(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 304 985 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **88201732.0**

(51) Int. Cl.4: **D03C 3/20 , D03C 13/00**

(22) Date of filing: **15.08.88**

(30) Priority: **26.08.87 BE 8700946**

(43) Date of publication of application:
01.03.89 Bulletin 89/09

(84) Designated Contracting States:
CH DE FR GB IT LI NL

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(54) Device for making a shed in weaving machines.

(57) Device for making a shed in weaving-machines, characterized in that it mainly consists of primary means (1) that are connected with, of are part of, the heddles (2) of the warp-threads (3); of secondary means (4) that can be moved to and fro, by means of which the primary means (1) can be moved; and of controllable locking-means (5) that can act together with the primary means (1) in order to put or to keep them in a given position.

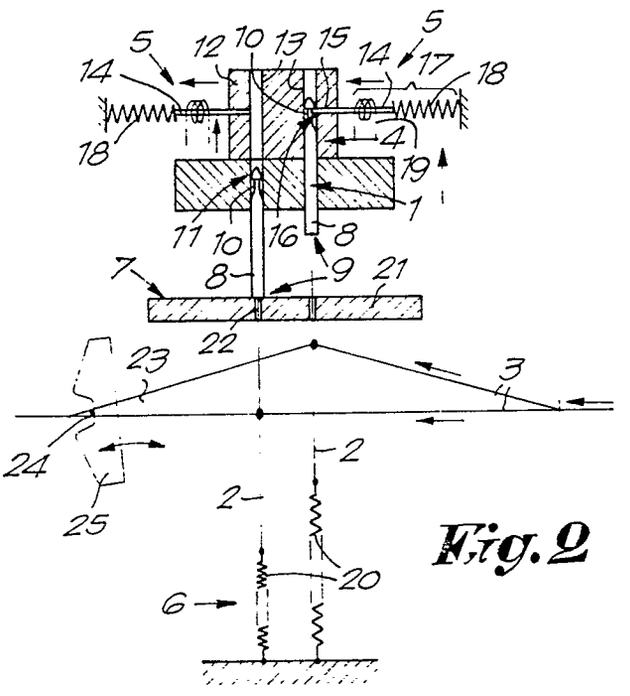

Fig. 2

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Device for making a shed in weaving-machines.

This invention concerns a device for making a shed in weaving-machines, in other words a device for putting the so-called heddles in a weaving-machine alternatively in an upper and in a lower position.

In a preferred embodiment, the invention concerns a device that is intended to be applied in pattern-weaving and in which all heddles can be operated separately.

In pattern-weaving, it is known that a jacquard-machine is employed to operate the heddles separately. Such jacquard-mechanisms, controlled by punched cards or the like, are very bulky. Jacquard-machines are hence set up at a relatively great height above the weaving machines, whereby separate connections from the jacquard-machine to the different heddles are provided for. Such machines present the disadvantage that they are not very practical.

The present invention hence aims to provide for a device, that can be employed in pattern-weaving, and that does not present the above disadvantage. The device presented hereafter according to the invention can indeed be set up immediately above the heddles or the frame of a weaving-machine.

The invention also aims at a device for making a shed, whereby the movement of the heddles can be controlled electronically. The time-consuming manufacture of punched cards hereby becomes unnecessary, as a designed pattern or motif can simply be scanned by means of a scanner, whereby the values are stocked in the memory and are automatically employed for the electronic control of the operation of the heddles.

For this purpose the invention hence concerns a device for making a shed in weaving-machines, with as characteristic that it mainly consists of primary means that are connected with the heddles of the warp-threads or are part of same; of secondary means that can move to and fro, and by which the primary means can be moved; and controllable locking means that can act together with the primary means in order to put and/or to keep the latter in a given position.

In the most preferred embodiment, the device provides for a combination of the above mentioned primary means, whereby the latter consist of sliding pins that are connected at one end with the heddles; of the above mentioned secondary means, whereby the latter consist of a body provided with guides in which the pins can slide; of a supporting-plate, placed between the warp-threads out of which the shed will be made and the above mentioned body, and provided with apertures allowing the passage of the heddles and/or the connections between the pins and the heddles; of the above mentioned locking-means, whereby the latter are mounted permanently on the above mentioned body in such a way that they can lock the pins with respect to this body; and of means that force the heddles and the pins into a well-defined position, in such a way that the pins, when unlocked, rest against the supporting- plate with their ends that are connected to the heddles; whereby each guide, pin and heddle that belong together are in line with one another. Now when one moves the above mentioned body to and fro, preferably up and down, with respect to the supporting-plate, the pins that are not locked will naturally remain in contact with the supporting-plate, while the pins that are locked with respect to the body are lifted up together with the latter. That way, while the body is moved away from the supporting-plate, a number of pins can be moved at will by applying the corresponding locking-means, while the other ones remain in their resting position. By moving a number of these pins, respectively an upper and a lower warp is obtained, so that, as is known, a shed is made.

The above mentioned locking-means are preferably controlled electro-magnetically.

In a particular embodiment, the device is preferably built up in modules, which enables it to be extended and/or adapted simply in terms of the amount of heddles that are to be controlled.

In view of better showing the characteristics according to the invention, a preferred embodiment is described below, as an example without any restrictive nature, and referring to the attached drawings, in which:

figures 1 and 2 show a device according to the invention, respectively for two different positions;

figure 3 shows a practical embodiment of the device according to the invention;

figure 4 shows a section through line IV-IV in figure 3;

figure 5 shows a section through line V-V in figure 4;

figures 6 to 12 clarify the operation of the device for different positions;

figure 13 shows a variant of the embodiment according to figure 3.

As shown in the schematical representation of figures 1 and 2, the device according to the invention mainly consists of primary means 1 that are connected to, or are part of, the heddles 2 through which the warp-threads 3 are led; of secondary means 4 that can move to and fro, in this case

along arrow P, by which the primary means 1 can be moved; and of controllable locking means 5 that can act together with the primary means in 1 in order to put or to keep the latter, together with the above mentioned secondary means 4, in a given position. In the embodiment shown, the locking means 5 are mounted on the above mentioned secondary means 4, whereby the primary means 1 can or cannot be locked with respect to the secondary means 4. In the schematic figures 1 and 2 are also shown, on the one hand, means 6 that force the heddles 2, and hence also the primary means 1, into a well defined position, and on the other hand, supporting means 7 that can keep the primary means 1 in a resting position at a well defined place, counter the force of the above mentioned means 6.

In the embodiment shown, the primary means 1 consist of pins 8 that are connected at one end 9, directly or indirectly, with the heddles 2. Hereby the pins 8 are provided with radial recesses 10, that are preferably situated in the neighbourhood of the opposite end 11.

The above mentioned secondary means 4 mainly consist of a body 12, provided with guides 13, e.g. bores, the lot made in such a way that the above mentioned pins 8 can slide therein.

The controllable locking means 5 mainly consist, in the embodiment shown, of movable needles 14, which also can slide by means of guides or apertures 15 in the above mentioned body 12, in such a way that one end 16 of them can be inserted radially into the above mentioned guides 13 of the pins 8, and in such a way that they hence can act together with the recesses 10 in the pins 8. It is obvious that the locking means 5 contain a drive mechanism 17 in order to put the above mentioned needles 14 in the desired position; thereby, this mechanism can of course be of any nature, but preferably provides for moving the needles 14 electro-magnetically, combined or not with the use of elastic elements like springs.

Figures 1 and 2 hence show, on the one hand, elastic means consisting of springs, particularly compression springs 18, and on the other hand, solenoids 19 that act together with the needles 14. The springs 18 press the needles 14 towards the guides 13, while, by means of the excitation of the solenoids 19, the needles 14 can be moved counter the force of the springs 18, and thus can be drawn with their ends 16 out of the guides 13, or can be kept out of them.

The above mentioned means 6, that force the heddles 2 and the pins 8 towards a well defined place, consist, in the embodiment shown, of draw springs 20 that draw the heddles 2 downwards. It is obvious that they can also consist of other means, such as small weights and the like.

The above mentioned supporting means 7 consist, in the embodiment shown, of a supporting-plate 21, against which the pins 8 can rest with their ends 9, whereby this supporting-plate 21 is provided with apertures 22 allowing a free passage of the heddles 2 and/or of the connections between the heddles 2 and the pins 8.

It is obvious from the figures that the guides 13, the pins 8, the heddles 2 and the apertures 22 in the supporting-plate are preferably all in line.

The operation of the device can easily be derived from figures 1 and 2. According to these figures, the body 12 that moves up and down stands respectively in its upper and in its lower position.

If, for instance, the heddle 2, shown at the left of the figure, must remain in its lower position, while the heddle 2 shown at the right must be raised, then, at the moment that the body 12 is in its lower position, only the solenoid 5 shown at the left is excited. As a consequence of this situation, during the upward motion of the body 12, the needle 14 shown at the right is pressed by means of the corresponding compression spring 18 into the recess 10 of the corresponding pin 8, while the needle 14 shown at the left is entirely outside the corresponding guide 13 and hence cannot engage into the recess 10. It is obvious that the right hand pin 8 is taken upwards by means of the needle 14 through the movement of the body 12, while the left hand pin 8 remains against the supporting-plate.

Finally figure 2 also shows the lease and the shed 23 that is made, into which the weft 24 can be fed in the usual manner and can subsequently be beaten up by means of the reed 25.

In order to provide for the desired pattern design, the body 12 is then moved back downwards, whereafter, by exciting the appropriate solenoid 19, the desired pins 8 and corresponding heddles 2 are raised anew on a following upward move.

It is obvious from the above figures, that, when the body 12 is in its lower position, the recesses 10 in the pins 8 must be situated above the needles 14.

As it is known, a weaving-machine contains a large amount of heddles 2, that are placed closely alongside one another. As it is proposed to mount the device according to the invention directly on the weaving machine, whereby the heddles 2 and the above mentioned pins 8 are always in line, it is obvious that the pins 8 must also be situated closely alongside one another.

With figures 3 to 12 a practical embodiment of the invention is hence described, whereby, by means of a number of advantageous constructive details, the control of a large amount of pins 8 situated closely alongside one another can be pro-

vided for in an efficient manner.

As shown in figures 3 and 4, the pins 8 (A, B, C, ...) are placed in rows, respectively 26A, 26B, 26C, etc... In order that locking means 5 (A, B, C, ...) can act together with all pins 8 (A, B, C, ...), the pins 8 are, at rest, arranged with their loose ends 11 (A, B, C, ...) in a stepped pattern, whereby the widest base of this stepped pattern is placed closest to the warp-threads 3. This stepped pattern allows the pins 8A of the first row 26A not to hinder the mounting of the locking means 5B for the pins 8B of the second row 26B. It is hence obvious that the above mentioned locking means 5 (A, B, C, ...) must be placed one above another for each separate row 26A, 26B, etc., as shown in figure 3.

As also shown in figure 3, the body 12 shall also preferably be made according to a stepped pattern. The stepped pattern can of course be provided for on both sides 27 and 28 of the body 12, in such a way that it forms a pyramidal construction.

In the preferred embodiment of the invention, the body 12 is built up in modules out of plates or blocks 29 A, B, C, etc., placed onto one another and provided with the above mentioned guides 13, whereby the latter are of course situated in line with one another. The plates 29 A, B, C, ... preferably follow the above mentioned stepped pattern and can at will be installed in various amounts, according to the number of heddles 2, particularly according to the number of rows 26, on the heddles 2 that are to be controlled.

In order to provide for a good guiding of the shortest pins 8 even in the upper position of the body 12, the body 12 is preferably also built up out of an intermediate layer 30 situated under the lowest plate 29A and a bottom 31.

The locking means that can act together with a same row of pins are respectively incorporated in a U-shape or U-profile 32, whereby these U-profiles 32 are mounted against the side 33, respectively the sides, of the body 12 and/or of the corresponding layers 29.

In order to keep the interval between the successive pins 8 of a same row 26 within bounds, the locking means 5 and especially the drive mechanisms 17 that correspond to a same row 26, in other words that are mounted in a same U-shape 32, are successively set out of square with respect to one another, as shown in figure 5.

For clarity's sake, figure 4 shows solely the locking means 5 situated at the bottom of the corresponding U-shape 32.

The fastening of the locking means 5 in the various U-shapes 32 is shown in detail in figures 4 to 6. Herein the solenoids 19 and the compression springs 18 are placed in line with one another between the arms 34 and 35 of the U-shape 32, while the needles 14 extend respectively through the springs 18 and the solenoids 19. The needles 14 are each provided with a fixed flange 36 which forms a stop for the compression springs 18, whereby this flange 36 can act together with the inside wall 37 being at the same time the arm 35 of the U-shape, in such a way that, in case the solenoids 19 are not excited, the needles 14 can extend with their ends 16 up to the middle of the guides 13.

The opposite ends 38 of the above mentioned needles 14 can act together with the ends 39 of axially movable positioning pins 40, whereby the latter are screwed for that purpose into the arm 34 of the U-shape 32 by means of an adjusting screw. The adjustment of the positioning pins 40 determines how far the needles 14 can be withdrawn when the respective solenoids 19 are excited. The positioning pins are preferably adjusted in such a way that the needles 14, in withdrawn position, are situated just outside the corresponding guides 13.

The above mentioned recess 10 in each pin 8 is preferably limited, one the one side, by a radial wall 42 and, on the other side, by a slanting or conical wall 33. The radial wall 42 is above the recess 10. Furthermore the pins 8 have a bevelled, rounded off or conical top 44.

The needles 14, which preferably have a circular section, are provided at their ends 16, on the one hand with a flattening 45 that can act together with the radial wall 42, and on the other hand with a bevel or rounding-off 46 that can act together with the conical wall 43. The utility of these details will still be explained in the further description.

In order to obtain that the flattening 45 is always situated in a same plane, the needles 14 must be prevented to rotate. According to the invention this is obtained by carrying out the above mentioned flanges 36 in the form of a hexagonal plate, as shown in figure 6, in such a way that the sides of these flanges 36 touch one another and lock one another avoiding rotation.

The U-shapes 32 are preferably fastened to the body 12 and/or to the plates 29 by means of screws 45 that fit into the apertures 48 in the arms 35 of the U-shape 32.

Such a dismountable fastening offers the advantage that, in case one of the locking means 5 breaks down during weaving, one can install a new module, consisting of a new U-form 32, in replacement of the defective module, in a relatively short time. Opposite the above mentioned aperatures 48, holes or apertures 49 are made in the second arm 34 of the U-shape 32, allowing the passage of a screw-driver for loosening, respectively fastening the screws 47.

The operation of the device is decribed below as shown in figures 6 to 12.

Figures 6 to 8 show the operation if a pin 8 must remain in its lower position. Hereby the solenoid 19 is excited, by which the needle 14 is drawn against the positioning pin 40. Thereby, as shown in figures 7 and 8, no locking occurs between the needle 14 and the pin 18 during the upward motion of the body 12, so the pin 18 remains in its lower position.

According to figure 9, the solenoid 19 is not excited, whereby the needle 14 is pressed against the pin 8 by means of the compression spring 18. Hence, as shown in figure 10, during the upward motion of the body 12, the needle 14 slides into the recess 10. Through the further upward motion of the body 12, the flattening 12 and the radial wall 42 come into contact with one another, whereby the pin 8 is also raised, as further shown in figure 11.

It is obvious that, as the body 12 moves back down again, the pin 8 is at a certain moment stopped by the supporting-plate 21, in such a way that, by further lowering the body 12, the needle 14 is pushed back to the left by means of the conical wall 43, whereby one returns to a situation as in figure 9.

The excited solenoids 19 can be disconnected again after the moment that the needles 14 are above the ends 11 of the pins 8. While the body 12 returns downwards, the corresponding needles 14 are automatically pushed back into the apertures 15 by the concurrence of the bevels or rounding-offs 46 with which they are provided, and of the bevelled and/or rounded-off tops of the pins 8.

The positioning pins 40 and the needles 14 form together a core for the solenoids 19. By adjusting the positioning pins to a minimal play, whereafter they are sealed, a maximal magnetic force of attraction, exerted on the needles 14, can be guaranteed with a minimal power dissipation.

The wiring that leads to the different solenoids 19 is preferably carried out in the form of a printed circuit or print not shown in the figures, that is fastened on the bottom 50 of the U-shape 32, and from where electrical connections to the solenoids 19 can be provided for.

As, in the construction shown, when the body 12 is in its lower position, the needles 14 are always pushed back mechanically, it is obvious that the working of the solenoids can remain restricted to keeping these needles 14 in their retracted position. Hence the solenoids 19 need not be heavily built, and thus take little space.

The needles 14 are preferably thermically nickel-plated, while, in order to avoid crater-forming, the pins 8 are both cemented and thermically nickel-plated.

The mechanism for moving the body 12 can be of any shape. To that end, the body 12 is preferably fastened to a frame that is moved up and down by means of a cam mechanism, whereby the latter is carried out in such a way that the body 12 is kept as long as possible in its upper position. As such a mechanism can be carried out by a craftsman in any way, and as the nature of this motion mechanism does not form the essence of this invention, this is hence not described any further in detail.

As the working of the device resides on an electro-magnetic control, it is obvious that, contrarily to classical jacquard-machines, one can now simply make use of a computer or micro-processor in order to provide for the control of the heddles according to a given pattern.

It is obvious that various variants of the invention are possible. Thus, for instance, the supporting-plate 21 is not a necessity. Indeed, the means 6 can be carried out in such a way that they can at the same time provide for the limitation of the downward movement of the pins 8.

It is also obvious that, by changing the length of the pins 8, one can also change the length of stroke of the up-and-downward movement of these pins 8. If the pin 8 is made a bit longer, then the length of up and downward stroke becomes proportionally shorter, and vice versa. By giving the pins of the different rows of holes an appropriate length, one can thus arrange that the resulting shed of warp-threads be perfectly even, in other words that all warp-wires that are raised stand at a same angle.

The above mentioned secondary means 4 that can move to and fro need not necessarily consist of the body 12, but can for instance also by formed by the supporting-plate 21, in such a way that, by the movement of the latter, the pins are pushed upwards into the body 12 that is then mounted rigidly, whereafter, when this supporting-plate 21 moves down again, the desired pins 8 are kept in the upper position by engaging the locking means 5, while the other pins 8 move downwards together with the supporting-plate 21.

The device as shown in figure 13 also enables forming a double shed 3-3, respectively 3A-3A (e.g. for carpet material), if one allows two different locking-needles 14 to act on a same pin 8, in a double constuction, by providing for two successive plates 29, respectively 29A1 and 29A2, 29B1 and 29B2, ... If one does not excite any solenoid 19 of these locking-needles, then the pin 8 is taken along by the upper locking-needle 14 in plate 29A2. If one only excites the upper solenoid, then the pin 8 is taken along by the lower locking-needle 14 in plate 29A1, and will thus only perform part of the up-and-downward movement. If one excites both solenoids 19, then the pin 8 will not be taken along.

The present invention is by no means restricted to the embodiment described as an example and shown in the figures, but such a device for making a shed in weaving-machines can be carried out in various forms and dimensions without departing from the scope of the invention.

Claims

1.- Device for making a shed in weaving-machines, characterized in that it mainly consists of primary means (1) that are connected with, and/or are part of, the heddles (2) of the warp-threads (3); of secondary means (4) that can move to and fro, by means of which the primary means (1) can be moved; and of controllable locking-means (5) that can act together with the primary means (1) in order to put and/or to keep the latter in a given position.

2.- Device accoring to claim 1, characterized in that the locking-means (5) are connected permanently to the above mentioned secondary means (4), and thus can lock or not lock the above mentioned primary means with respect to the secondary means.

3.- Device according to claim 2, characterized in that it is also provided with means (6) that can force the heddles (2) and the primary means (1) towards a well defined position, and with supporting means (7) that can keep the primary means (1) in a given place counter the force of the above mentioned means (6).

4.- Device according to claim 2 or 3, characterized in that the above mentioned secondary means (4) consist of a body (12), that is provided with guides (13) in which the primary means (1), when unlocked, can slide during the movement of the secondary means.

5.- Device according to claim 4, characterized in that the guides (13) in the body (12) consist of bores.

6.- Device according to one of the claims 3 to 5, characterized in that the above mentioned supporting-means (7) consist of a supporting-plate (21).

7.- Device according to one of the claims 4 to 6, characterized in that the above mentioned primary means (1) consist of pins (8) that can slide in the guides (13).

8.- Device according to claim 1, characterized in that it provides for a combination of the above mentioned primary means (1), whereby the latter consist of sliding pins (8) that are connected at one end (9) with the heddles (2); of the above mentioned secondary means (4), whereby the latter consist of a body (12) that is provided with guides (13) in which the pins (8) can slide; of a supporting-plate (21) mounted between the warp-wires (3) and the above mentioned body (12) and provided with apertures (22) allowing passages for the heddles (2) and/or for the connections between the pins (8) and the heddles (2); of the above mentioned locking-means (5) that are mounted permanently on the above mentioned body (12), in such a way that they can lock the pins (8) with respect to the body (12); and of means (6) that force the heddles (2) and the pins (8) in a well defined position in such a way that the pins (8), when unlocked, rest against the supporting-plate (21) with their ends (9) that are connected to the heddles (2); whereby the above mentioned guides (13), pins (8) and heddles (2) are in line with one another.

9.- Device according to one of the claim 7 or 8, characterized in that the locking-means (5) mainly consist of movable needles (14) that can be inserted into the guides (13), whereby the pins (8) are provided with recesses (10) that can act together with the needles (14).

10.- Device according to claim 9, characterized in that the movable needles (14) are controlled electro-magnetically.

11.- Device according to claim 9, characterized in that the needles (14) are movable by means of a drive mechanism (17) consisting of springs (18) that push the pins with their ends into the guides (13), and of solenoids (19) by which the needles (14) can be kept and/or drawn electro-magnetically outside the guides (13) of the pins (8).

12.- Device according to one of the claims 9 to 11, characterized in that the recesses (10) in the pins (8) are situated close to the ends (16) of the latter opposite the ends (9) that are connected to the heddles (2).

13.- Device according to claim 12, characterized in that the pins (8) are arranged in several rows (26), and are situated, with their ends provided with the above mentioned recesses (10), according to a stepped pattern as concerns the successive rows (26A, 26B, ...).

14.- Device according to claim 13, characterized in that the body (12) is built up in modules out of plates (29A, 29B, ...), that form joint guides (13) for the pins (8).

15.- Device according to one of the claims 9 to 14, characterized in that the locking-means (5) are mainly built-in into one or more U-shapes (32).

16.- Device according to claim 15, characterized in that, for each row (26A, 26B, ...) of pins (8), a U-shape is provided for, whereby the latter, for the respective succession of rows (26A, 26B, 26C, ...) are mounted above one another against one or more sides (27, 28) of the body (12).

17.- Device according to claim 15, characterized in that each drive mechanism (27) of the locking-means (5) mainly consists of a solenoid

(19) and of a compression spring (18) placed in line with one another, which are mounted between the respective arms (34, 35) of the U-shapes (32), whereby the needle (14) extends axially through the solenoid (19) and the compression spring (18) and is provided with a flange (36) situated between the compression spring (18) and one arm (35) of the U-shape (32).

18.- Device according to claim 17, characterized in that each solenoid (19) contains a positioning pin (40), that can be shifted axially by means of an adjusting screw (41) or the like, the end (39) of which can concur with the end (38) of the needle (14) that is situated opposite the end (16) that is inserted into the above mentioned guides (13).

19.- Device according to claim 17 of 18, characterized in that the flanges (36) are carried out in the form of a hexagon, whereby the flanges (36) that lie side by side act together with one another and provide for locking the needles (14) against rotation.

20.- Device according to one of the claim 9 to 19, characterized in that the recesses (10) in the pins (8) are limited by a radial wall (42) in the direction in which the needles (14) can take the pins (8) along, while they are limited by a conical or slanting wall (43) on the other side.

21.- Device according to one of the claims 9 to 20, characterized in that the pins (8) are provided, at their loose ends (11), with a bevelled and/or conical head (44), while the above mentioned needles (14) show a bevel or a rounding-off (46) that can act together with that head.

22.- Device according to one of the claims 4 to 21, characterized in that the above mentioned body (12) is provided with an intermediate layer (3) and/or bottom (31) that forms, respectively form, and extra guide for the pins (8).

23.- Device according to one or more of the above claims, characterized in that one locking-means (5) concurs with a pin (8).

24.- Device according to one or more of the claims 1 to 22, characterized in that two or more locking-means (5) concur with a pin (8).

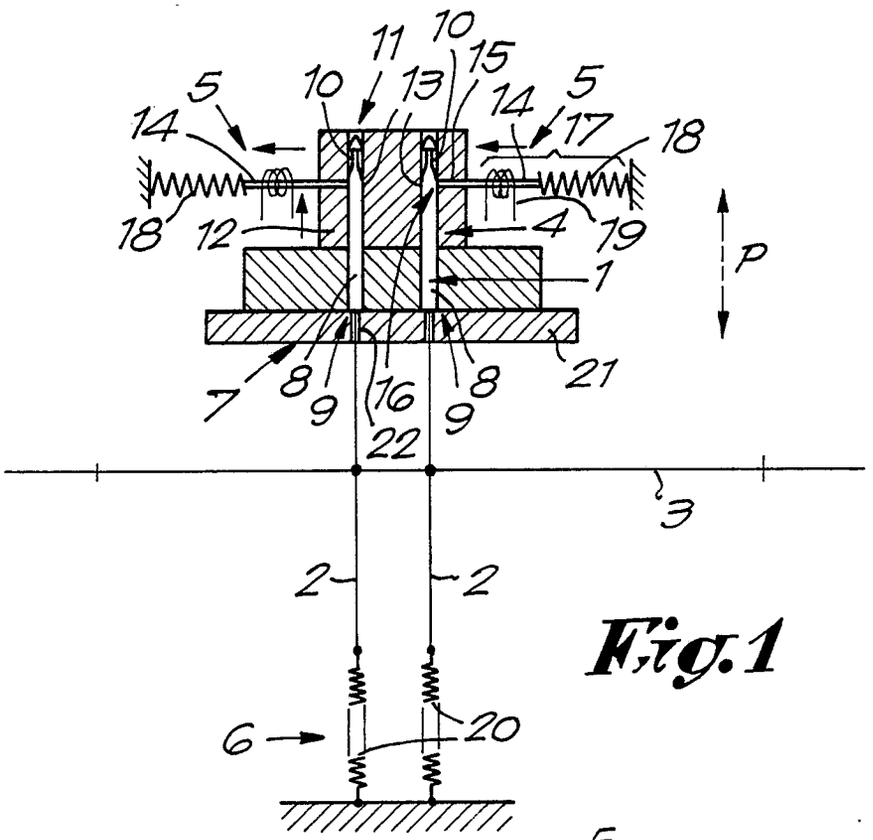
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Fig. 1

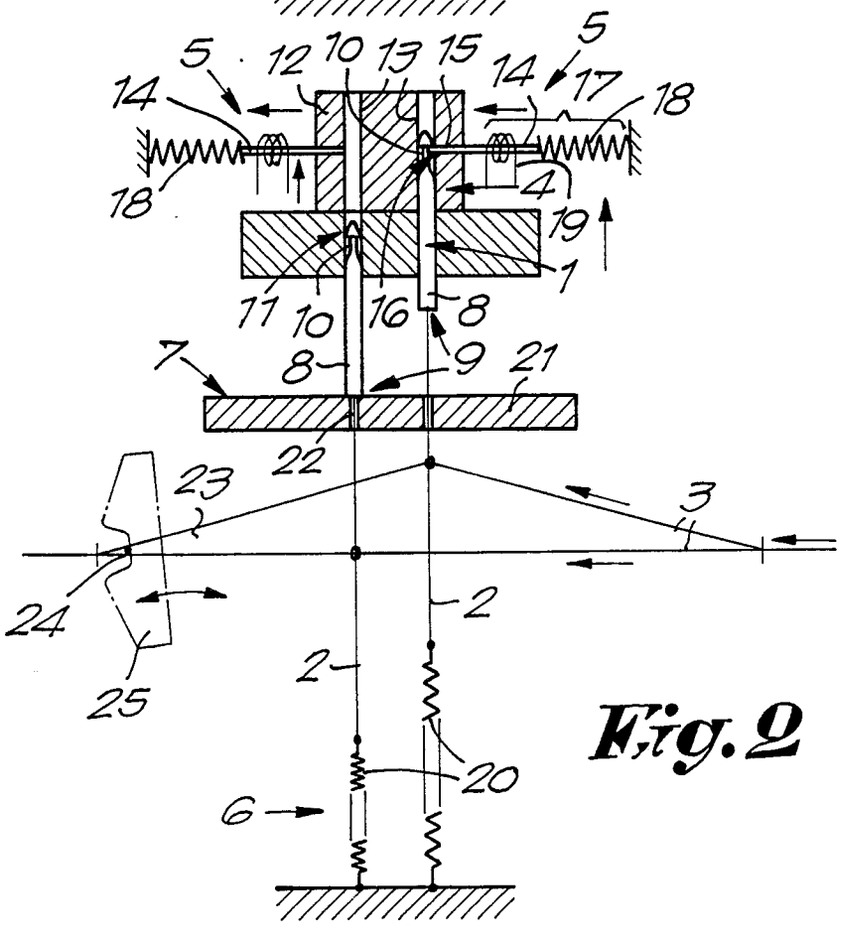
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Fig. 2

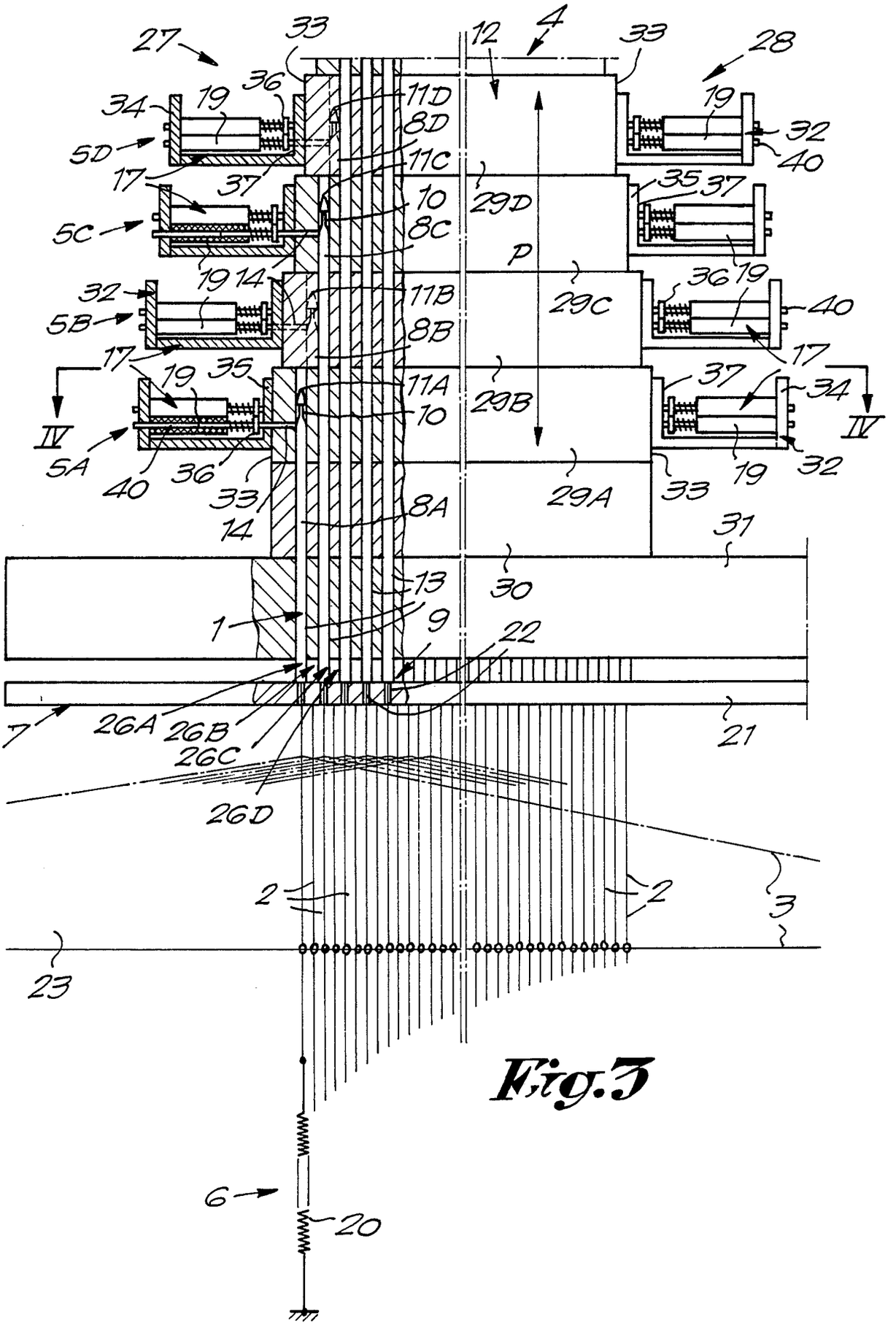
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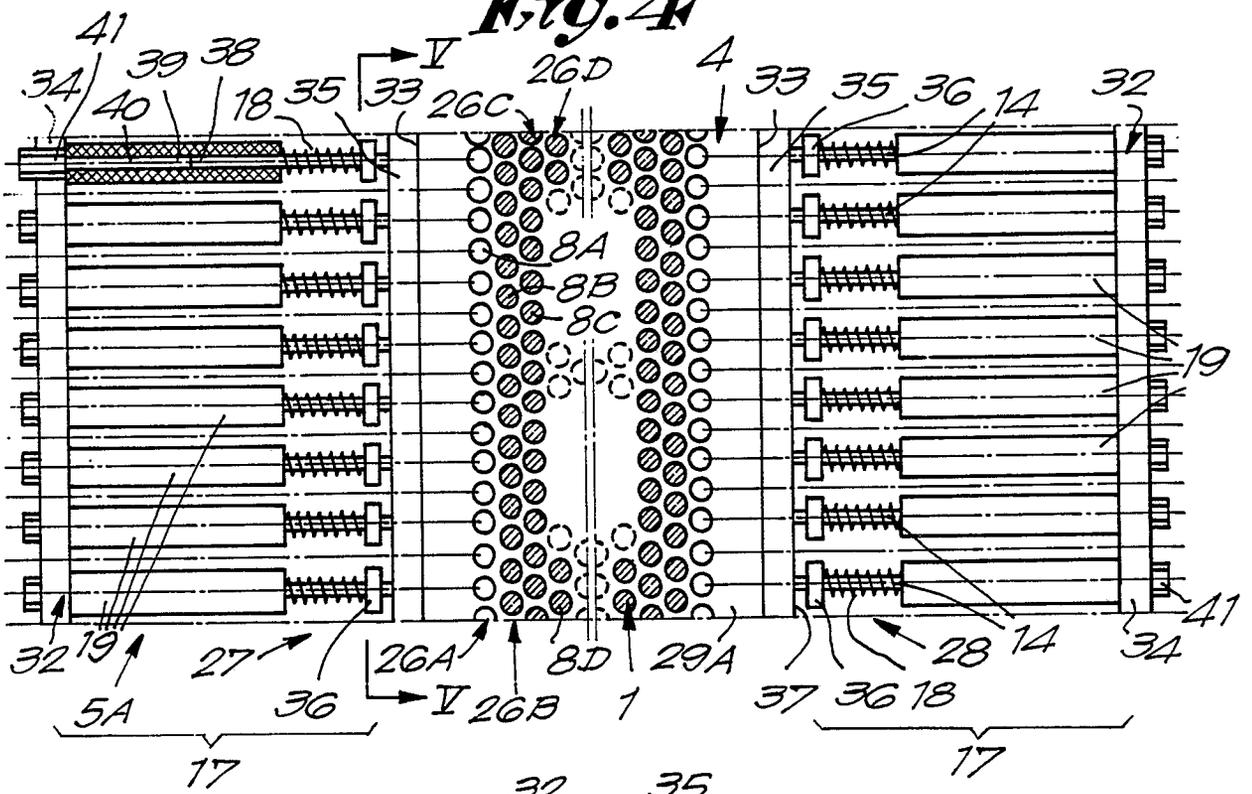
Fig.3

Fig.4



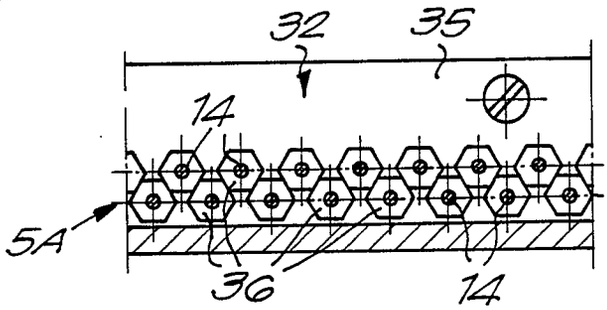


Fig.5

Fig.12

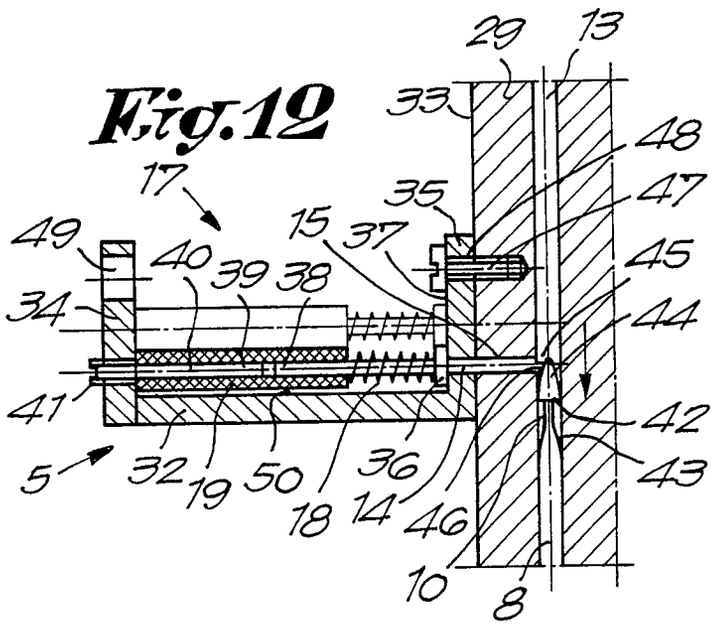


Fig. 6

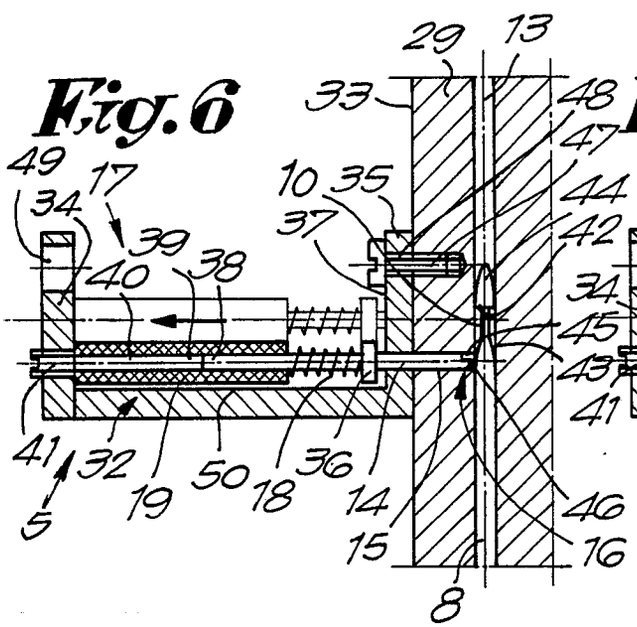


Fig. 9

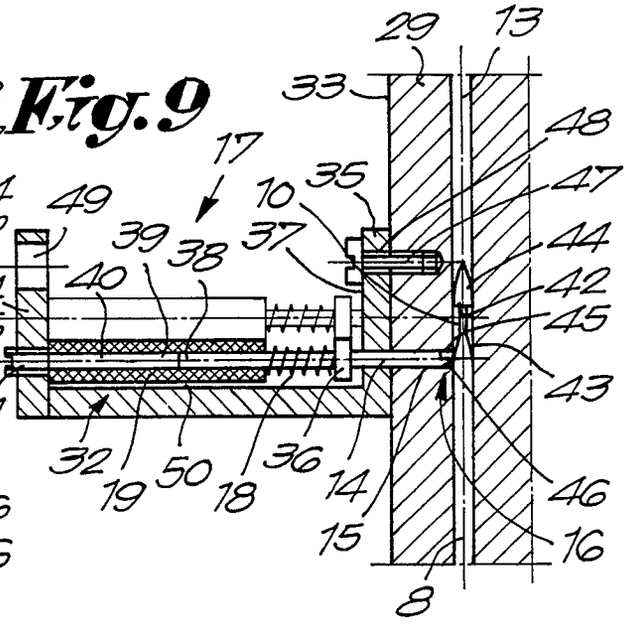


Fig. 7

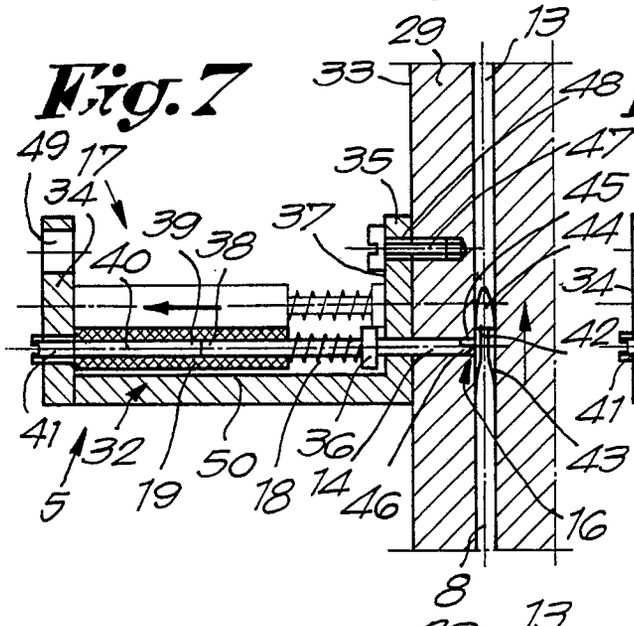


Fig. 10

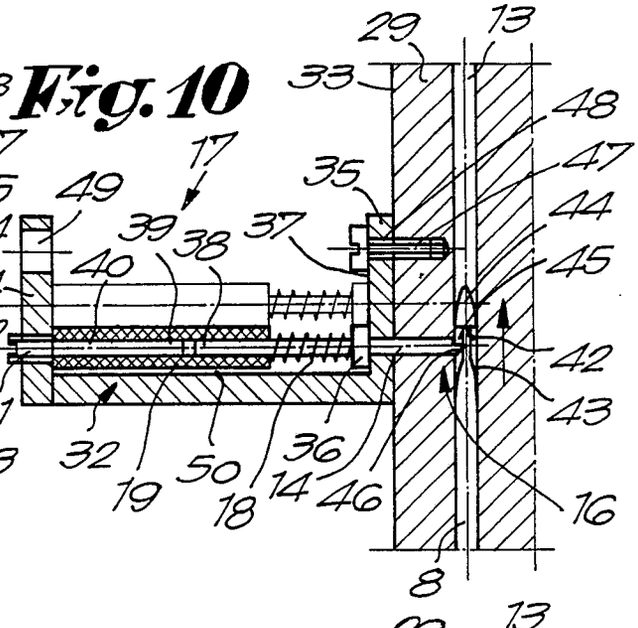


Fig. 8

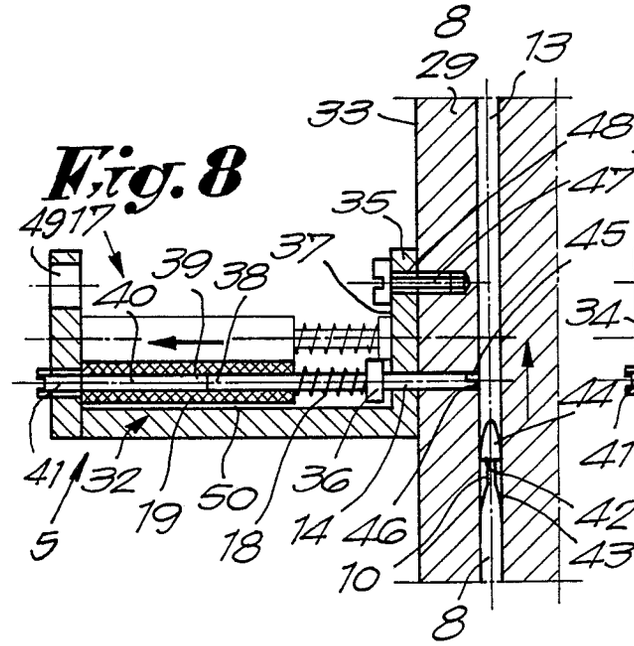
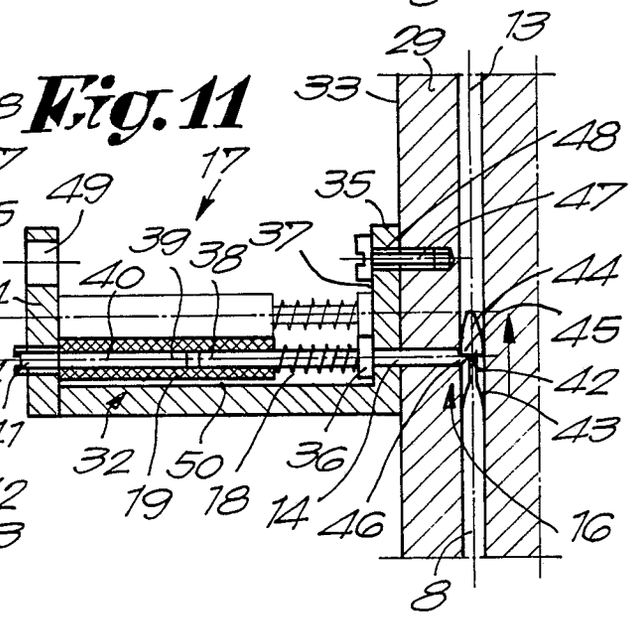
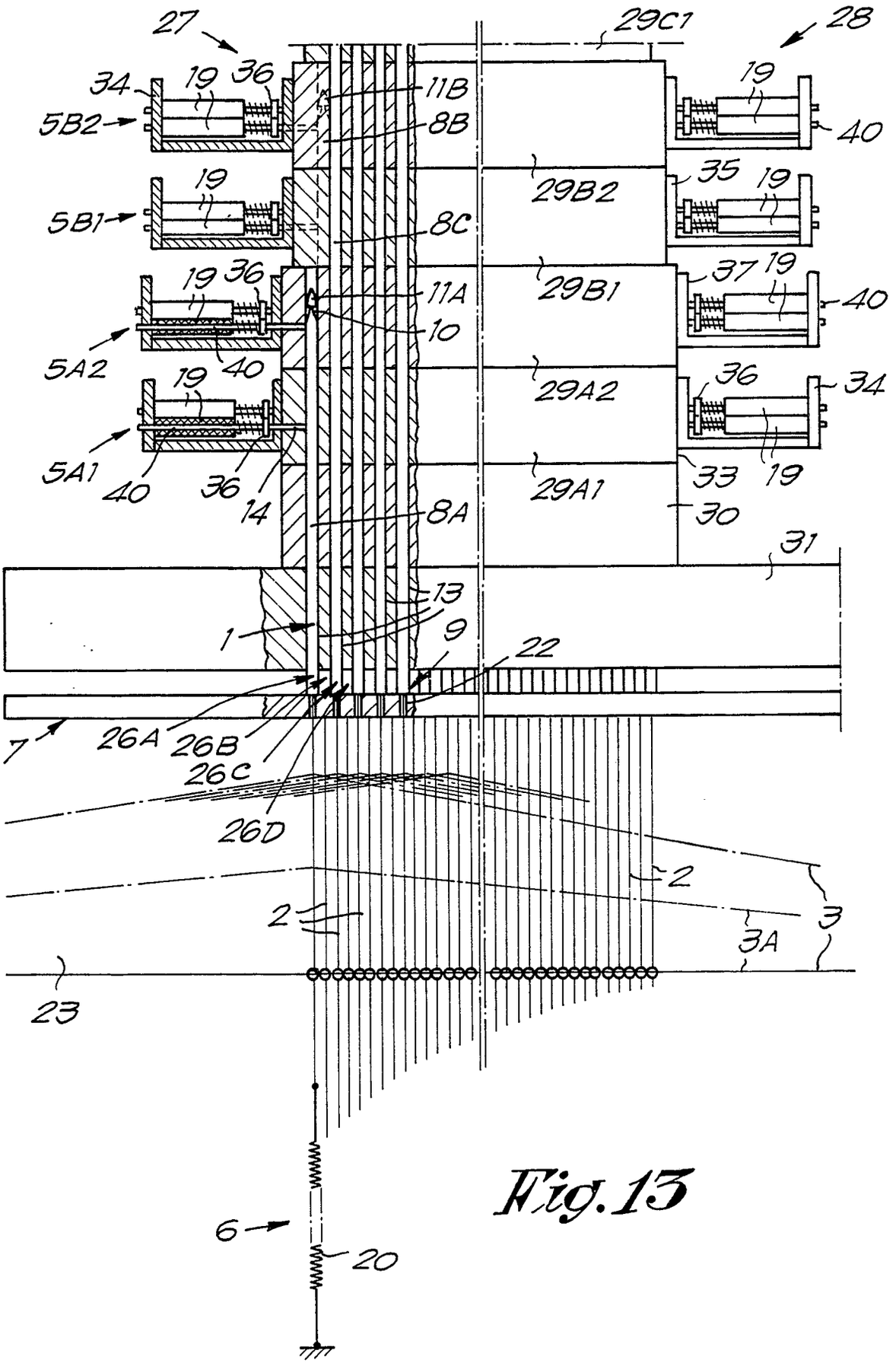


Fig. 11

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14
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26A
26B
26C
26D
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3A
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Fig. 13

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 88 20 1732

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	DE-A-2 203 925 (VAUPEL) * Page 9, line 1 - page 14, line 21; figures 1-4 *	1,2,23	D 03 C 3/20 D 03 C 13/00
A		9	
X	DE-B-1 024 897 (SCHIESSER) * Column 2, line 44 - column 3, line 52; figure 1 *	1	
A	GB-A-1 467 231 (BATTY) * Page 2, line 112 - page 3, line 52; figures 2-4 *	1,3,6	
A	DE-A-2 330 420 (SULZER) * Page 3, line 26 - page 6, line 3; figures 1-5 *	1	
A	FR-A-1 477 674 (LECLERCQ) * Page 1, column 2, lines 7-10; figure 1 *	3,6	
A	FR-A-1 268 994 (LAURITSEN)		TECHNICAL FIELDS SEARCHED (Int. Cl.4) D 03 C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	14-11-1988	BOUTELEGIER C.H.H.

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