one another, and hence with a large amount of scrap material in terms of metal strip;
- Figure 3 is a plan view illustrating the prior art, where the blanks of Figure 1 are cut from the strip in succession two at a time, with the shapes (blanks) that penetrate into one another, and hence with a maximum possible use of the metal strip (minimum waste);
- Figure 4 is a plan view illustrating schematically a die suited for implementing the method according to the invention;
- Figures 5 to 11 illustrate the succession of the operating steps of the method according to the invention;

- Figure 12 is a plan view illustrating, in greater detail, the punches of the die of Figure 4, taken according to the plane of trace XII-XII of Figure 14;
- Figure 13 is a plan view illustrating the matrices of the die of Figure 4, taken according to the plane of trace XIII-XIII of Figure 14;
- Figure 14 is a cross section taken according to the plane of trace XIV-XIV of Figure 12;
- Figures 15 and 16 are two schematic views illustrating the operating and non-operating positions, i.e., the raised position and the lowered position respectively, of the punches of the die, taken according to the plane of trace XV-XV of Figure 12;
- Figure 17 is a plan view illustrating the carriage for positioning the punches in the two punch-matrix assemblies;
- Figure 18 is a cross section taken according to the plane of trace XVIII-XVIII of Figure 17;
- Figure 19 is a cross section taken according to the plane of trace XIX-XIX of Figure 17;
- Figure 20 is a perspective view of the carriage illustrated in Figures 17 to 19; and
- Figure 21 is a detail shown in perspective view illustrating the bushing with spiral for controlling the extractor of the blanks from the punch-matrix assembly.

[0017] With reference to Figure 1, number 10 designates as a whole a non-limiting example of a semi-finished piece or blank to be made using the method and apparatus of the present invention, namely a blank that is to undergo subsequent processes for forming a so-called "leaf" of a hinge for pieces of furniture.

[0018] According to the known art, as illustrated in Figure 2, a multiplicity of blanks 10 are die-cut, in succession, from a strip of metal 11 having the shapes (openings) 12 that do not interpenetrate, and hence with a considerable waste of material of the metal strip.

[0019] This means that, as emerges clearly from Figure 2, after die-cutting of each individual blank 10, a piece of scrap material will be formed made up of a multiplicity of shapes held together and separated from one another by a wide area 13 (shown hatched in the drawing), which, together with the longitudinal edge of the strip 11, represents the scrap.

[0020] In order to overcome the drawback of such a large amount of scrap material, as represented by the wide areas 13 between the successive shapes 12, a known technique is to die-cut from the strip 11 two blanks 10 at a time, but with the successive shapes 12 which interpenetrate with one another, as illustrated in Figure 3.

[0021] In this way, between the successive shapes 12, there may be identified a minimum area 13A of scrap material, which is considerably smaller than the area 13 illustrated in Figure 2, which derives from die-cutting of one blank at a time without any interpenetration of the shapes.

[0022] However, as is well known to persons skilled in the sector, the technique of cutting two blanks at a time with interpenetration of the shapes means that costly equipment must be provided downstream of the first blanking station of the plant, the expense for which is only justified by production of large quantities of pieces.

[0023] The present invention belongs in the context described above, with reference to Figures 1 to 3, the main aim of which is to provide a method and an apparatus that are economically advantageous for die-cutting one blank at a time in succession from a metal strip.

[0024] The method according to the invention is implemented using an apparatus comprising a die 14, a schematic illustration of which is provided in Figure 4 and, in greater detail, in Figures 12 to 19.

[0025] For implementation of the method according to the invention, the die 14 is structurally formed by a first punch-matrix assembly 15 and a second punch-matrix assembly 16.

[0026] The first assembly 15 comprises a punch 17 and a matrix 17A, and the second assembly 16 comprises a punch 18 and a matrix 18A.

[0027] The matrices 17A and 18A may be integral ones (i.e., made of a single piece) or else made up of a number of separate pieces.

[0028] In the example illustrated in Figures 12 to 14, the punches 17, 18 are set at the bottom , whilst the matrices 17A, 18A opposing them are set at the top, but of course such an arrangement could be inverted.

[0029] As emerges clearly from Figure 4, according to the invention, the punches 17, 18 (and the corresponding matrices 17A, 18A) are set rotated by 180° with respect to one another. The distance between the punches 17, 18 and the corresponding matrices 17A, 18A, as is known, should be such as to guarantee an adequate mechanical resistance of the die over time.

[0030] As will be explained in what follows with reference to Figures 12 to 21, the punches 17, 18 and the respective matrices 17A, 18A have a relative motion in a vertical direction for die-cutting of the strip 11 and operate alternately in succession, i.e., when the first punch-matrix assembly 15, 17, 17A is operating, the second punch-matrix assembly 16, 18, 18A is not operating, and vice versa.

[0031] The aforesaid operative and non-operative positions of the assemblies 15, 16 are obtained, respectively, by raising and lowering the punches 17, 18.

[0032] In the raised position, the punches 17, 18 act alternately on the strip 11, blanking it, whilst, in the lowered position, they do not act on the strip 11, and do not interfere with it.

[0033] With reference to Figures 5-11, the blanking method according to the invention comprises the operating steps described in what follows.

[0034] The strip 11 is fed, in the direction indicated by the arrow F, between the assemblies 15, 16, with the head T in a position such as to comprise the entire shape

of the first punch-matrix assembly 15, 17, 17A. With the strip 11 in this position, the punch 17 is raised in the operative position, whilst the punch 18 is lowered in the non-operative position, as illustrated in Figures 15 and 16, respectively.

[0035] In this way, the actuation of the first matrix 17A (by means of the ram of a press, represented schematically and indicated as a whole by M in Figures 15 and 16) die-cuts from the strip a first blank S1, which is shown hatched in Figure 5.

[0036] The blank S1 thus cut, is then raised from the punch 17 using a first extractor 19 (see Figures 6, 14), rotated through 90°, and, using a transfer of a known type, designated as a whole by F1, brought into the position illustrated in Figure 7 (outside of the die) to be sent on for subsequent processing operations in the workstations of the plant set downstream of the first station, which comprises the die 14.

[0037] As may be seen clearly from Figure 7 of the drawings, the die-cutting of the blank S1 has left in the strip 11 a shape 12A.

[0038] At the same time, corresponding with the translation of the first blank S1 into the position illustrated in Figure 7, there occurs descent of the extractor 19 and of the punch 17, as well as the ascent of the punch 18.

[0039] The strip 11 is now fed by one step into the position illustrated in Figure 8, so as to enable cutting of a second blank S2 with the maximum interpenetration in the shape 12A, i.e., with as small a distance "d" as possible.

[0040] Actuation of the second matrix 18A die-cuts from the strip 11 a second blank S2, which is shown hatched in Figure 8, whilst, by means of shears, represented schematically designated as a whole by C, there is sheared off the scrap material designated by 21 in Figure 9.

[0041] The blank S2 thus cut, is then raised from the punch 18 using a second extractor 20 (see Figure 9), rotated through 90°, and, using the transfer F1, brought into the position illustrated in Figure 10 to be sent on for the subsequent processing operations as for the blank S1.

[0042] As may be seen clearly from Figures 9 and 10, the die-cutting of the blank S2 has left in the strip a shape 12B, which is identical to the shape 12A.

[0043] At the same time, corresponding to this operation of displacement of the second blank S2 into the position illustrated in Figure 10, there occurs the descent of the extractor 20 and of the punch 18, as well as the ascent of the punch 17.

[0044] Now, according to the present invention, the strip 11 is moved back by one adjustment step (in the direction indicated by the arrow R) into the position illustrated in Figure 11, so as to enable interpenetration, as much as possible, of the shape 12B within the shape of the punch 17, i.e., so as to identify the same minimum distance "d" indicated in Figure 8. A third blank can thus be cut, with the minimum waste of material possible, and so forth, according to the same modalities as those described previously with reference to Figures 5-10.

[0045] As illustrated in Figure 14, the extractors 19, 20 terminate in a magnetic head 22 and are characterized by a combined motion of rotation and translation by means of an actuator 23 and a bushing 32 with a spiral 33 engaged by a radial pin 34 (Figure 21). It thus emerges clearly how there will correspond to the translation in the directions indicated by the arrow F3 of the transfer 19 also a rotation of the said transfer through the action of the bushing 32, which is set in rotation by the combined action of the spiral 33 and of the radial pin 34.

[0046] As illustrated in Figures 14, 15 and 16, characteristically, the punches 17, 18 are moved, alternately, into their raised operative position and lowered inoperative position by means of a carriage 24, which is moved backwards and forwards in the directions indicated by the arrow F2 by means of an actuator 25.

[0047] According to the invention, the carriage 24 has a working surface that moves up and down acting on a complementary surface of said punches 17, 18. More precisely, said working surface that moves up and down of the carriage 24 comprises inclined planes 26 which are separated from one another by a rectilinear stretch 27 and are convergent in a top or crest resting surface 28 for resting of the punches 17,18, which, at the bottom, are shaped in a complementary way, as clearly illustrated in the drawings.

[0048] The translation of the carriage 24 is guided by means of lateral guides 29.

[0049] The assemblies 15, 16 are comprised between a base 30 and a crown 31 of the die 14.

[0050] The same result described above with reference to the drawings could be obtained by feeding the strip 11 by a feed step that is always constant, and recovery of material could also be obtained by the to-and-fro movement of the assemblies 15, 16 made up of punch and matrix (17, 17A; 18, 18A) with respect to the stationary carriage 24.

[0051] Basically, the movements between the strip 11, the assemblies 15, 16 and the carriage 24, described with reference to the present invention, are to be considered as relative movements.

[0052] It is to be noted that moving of the blanks S1, S2 outside the die 14 is obtained by means of raising and rotating said blanks S1, S2 in the context of the same operation of die-cutting and of the same processing station which comprises said die 14, so that the rotated piece can be moved directly to a subsequent processing station without any dead spaces and/or long distances between one station and another.

[0053] In addition to the considerable recovery of material referred to above, the advantages of the invention can be summarized in the elimination of idle steps of the strip 11, in the execution of shorter steps of the said strip 11, in a processing station, and hence a machine, that is more compact, in a higher rate of production, and con-

sequently in a lower cost of the plant.

Claims

1. A method for die-cutting from a metal strip (11) a succession of semi-finished pieces or blanks (10) which interpenetrate with one another, where said strip (11) is fed to a workstation comprising a die (14), which includes a first punch (17)-matrix (17A) assembly (15) and a second punch (18)-matrix (18A) assembly (16), which are set opposite to one another and move with respect to one another, operating in succession and alternately on said strip (11), which is moved in step-like fashion between them, the said method comprising the steps of:

   - feeding the strip (11) between said first assembly (15), and die-cutting a first blank S1, whilst said second assembly (16) is in a non-operative position;
   - moving said first blank (S1) outside of said die (14) ;
   - displacing said first assembly (15) into a non-operative position and said second assembly (16) into an operative position;
   - feeding the strip (11) by one feed step between said second assembly (16), and die-cutting a second blank (S2), whilst the first assembly (15) is in the aforesaid non-operative position, so that in the strip (11) are identified two shapes (12A, 12B), which interpenetrate as much as possible, i.e., they are separated by a minimum distance "d" or area (13A) of the strip (11) itself;
   - moving said second blank (32) outside the die (14);
   - displacing said second assembly (16) into the aforesaid non-operative position and bringing said first assembly (15) back into the aforesaid operative position;
   - moving the strip (11) back by one adjustment step so as to position it with respect to said first assembly (15) in a position such that the shape (12C) deriving from the die-cutting of a further blank will interpenetrate as much as possible in order to achieve the same aforesaid distance "d"; and
   - die-cutting said further blank, and so forth.

2. The method according to Claim 1, **characterized in that** the moving of the blanks (S1, S2) outside the die (14) is obtained by raising and rotation of said blanks (S1, S2) in the context of the same blanking operation and of the same processing station comprising said die (14), so that the rotated piece can be moved directly on to a subsequent processing station.

3. An apparatus for implementing the method according to Claim 1, **characterized in that** it comprises in combination:

   - a first punch (17)-matrix (17A) assembly (15) and a second punch (18)-matrix (18A) assembly (16), set opposite to one another and mobile with respect to one another, between which there is fed said strip of metal (11); and
   - actuation means for moving said punches (17, 18) in succession and in alternation between two positions, i.e., a raised operative position and a lowered non-operative position.

4. The apparatus according to Claim 3, **characterized in that** said actuation means comprise a carriage (24), which can move to and fro and has a working surface that moves up and down acting on one complementary surface of said punches (17, 18) so that when the punch (17) is in an up operating position, the punch (18) is in a down non-operating position, and vice versa.

5. The apparatus according to Claim 4, **characterized in that** said working surface that moves up and down comprises inclined planes (26) which are separated from one another by a rectilinear stretch (27) and are convergent in a top or crest resting surface (28) for resting of the punches (17, 18).

6. The apparatus for implementing the method according to Claim 2, **characterized in that** the moving of the blanks (S1, S2) outside the die (14) is obtained by means of an extractor (19, 20) with a top magnetic head (22), moved by means of an actuator (23) via a bushing (32) with a spiral (33) engaged by a radial pin (34).

Fig.1

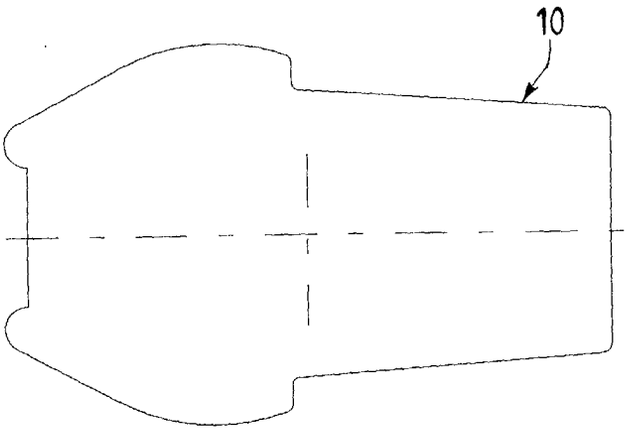


Fig.21

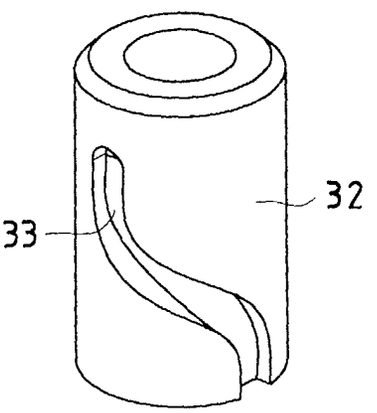


Fig.2

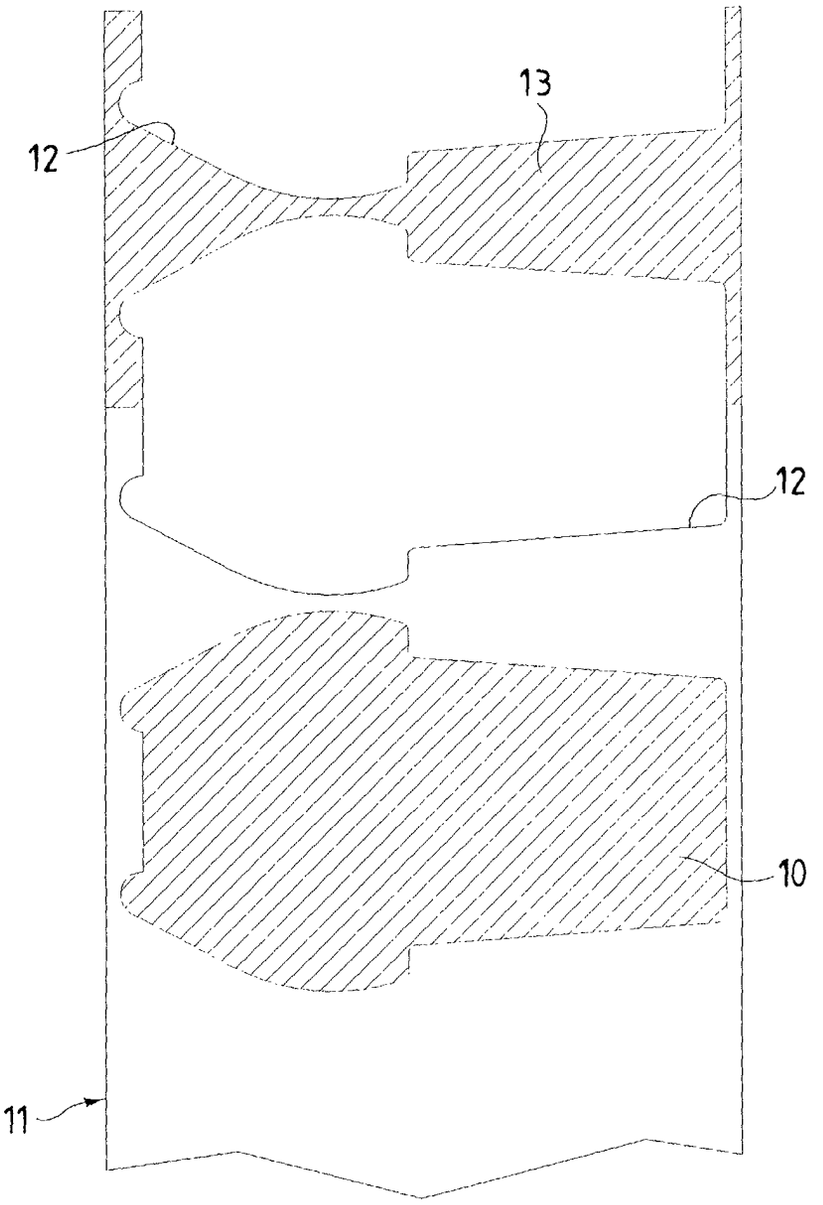


Fig.3

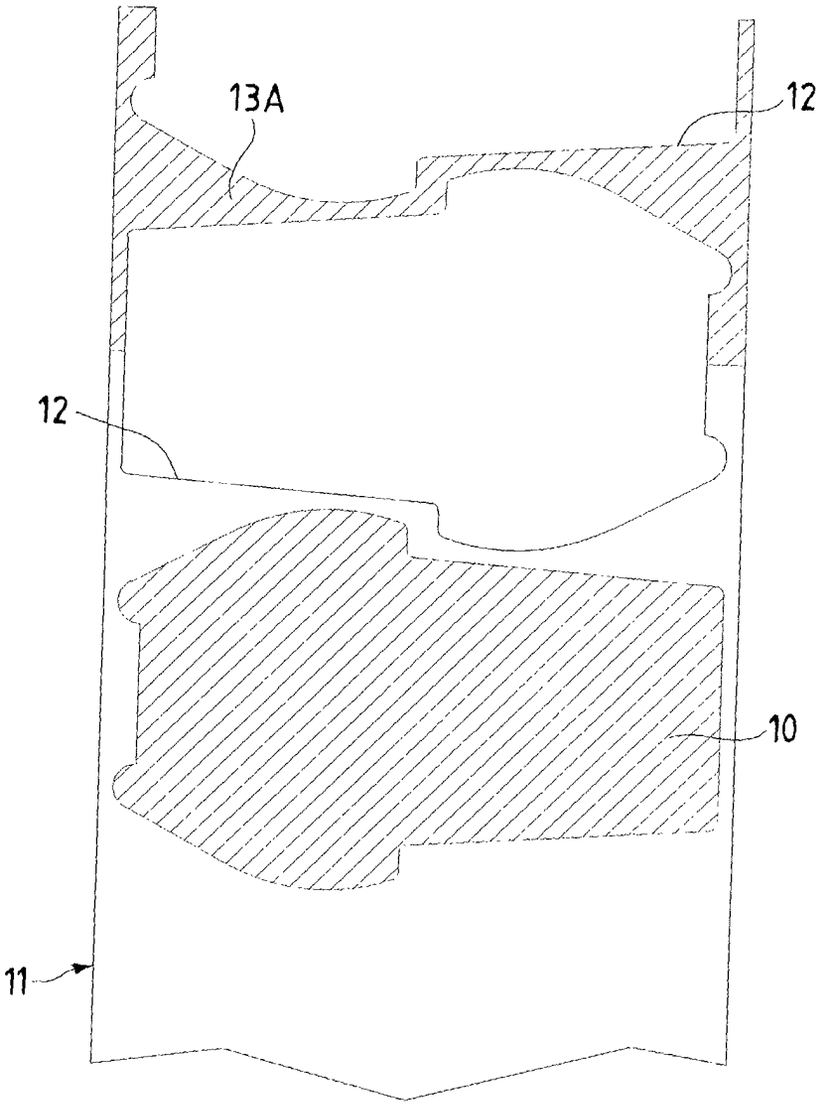


Fig.4

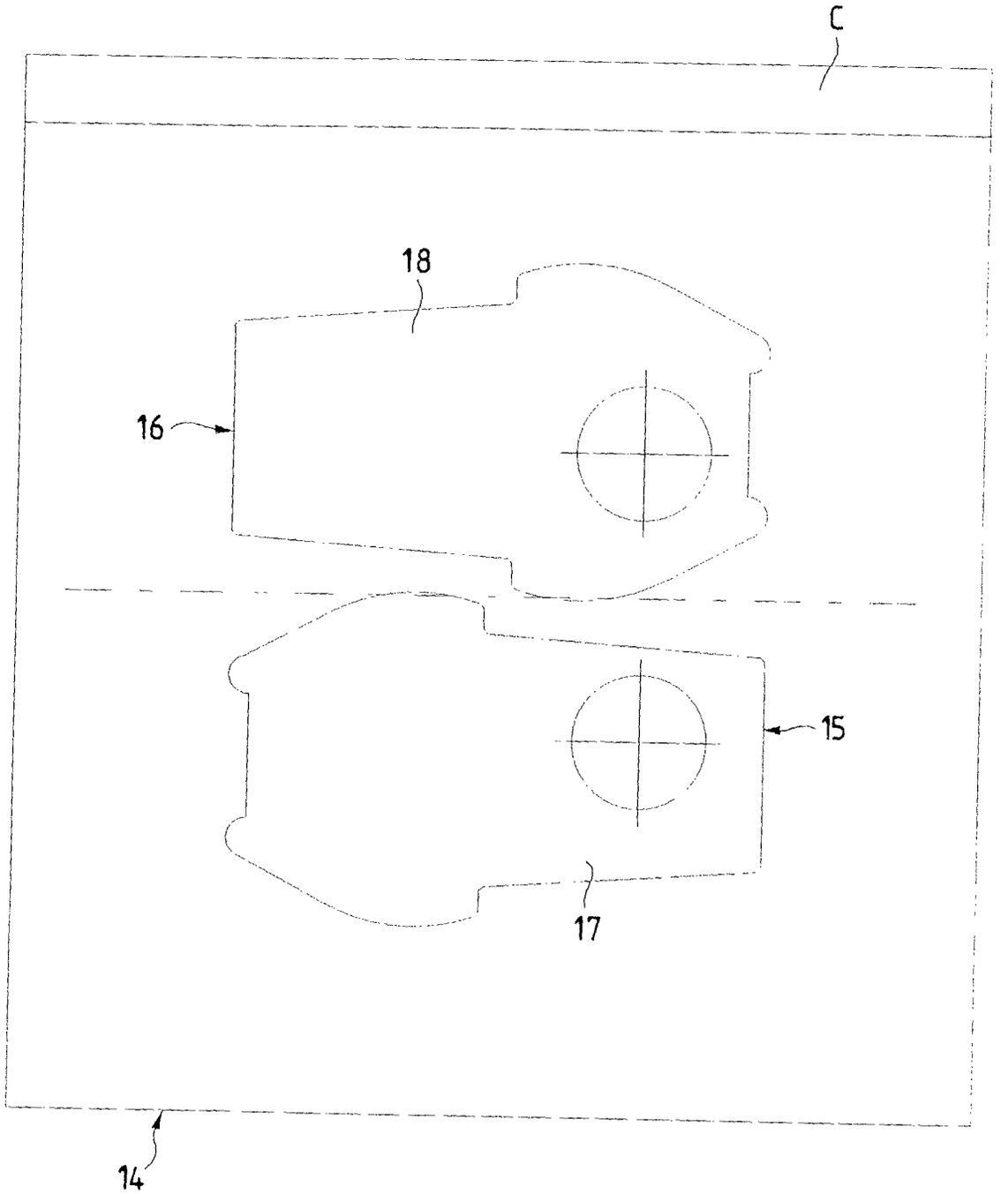


Fig.5

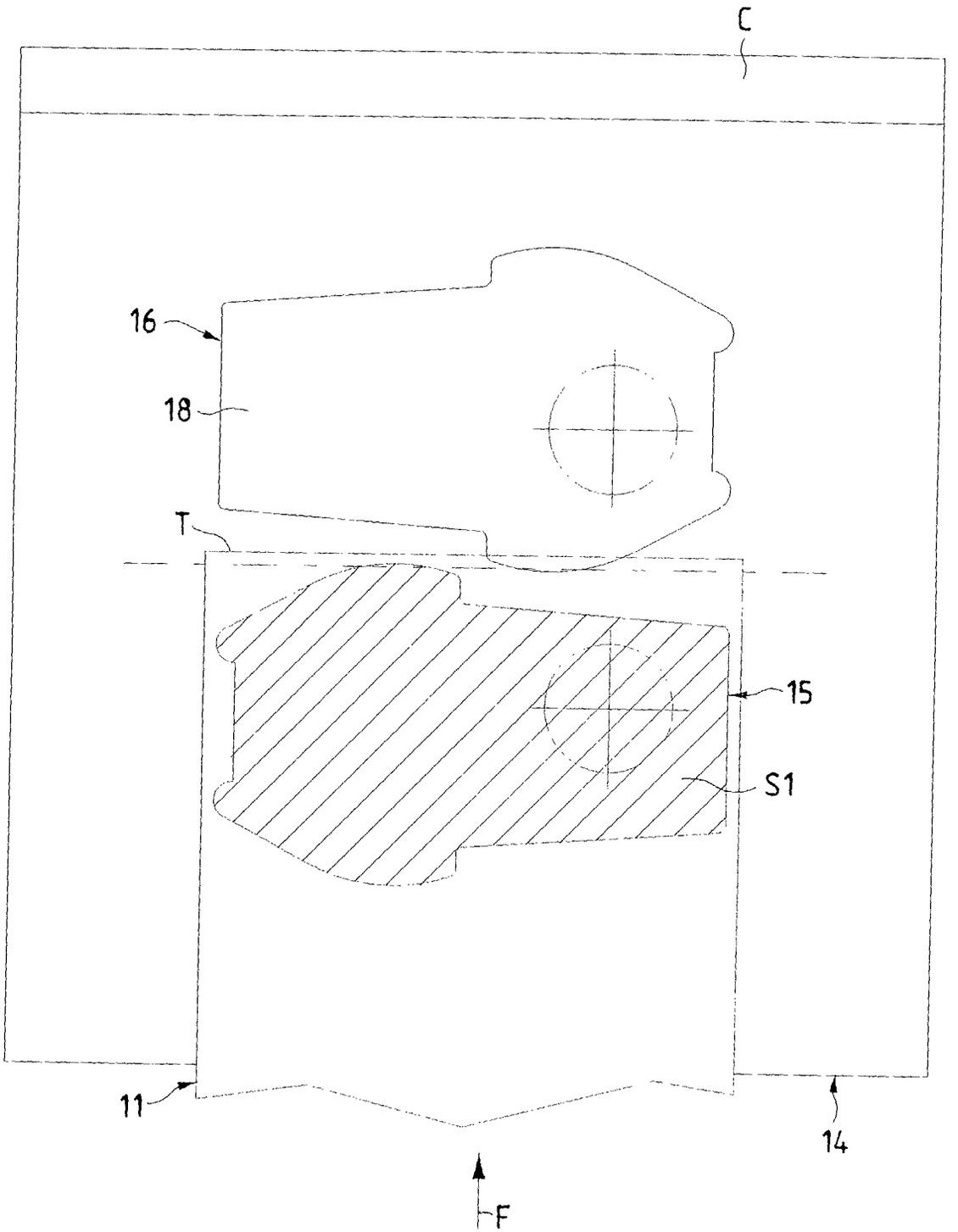


Fig.6

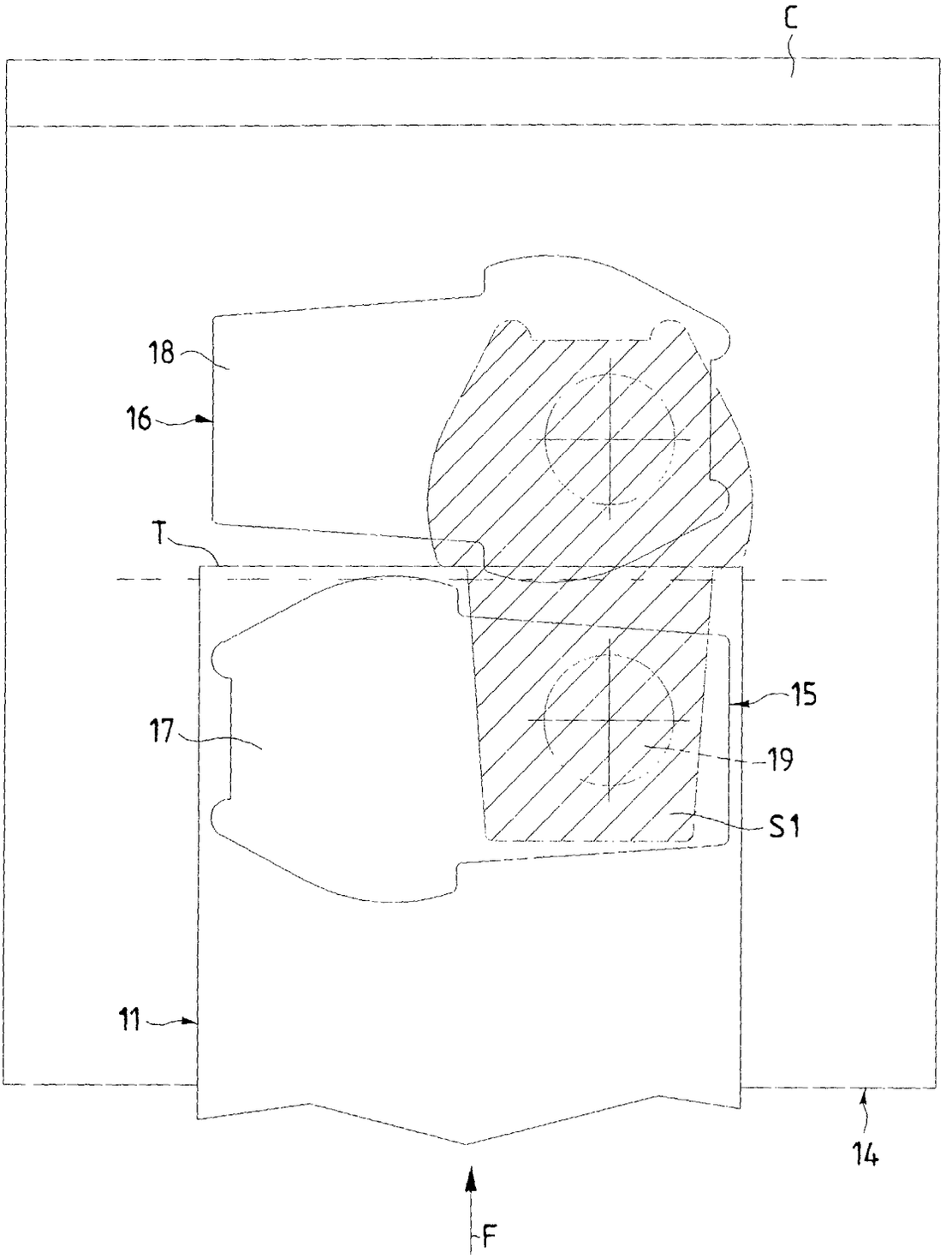


Fig.7

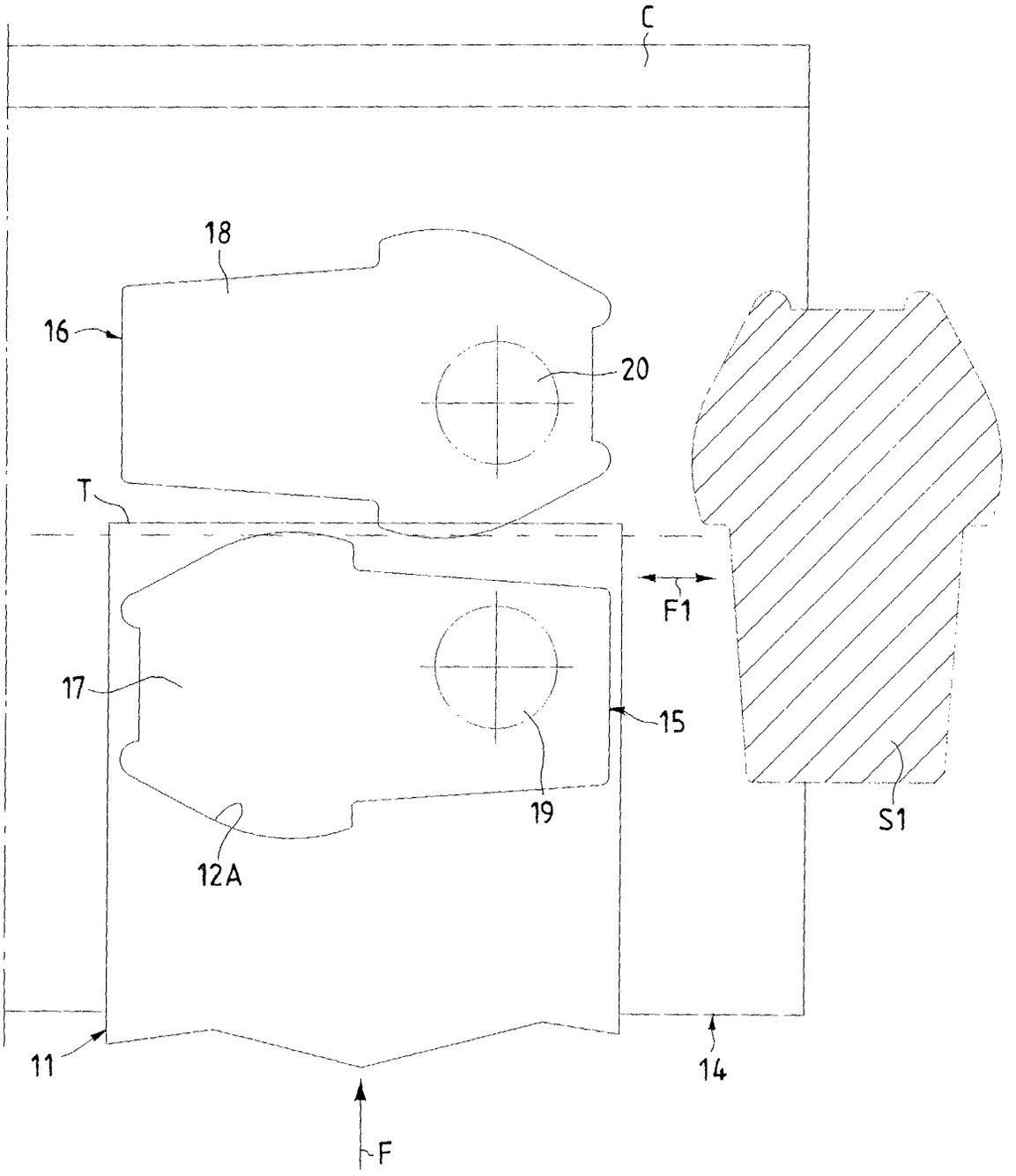


Fig.8

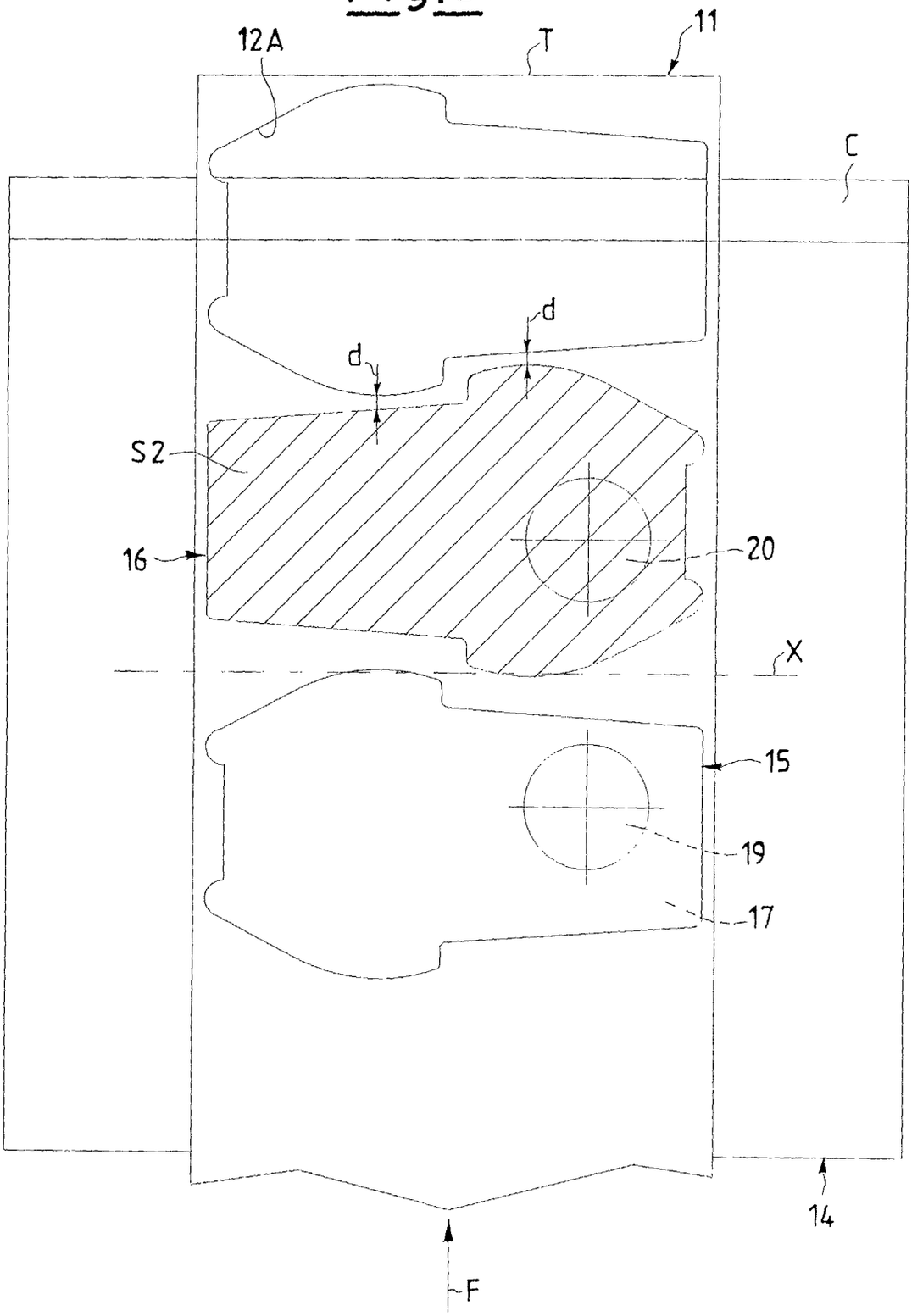


Fig.9

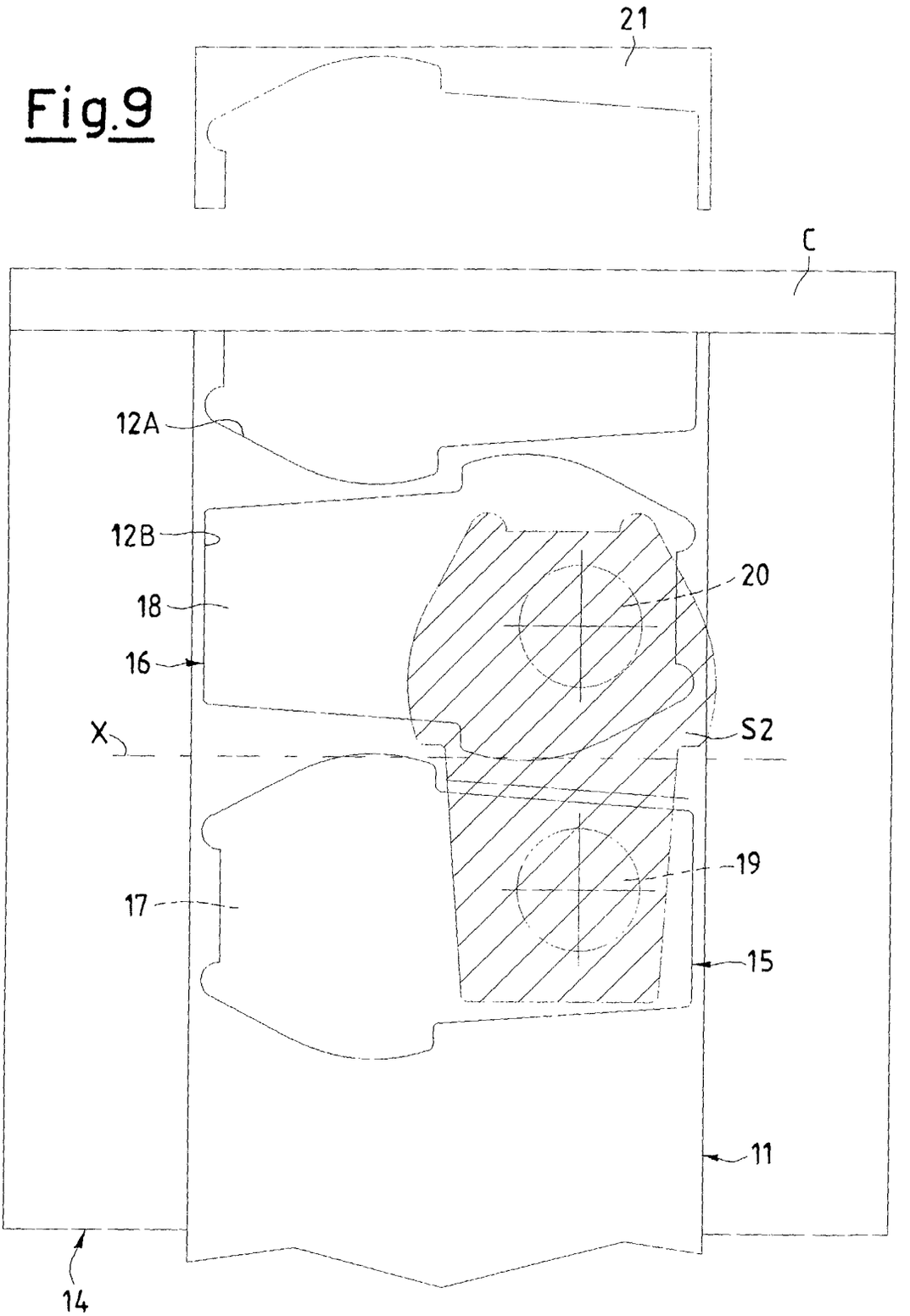


Fig.10

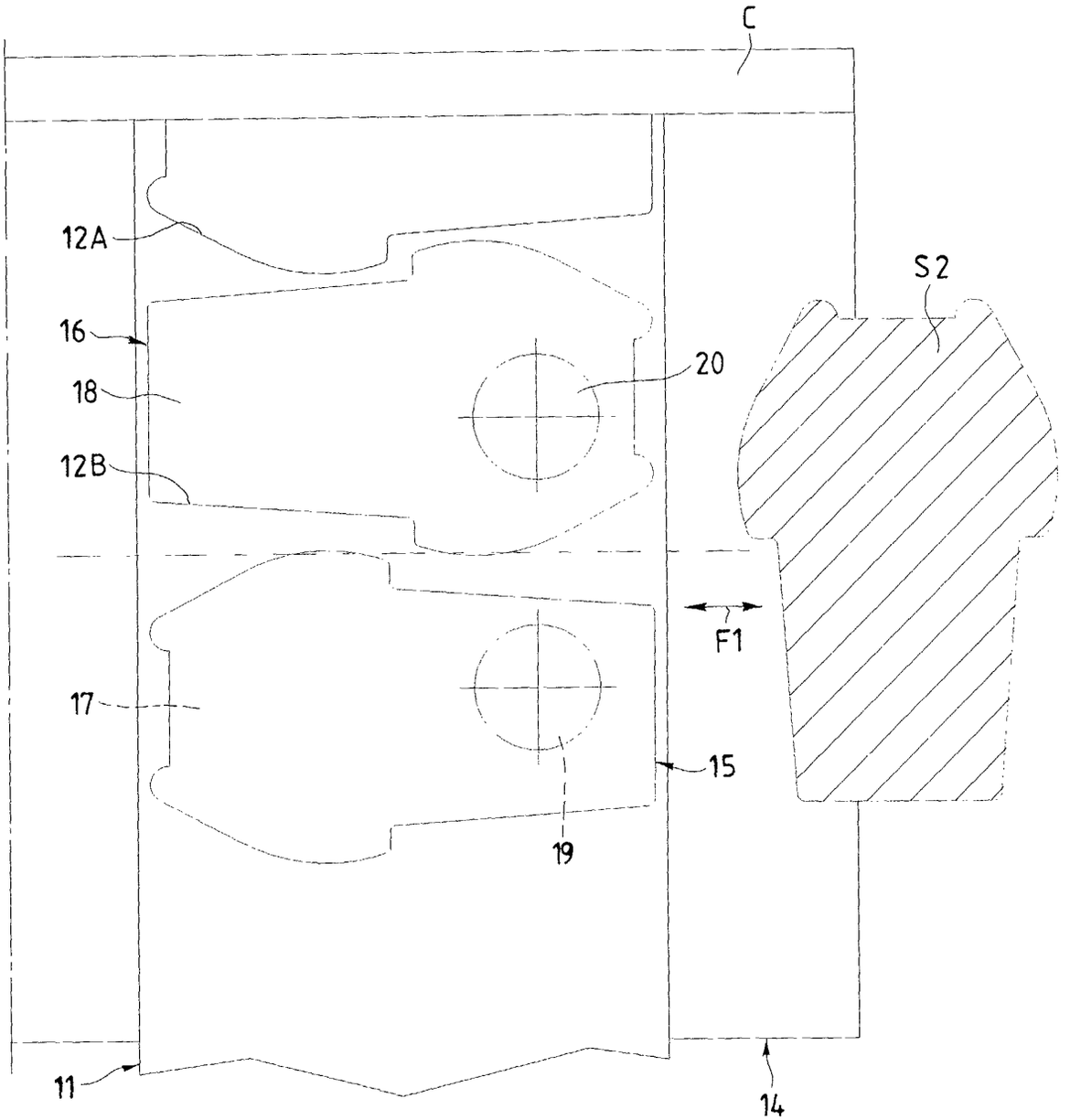
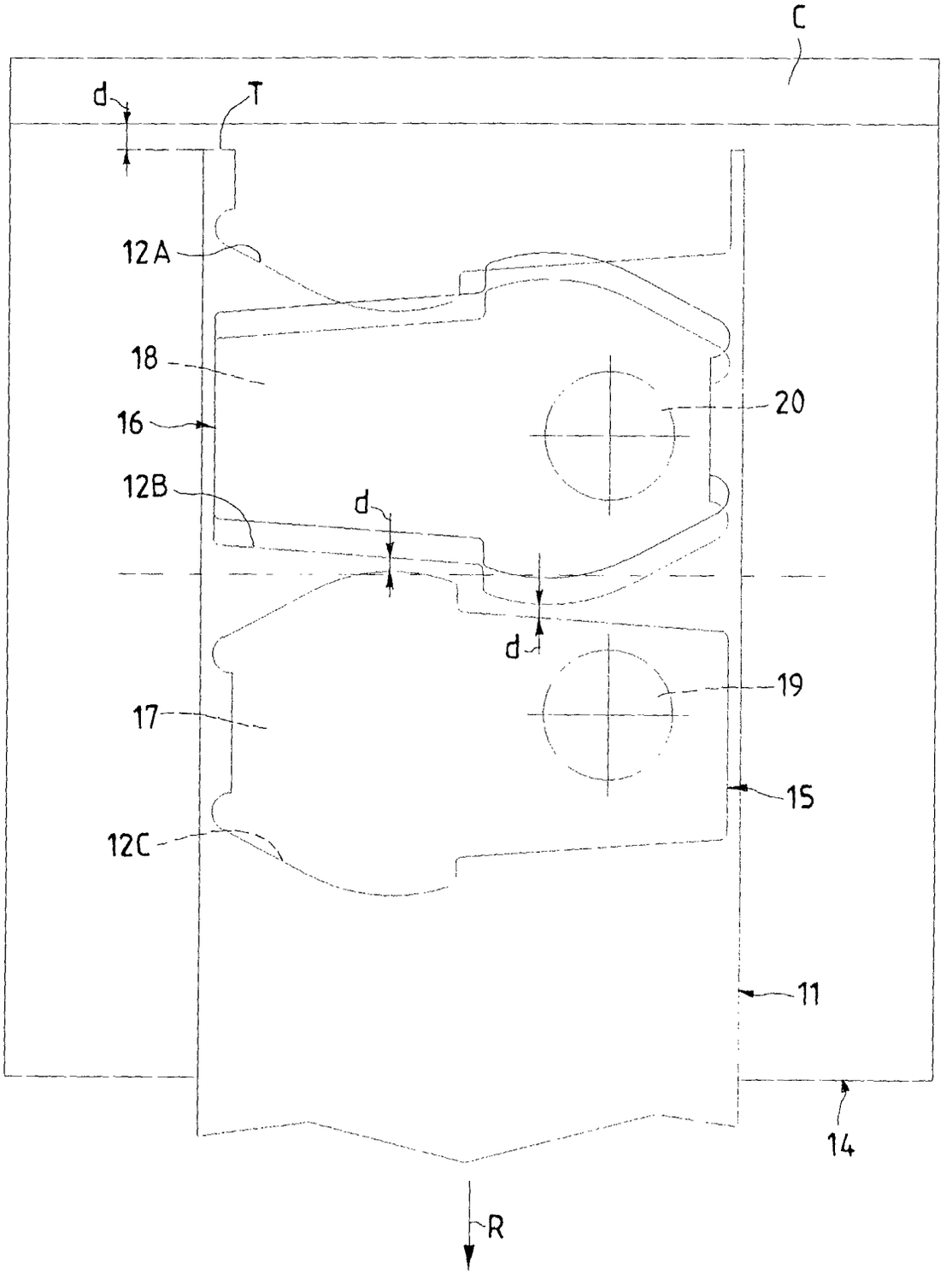


Fig.11



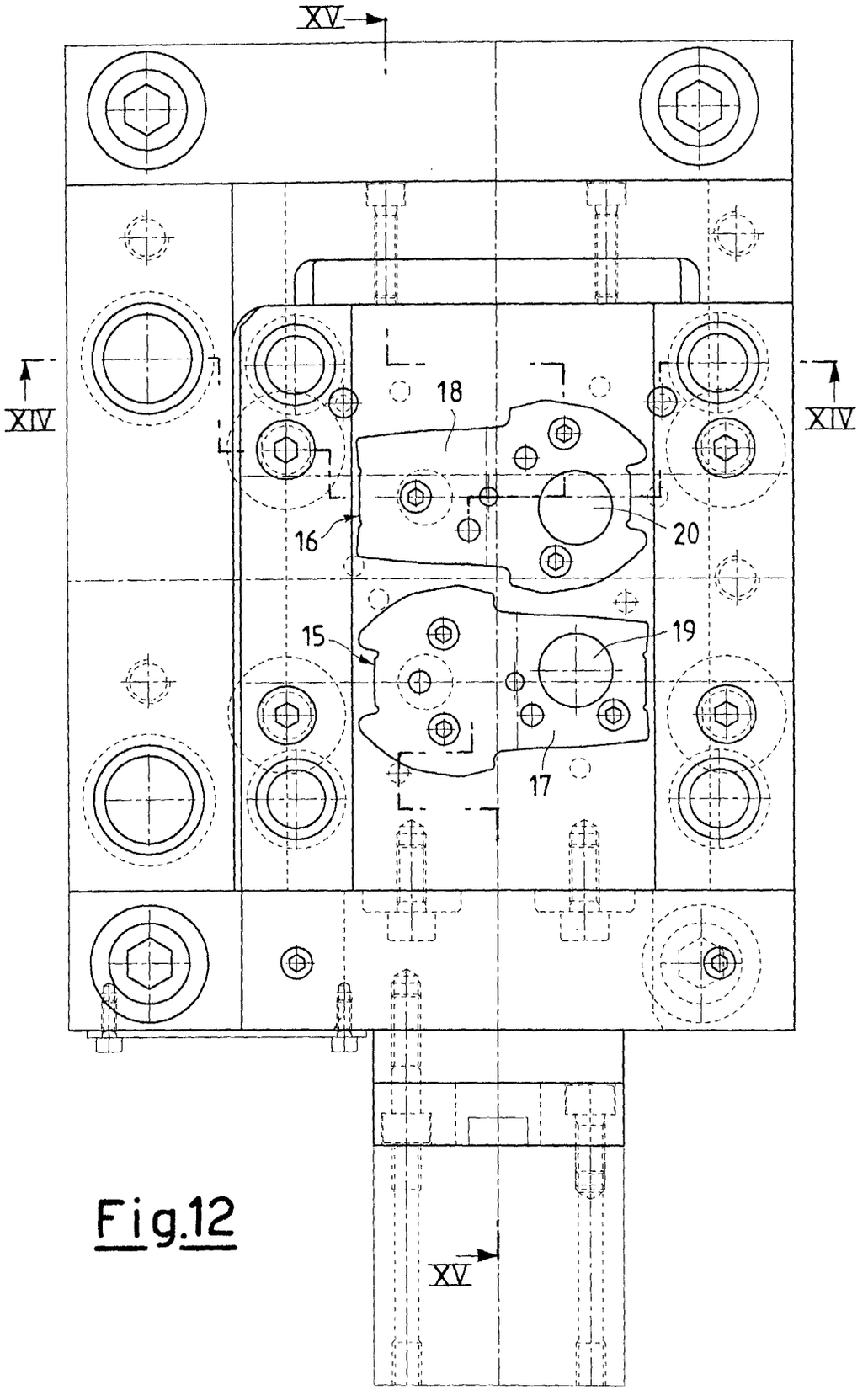
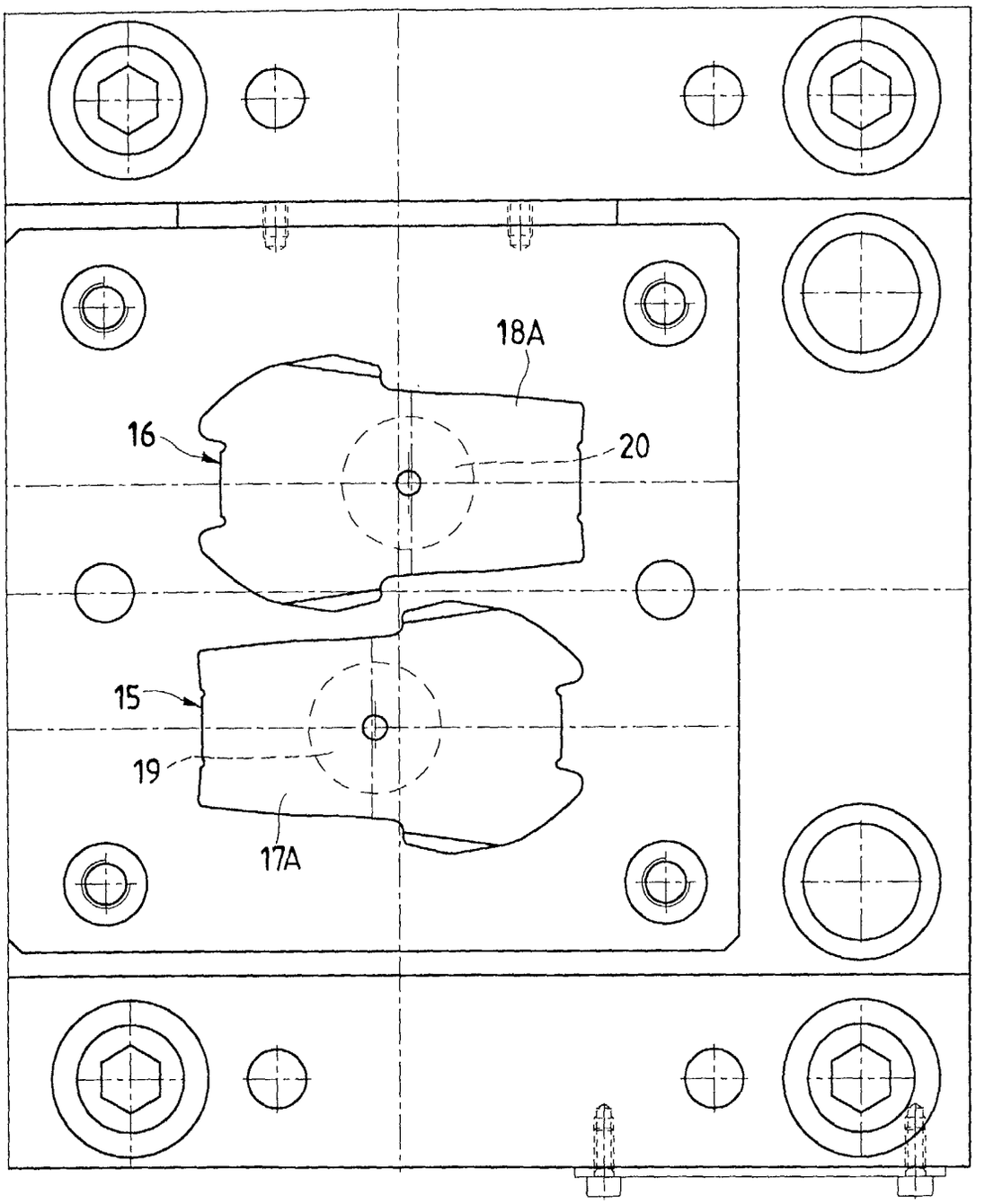


Fig.12

Fig.13



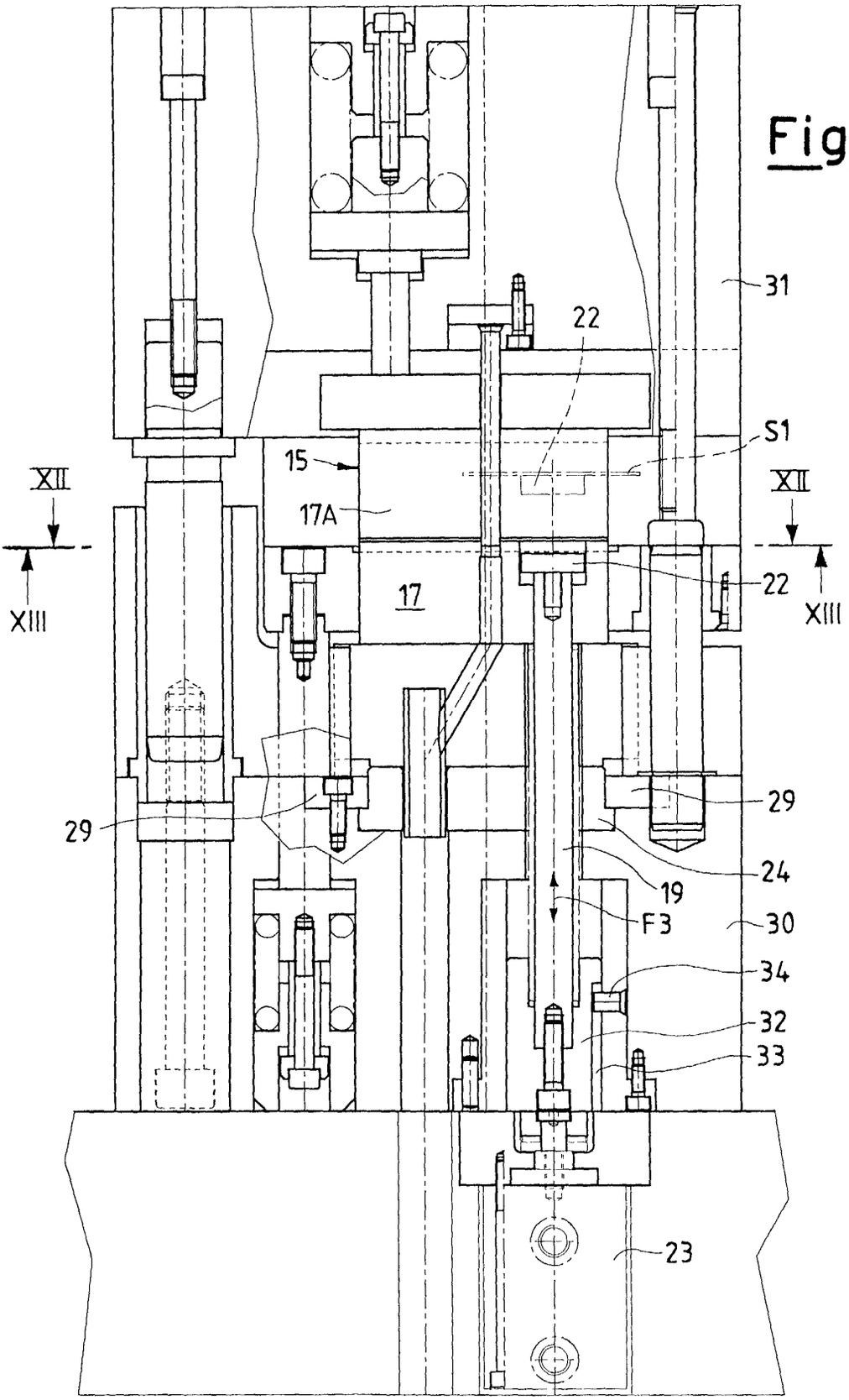


Fig.14

Fig.15

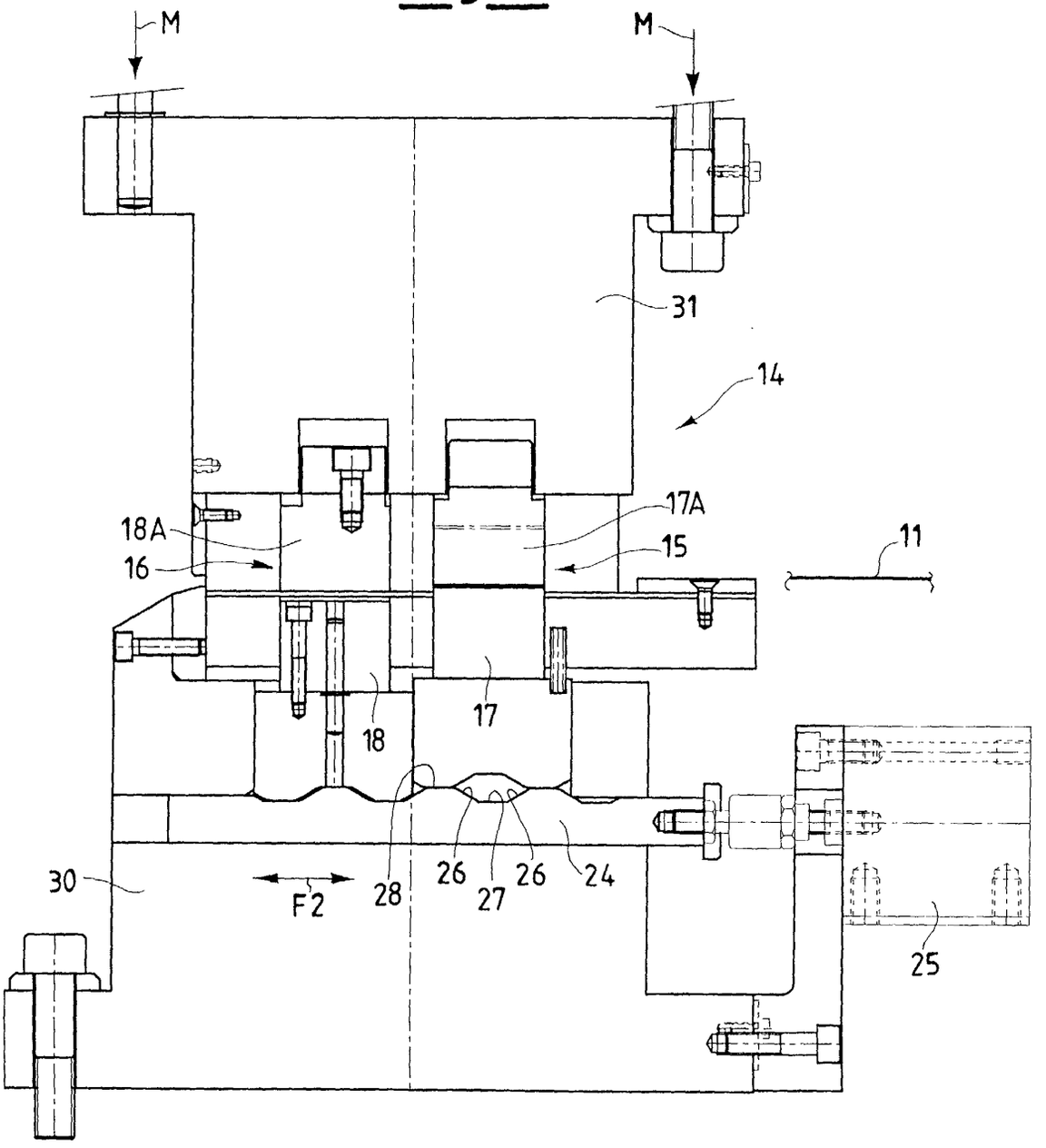


Fig.16

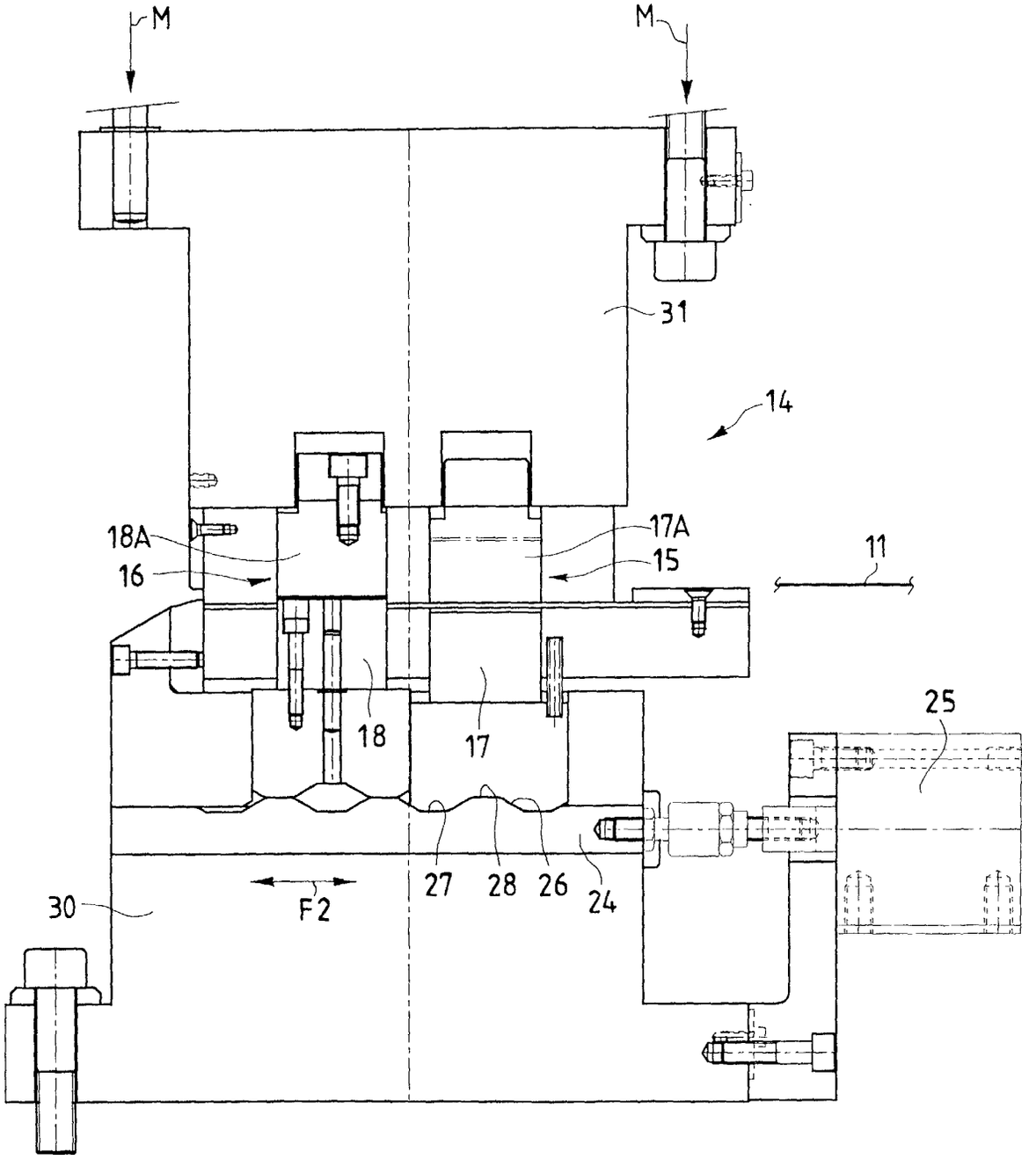


Fig.17

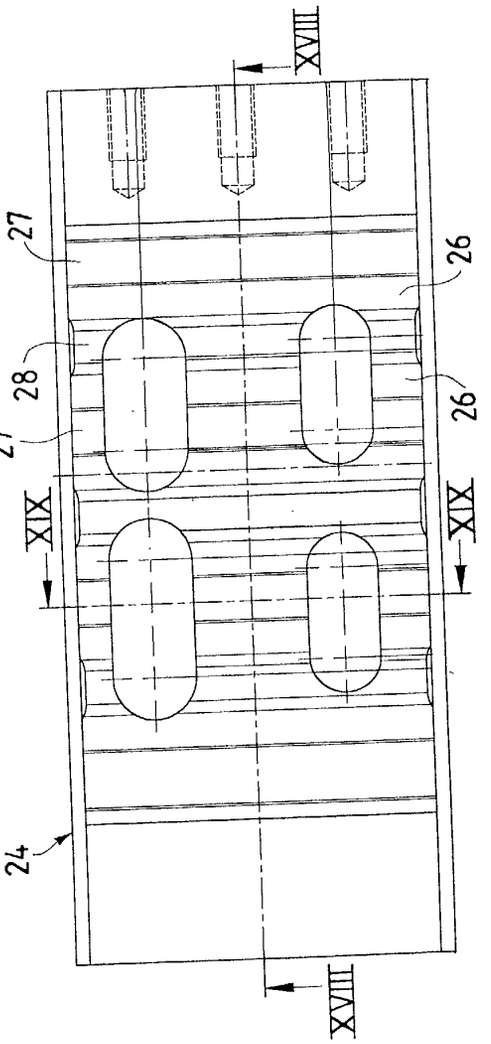


Fig.18

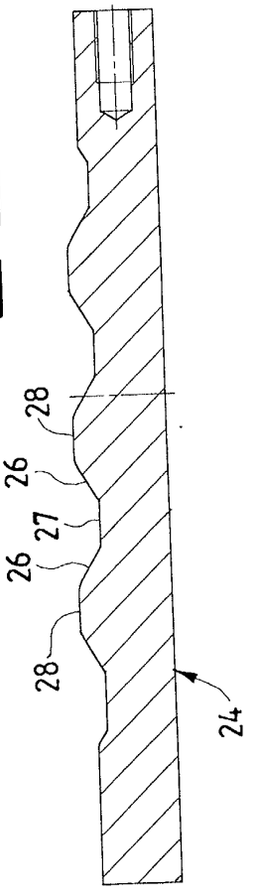


Fig.19

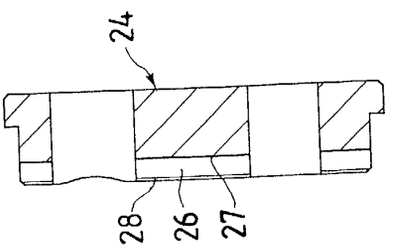
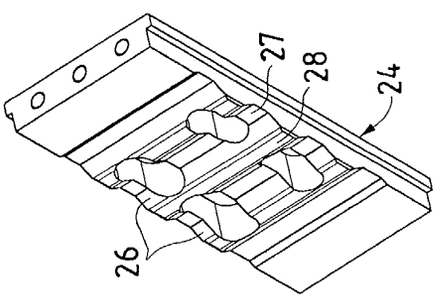


Fig.20



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Application Number
EP 02 07 9386

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