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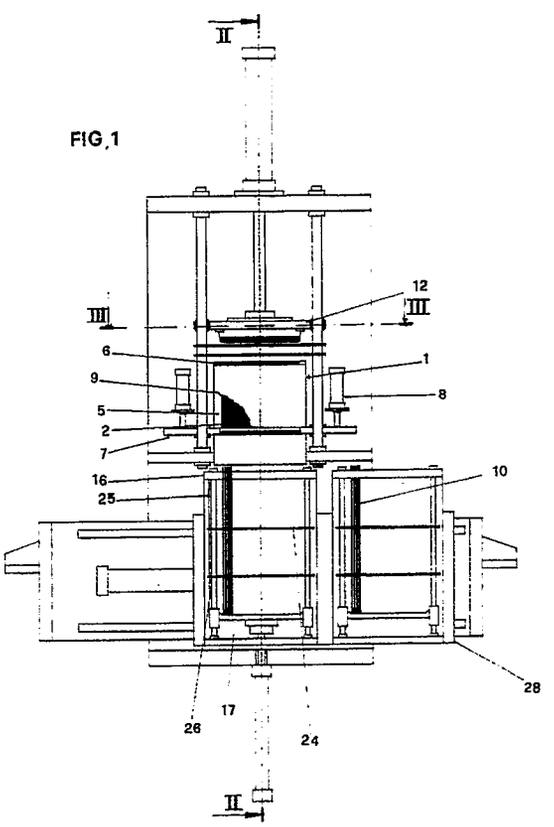
(54) Machine for realizing mechanical radiators, particularly those for motor vehicles.

(57) A machine for realizing machanical radiators, particularly those for motor vehicles, including positioning and support means for the radiators to be treated and a plurality of rods provided with an expansion element at one end and associated with means for their movement along the tubes of said radiators, characterized by comprising:
- a loading table (1) removably housing a radiator (2) in a blocked condition during the expansion treatment and having the walls in contact with the ends of said tubes (4) provided with openings facing them, for the passage of said rods (10),
- vertically mobile means (17), for holding the expansion elements (11) in the correct reciprocal operative position,
- stationary means (16) placed between the loading table (1) and said holding means (17) for centering and guiding said rods (10) in the correct reciprocal operative position, and
- a device (12) for the disengageable hooking of the ends of the rods (10) not provided with the expansion element (11) and making traction on it, said device (12) being placed on the part of the loading table (1) opposite to that in which said stationary centering means (16) and said mobile holding means (17) are.

FIG.1



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The present invention relates to a machine for realizing mechanical radiators, in particular those for motor vehicles.

Radiators for motor vehicles are known that include a plurality of vertical tubes which, as a group, form the circuit for the thermal exchange fluid, as well as a plurality of fins, crossed by said tubes and maintained in contact with these in order to guarantee thermal exchange.

If the constraint between the tubes and the fins is carried out by braze welding, the radiators are called brazed, whereas if this constraint takes place by the mechanical expansion of the tubes, the radiators are called mechanical.

The technical field to which the present invention belongs is that of mechanical radiators.

Currently, the operation of enlarging or expanding the tubes takes place by means of special machines, called "inflators", which are fitted with a number of rods equal to the number of tubes to be expanded and which have, applied to one end, an elongated bulbous body, called "olive", made in hardened steel, having an external diameter equal to the final diameter of the individual tubes.

These rods are forcibly pushed into the tubes, in such a way as that the corresponding olives permanently dilate the tubes, thus binding them in a stable position to the pack of fins.

All known inflating machines work, therefore, by thrusting the rods and, therefore, the rods are frontally loaded. Due to the fact that these rods have a diameter of approximately 6-10 mm and a length of more than 1200 mm, they are extremely thin and, therefore, are unsuitable for efficiently supporting frontal loading. As a result, the advancement of the rods is discontinuous, determining an ununiformity in the enlargement of the tubes and a consequent bad coupling with certain fins. Moreover, the operative speed is reduced and sophisticated control means are required in order to assure the correct advancement of the rods into the tubes.

These drawbacks, which become increasingly accentuated as the diameter of the tube diminishes and as their length increases, may be eliminated by making the rods work by traction instead of by thrust but, up until now, a satisfying solution to this problem has not been found, due to the necessity of having to insert the single rods from the end of the tubes opposite to the end in which the traction apparatus should be found and, therefore, due to the necessity of having these rods separable from the said traction apparatus, with all the limits and difficulties that the separation and the successive constraint involves, especially as far as industrial production is concerned.

A main aim of the invention is to realize a machine that is able to carry out the treatment of inflating the tubes in mechanical radiators by eliminating the above mentioned drawbacks, that is a machine in which the expansion rods are activated by traction instead of thrust.

A further aim of the invention is to realize a machine that allows a high operative speed to be reached.

A further aim of the invention is to realize a machine that permits automatic working cycles to be carried out.

A further aim of the invention is to realize a machine that allows the rapid re-equipping in order to operate radiators with different characteristics.

These and other aims that are described in the following description are achieved, according to the invention, through a machine for producing mechanical radiators, in particular those for motor vehicles, as described in claim 1.

The prsent invention is hereinafter further clarified in its two embodiments with reference to the enclosed sheets of drawings in which:

Figure 1 shows in front view of machine according to the invention, in a first embodiment,

Figure 2 shows the machine according to the vertical section II-II of Figure 1,

Figure 3 partially shows the machine according to an enlarged horizontal section III-III of Figure 1,

Figure 4 partially shows the machine according to the vertical section IV-IV of Figure 3,

Figure 5 partially shows the machine according to the vertical section V-V of Figure 1,

Figure 6 shows the frontal section of the machine in a different embodiment, and

Figure 7 shows the machine according to the vertical section VI-VI of Figure 6.

As can be seen from the drawings, the machine according to the invention includes, in the embodiment illustrated in Figures 1 to 5, a loading table 1 fitted to receive the radiant mass 2 to be treated, that is the group of fins 3 crossed by the tubes 4 that must be stabilized to the latter for expansion.

This loading table 1 is fixed and is provided with vertical shoulders 5 for the lateral constraint of the radiant mass 2, as well as withwo horizontal containing plates, a fixed upper one 6 and a lower one 7, vertically mobile, driven by oleodynamic jacks 8. The group of these shoulders 5 and of these plates 6 and 7 make up a perimetral delimination frame of the radiant mass 2 that, once placed on these, is stably held in its seat by a front door 9 that blocks it during treatment.

Placed above the loading table 1 is a moving apparatus for a plurality of rods 10, each of which is fitted, at the lower end, with a traditional "olive" 11 for the expansion of the tubes 4.

In the drawings, this apparatus is represented with a hook and tow plate, generically indicated by

12, whereas all of the handling and control means, that can be considered to be of the traditional type, have only been indicated schematically.

This hook and tow plate 12 includes an external frame 13, within which two toothed plates 14,14′ slide in opposite directions, which, in this way, can vary the distance between the respective teeth from a maximum value, slightly more than the diameter of the rods 10, to a minimum value, corresponding to the diameter of a circumferential groove 15 engraved on the end of the rod itself opposite the olive 11 just underneath an extremal tapering.

The opposed longitudinal movement of the two toothed plates 14,14′ takes place simultaneously, operated by a pair of actuators syncronized with the other elements in order to assure the correct execution of the operative cycle, and not shown in the drawings for the sake of illustrative semplicity.

Placed under the loading table 1 is a fixed plate 16 for centering the rods 10 and an underlying plate 17, vertically mobile with respect to the fixed plate 16, to receive, with a light elastic forcing or other suitable systems, the olives 11 of said rods 10. In particular, the fixed plate 16 may either be of the analogous type to plate 12 or, more simply, may be a metallic plate perforated in line with the distribution of the tube 4 in the radiant mass 2. The lower plate 17 is, on the other hand, provided with a plurality of seats 18 internally fitted with elastic holding means for the olives 11.

The lower mobile plate 7 of the loading table 1 is provided, in correspondence with each rod 10, with a vertical through hole 19, of internal diameter slightly superior to the maximum diameter of the olives 10 and provided with a flaring 20 on its lower side. Ducts 22 lead into each hole 19; the ducts, together with the manifolds 23 make up a lubrication network for the olives 11 during the expansion phase of the tubes 4. This network is connected to a recirculation pump and to a filter, neither of which are illustrated in the drawings.

Moreover, between the fixed plate 16 for centering rods 10 and the mobile plate 17 for holding the olives, a plurality of intermediate strips 24 is placed, connected each other to through guide mechanisms 25 and with the ends sliding along vertical guides 26, fixed to the machine structure in order to assure the substantial parallelism of the rods 10 when the plates 16 and 17 are at the utmost spaced apart notwithstanding the length and the flexibility of said rods.

The operating of the machine in this first embodiment is as follows:
if, for clarity's sake, the instant in which the radiant mass 2 has just been placed on the loading table 1 is taken as the initial instant, in this phase (see Fig. 1):

- the hook and tow plate 12 is situated at the lower end of travel position with the teeth of the plates 14,14′ at the utmost spaced apart,
- the mobile plate 17 for holding the olives 11 is situated at the lower end of travel position, and
- the rods 10 are supported from below by plate 17, which houses in each seat 18 an olive 11, and are kept parallel with respect to each other thanks to their engagement in corresponding openings in the fixed centering plate 16 and the intermediate strips 24, said openind having a large enough diameter for the passage not only of the rods 10, but also of the olives 11.

After the radiant mass 2 has been placed on the loading table 1, the front door 9 is closed, thus blocking the mass 2 against the wall opposite the table 1 and the lifting of the lower plate 7, which blocks the mass 2 itself against the fixed upper plate 6, is simultaneously caused.

After the radiant mass 2 has, in this way, been stably blocked with respect to the loading table 1, an automatic command given to the plate 17 causes the latter to rise, also causing the consequent insertion of the upper end of all of the rods 10 into the tubes 4 of the radiant mass 2. This operation is facilitated by the tapering 21 of the upper end of the rods 5 and the flaring 20 of the holes 19 in the lower plate 7 of the table 1.

Since, obviously, the length of the rods 10 is greater than the length of the tubes 4, when the olives 11 are still housed in the respective seats 18 of plate 17, the upper ends of the rods themselves will, naturally, exit from the upper plate 6 of the table 1 and can be engaged by the teeth of the plate 14,14′.

A subsequent command to the actuator member of these plates 14,14′ will cause the teeth to reciprocally draw together, engaging the rods 10 in correspondence with their circumferential groove 15.

At this point the traction of the rods 10 can begin, with are in this way forced to pass through, together with their terminal olive 11, the corresponding tubes 4, thus expanding them.

As this expansion takes place, the olives are obviously sprayed with oil with is let into the tubes 4 through the ducts 22 and, at the same time, the plate 7 is forced to remain adherent to the overyling radiant mass 2 that, following the expansion of its tubes 4, undergoes an inevitable shortening.

At the end of the ascent travel but before the rods 10 have completely exited from the respective tubes 4, the inversion of the travel of the tow plate 12 is operated, which makes the rods 10 repeat the reverse course into the tubes 4, until the olives 11, after having repeated the passage through the holes of the lower plate 7 of the table 1 as well as of the centering plate 16, are elastically engaged in

the respective seats 18 of the mobile plate 17.

At this point, the teeth of the plates 14,14′ open to disengage the rods 10 and the descent travel of the plate 17 is simultaneously operated, until the rods themselves have been made to descend and have been made to fully exit the tubes 4 without, however, disengaging them from the fixed centering plate 16.

At this point, the radiant mass 2, completely released from the rods 10, is made to undergo an action of final "pressing" by the plate 7, to compensate for the inevitable ununiformity in shortening of the various tubes 4 during their expansion and, at the end of this phase, the front door 9 is opened to lift out the radiator 2 thus obtained and to substitute it with a new radiator to be submitted to the same operative cycle.

Naturally, when it is necessary to provide with the execution of the treatment on radiant masses with different characteristics (dimensions, number and distribution of the tubes, internal diameter of the tubes), it is necessary to carry out the reequipping of the machine. This operation is carried out by replacing the loading table 1, or parts of this, as required by the new conformation of the radiator, as well as by replacing the hook and tow plate 12, the centering plate 16, the intermediate strips 24, the support plate 17 of the olives 11 and the rods 10. This operation, however, can also be automatized and, in any case, does not require long intervention times. In particular, for re-equipping operations, two mobile trolleys 27,28 can be used. The first 27, orthogonally mobile with respect to the plane of the drawing (Fig. 1) is used for the substitution of the hook and two plate 12, while the second 28, parallely mobile with respect to the plane of the drawing, is used for the substitution of the fixed centering plate 16, of the mobile plate 17 and of the intermediate strips 24.

Both trolleys are of the double type and while one part maintains the various element in the operative position, the other part is ready to receive the new elements, so that the re-equipping can be carried out by only moving the two trolleys from one end of travel position to the other. On the other hand, the substitution of table 1 is preferably carried out by hand.

From the foregoing it is evident that the machine, according to the invention, presents much greater advantages than traditional machines, inasmuch as:

- it makes the rods work by traction and therefore, by not submitting them to frontal loading, does not make them bend and assures a continuous movement along the tube to be enlarged and a uniformity in the enlargement carried out,
- it operates at a higher work speed, due to the fact that the traction allows a higher speed of axial movement of the rods to be reached than that in the case of thrust and, at the same time does not require rigorous controls that, on the contrary, are required by the others.

In the embodiment shows in Figures 6 and 7, it being understood that the basic principle is that of submitting the rods 10 with the olives 11 to traction, the machine provides the complete release of the lower end of the rods (the end, that is, fitted with the olive 11), from the radiator that has just undergone to treatment, making them then re-descend to the outside of the tubes 4. In this case, the loading table 1 is of the overturning kind, in order to aid in the positioning and the removal of the radiant mass 2 and, as well as being provided with the fixed centering plate 16, it is also provided with another centering plate 16′, mobile between a lower position adjacent to the fixed plate of the previous example, and an upper position, above the radiant mass 2, to assure the centering of the rods 10 coming out of the tubes 4 of said radiant mass 2.

The operating of the machine according to the invention in this different embodiment is as follows, with reference to an instant considered initial, in which (see Fig. 6):

- the radiant mass 2 is situated in the operative position,
- the two plate 12 is situated at the lower end of travel position, with the teeth of the plate 14,14′ open to receive the upper end of the rods 10,
- the mobile centering plate 16′ is situated at the upper end of travel position, with the openings facing the tubes 4 of the radiant mass 2, and
- the plate 17 is situated at the lower end of travel position, with the seats 18 that accomodate the olives 11.

At this point, and ascent command to the plate 17 causes the introduction of the rods 10 into the corresponding tubes 4 of the radiant mass 2, until the upper end of said rods, after having passed through the openings of the mobile centering plate 16′, can place, as in the previous case, between the teeth of the tow plate 12, which will reinsert themselves to engage said rods before raising them to carry out the enlargement of the tubes.

The ascent travel of the plate 12 stops only after the rods 10 have completely exited from the tubes 4, but have not crossed with corresponding openings of the mobile centering plate 16′. At this point, the radiant mass 2 is removed by the overturning action of the table 1 and, at the same time, a command is given for the simultaneous descent of the tow plate 12 and of the mobile centering plate 16′, until the rods 10, which are kept perfectly centered, pass through, together with the olive 11, the openings of the fixed centering plate 16 and engage themselves in the seats 18 of the plate 17.

At this point, the teeth of the plate 14,14′ are opened, and a command is also given for the descent of the plate 17 holding the olives 11 and the re-ascent of the tow plate 12 and of the mobile centering plate 16′. At the end of the ascent travel of these plates 12 and 16′, the machine is ready to receive a new radiant mass 2 and to repeat the operative cycle.

The embodiment hereabove described presents all of the advantages of the previous one as well as other advantages, in particular:

- a sole travel of the rods 10 inside the tubes 4 and, therefore, the total elimination of risks involving the alteration of the freshly carried out swelling, following the possible variation in disposition of the olives 11 during the thrust phase in the return travel, and
- a higher operative speed, due to the possibility of using the dead time of the return travel of the rods 10 to carry out the substitution of the radiator 2.

It should be noted that in this second embodiment, the upper fixed plate 6 of the overturning table 1 cannot be, as in the case of the previous embodiment, a simple perforated plate, but must be an analogous plate with respect to the hook and tow plate 12, that is, provide with mobile toothed portions; in fact, the latter must be able to hold the upper end of the tubes 4 during treatment and, at the same time, allows the passage of the olives 11 at the end of this. However, due to the fact that the toothed portions work in a different manner and are made to undergo different levels of stress, it is prerable, for the sake of semplicity, that the two toothed portions be maintained with the teeth brought nearer to each other by springs, which only permit the passage of the olives.

Claims

1. Machine for realizing mechanical radiators, particularly those for motor vehicles, including positioning and support means for the radiators to be treated and a plurality of rods provided with an expansion element at one end and associated with means for their movement along the tubes of said radiators, characterized by comprising:
- a loading table (1) removably housing a radiator (2) in a blocked condition during the expansion treatment and having the walls in contact with the ends of said tubes (4) provided with openings facing them, for the passage of said rods (10),
- vertically mobile means (17), for holding the expansion elements (11) in the correct reciprocal operative position,
- stationary means (16) placed between the loading table (1) and said holding means (17) for centering the guiding said rods (10) in the correct reciprocal operative position, and
- a device (12) for the disengageable hooking of the ends of the rods (10) not provided with the expansion element (11) and making traction on it, said device (12) being placed on the part of the loading table (1) opposite to that in which said stationary centering means (16) and said mobile holding means (17) are.

2. Machine according to claim 1 characterized in that the wall (7) of the loading table (1) furthest away from the hooking device (12) is provided with a plurality of flared holes (19) communicating with a circuit (22,23) distributing lubricating substances.

3. Machine according to claim 1 characterized in that the wall (7) of the loading table (1) furthest away from the hooking device (12) is associated to translation means (8) moving in the direction towards the opposite wall (6).

4. Machine according to claim 1 characterized in that the holding means (17) for the expansion elements (11) is composed of a plate provided with a plurality of blind seats (18) for the removable contraint of said elements (11).

5. Machine according to claim 4 characterized in that the holding means (17) for the expansion elements (11) is mobile between one position brought nearer to the loading table (1), in correspondence with which the rods (10), engaged with the expansion element (11) in the respective seats (18), cross the stationary means (16) and the loading table (1) and exit with the other end from this to be engaged by said hooking device (12), and a position further spaced from said loading table, in correspondence with which the rods (10), still engaged with the expansion element (11) in the respective seats (18), have completely exited from said loading table (1), but remain engaged in the stationary centering means (16).

6. Machine according to claim 1 characterized in that the hooking and traction device (12) is mainly formed by a plate (13) provided with a plurality of variably sized openings to pass from a condition of disengagement of said rods (10) to a condition of engagement of the same in correspondence with a notch (15) engraved in correspondence with the opposite end to that in which the expansion element (11) is foreseen.

7. Machine according to claim 6 characterized in that the hooking and traction device (12) includes a frame (13), within which pairs of teeth, facing each other and mobile in opposite directions, are supported delimiting between them openings for the engagement of said rods (10).

8. Machine according to claim 1 characterized in that between the stationary centering means (16) and the mobile holding means (17) a plurality of strips (24) for centering (10) are placed, associated with guide mechanisms (25,26).

9. Machine according to claim 1 characterized in that the hooking and traction device (12) is mobile between a position brought nearer to the loading table (1), in correspondence with which it is possible to carry out the engagement of the end of the rods (10) exiting from the tubes (4) of the radiator (2) before the beginning of the expansion phase of said tubes, and a position further spaced apart from said loading table (1), in correspondence with which the expansion element (11) of the rods (10) has substantially completed the expansion of the tubes (4), but has not exited from them.

10. Machine according to claim 1 characterized by comprising, between the hooking device (12) and the stationary centering means (16), another centering means (16′) mobile between these, the hooking and traction device (12) being mobile between a position brought nearer to the loading table (1), in correspondence to which it is possible to carry out the engagement of the ends of said rods (10) exiting from said mobile centering means (16′) when this is situated in a position further spaced from the stationary centering means (16), before the beginning of the expansion phase of the tubes (4), and a position further spaced apart from said loading table (1), in correspondence with which the expansion elements (11) have exited from the respective tubes (4) at the end of the expansion phase, but have not exited from said mobile centering means (16′).

11. Machine according to claim 10 characterized in that the wall (6) of the loading table (1) nearest to the hooking and traction organ (12) is provided with a plurality of elastically dilatable openings for the passage of the expansion element (11) of the rods (10).

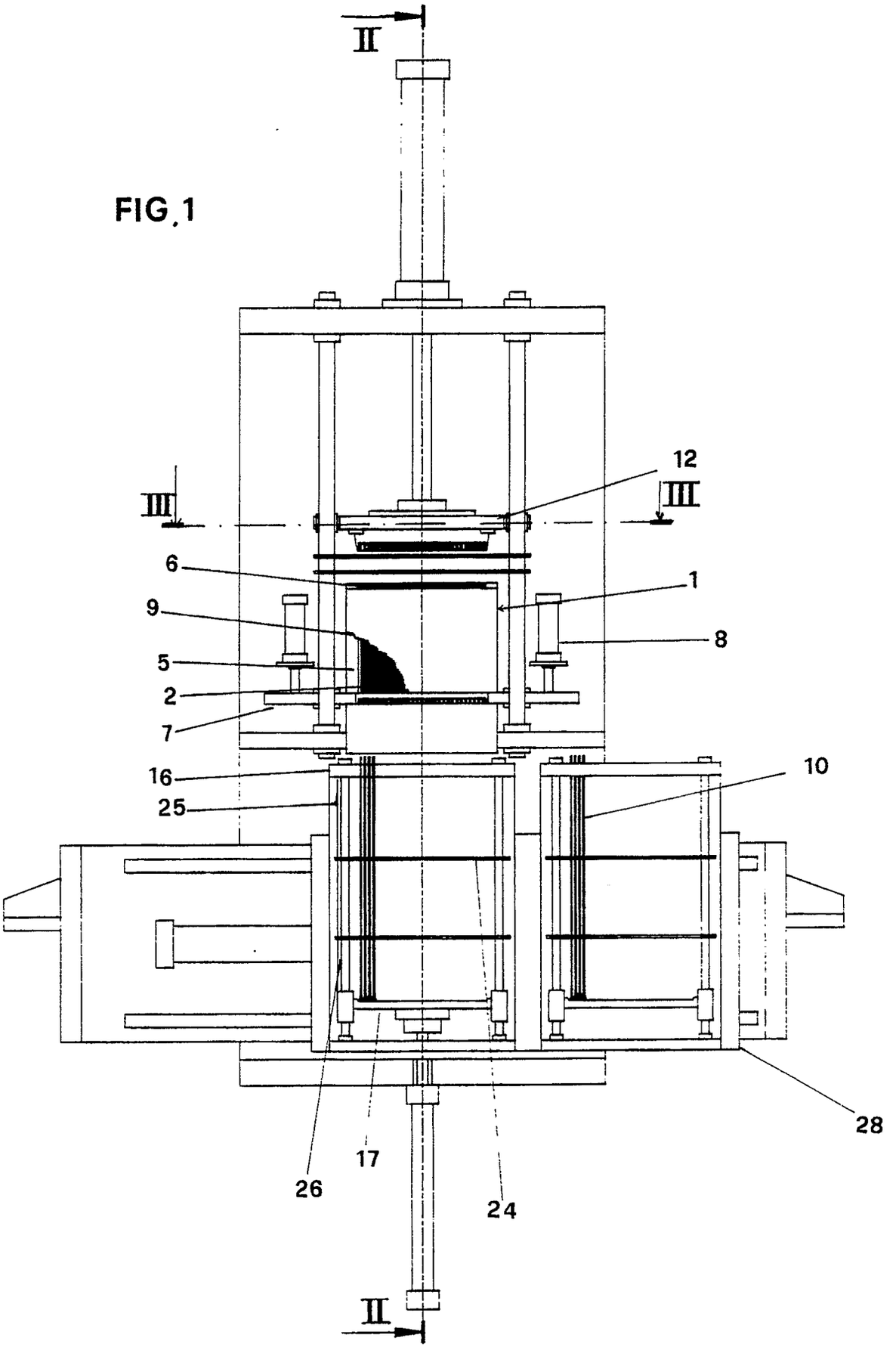
12. Machine according to claim 1 characterized in that the loading table (1) is of the overturning type.

13. Machine according to claim 1 characterized by comprising a trolley (27) with two stations for transferring the hooking and traction means into the correct operative position.

14. Machine according to claim 1 characterized by comprising a trolley (28) with two stations for transferring the stationary centering means (16) and the mobile holding means (17) into the correct operative position.

15. Machine according to claim 1 characterized in that the loading table (1) is provided with a door (9) for closing the internal space destined to house the radiator (2) and for blocking the latter against the end wall during the expansion treatment of the tubes (4).

FIG.1



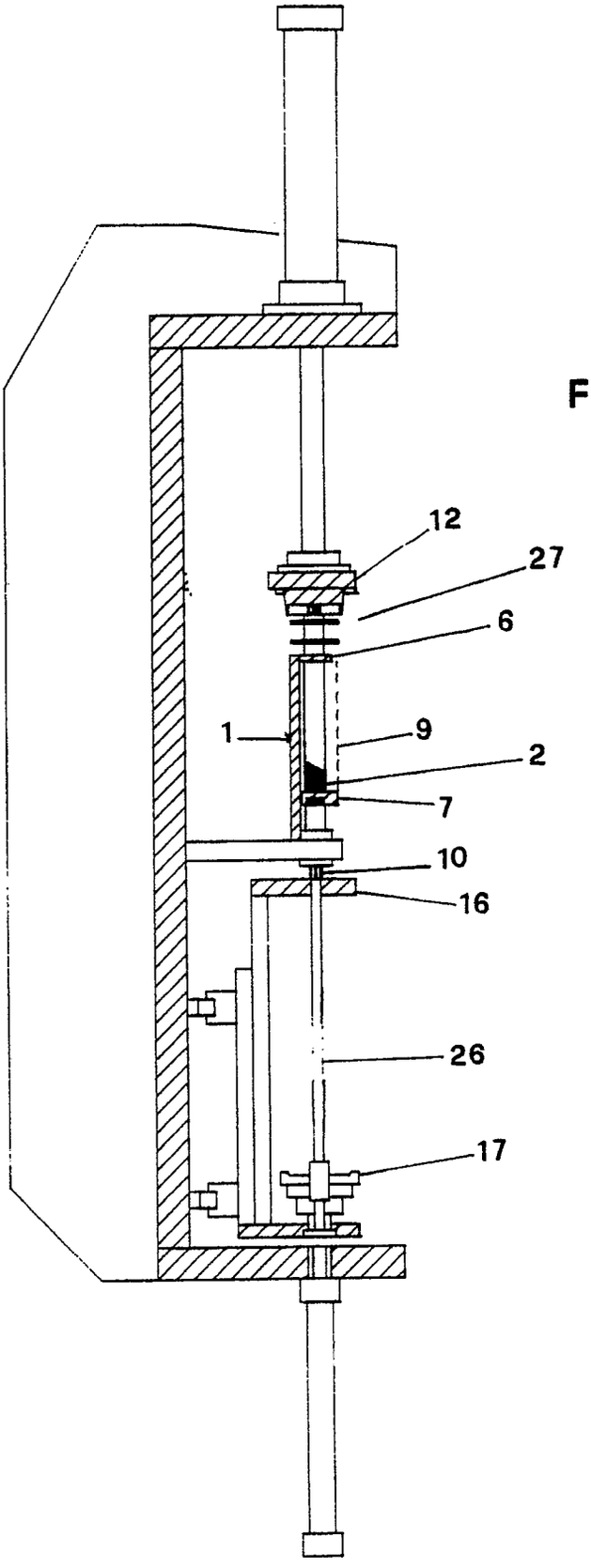


FIG.2

FIG.3

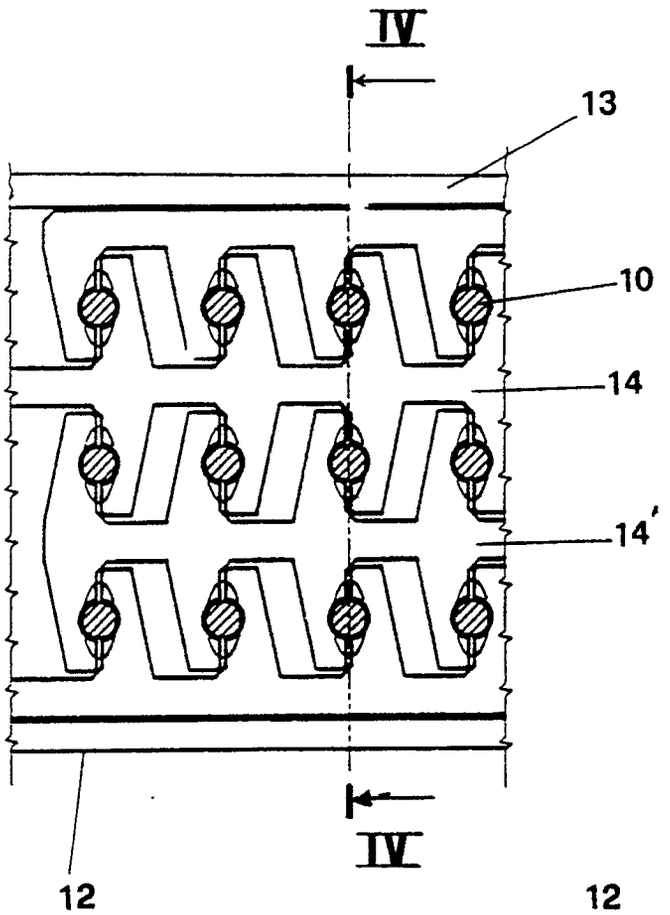
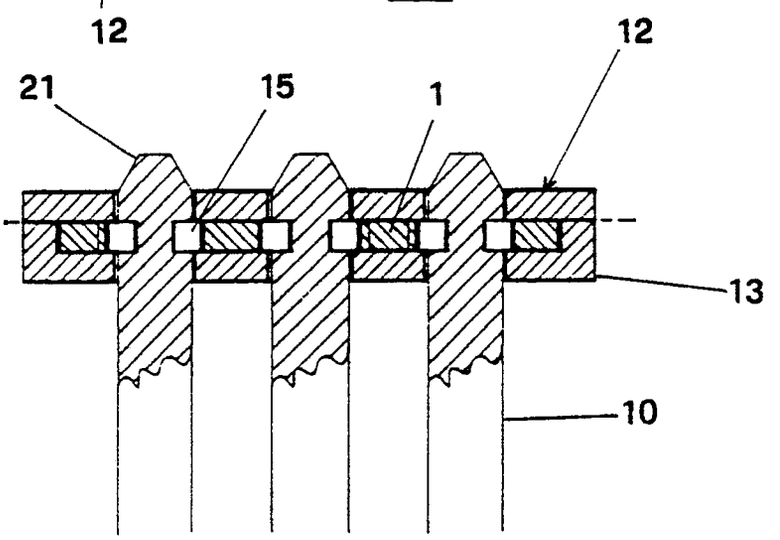


FIG.4



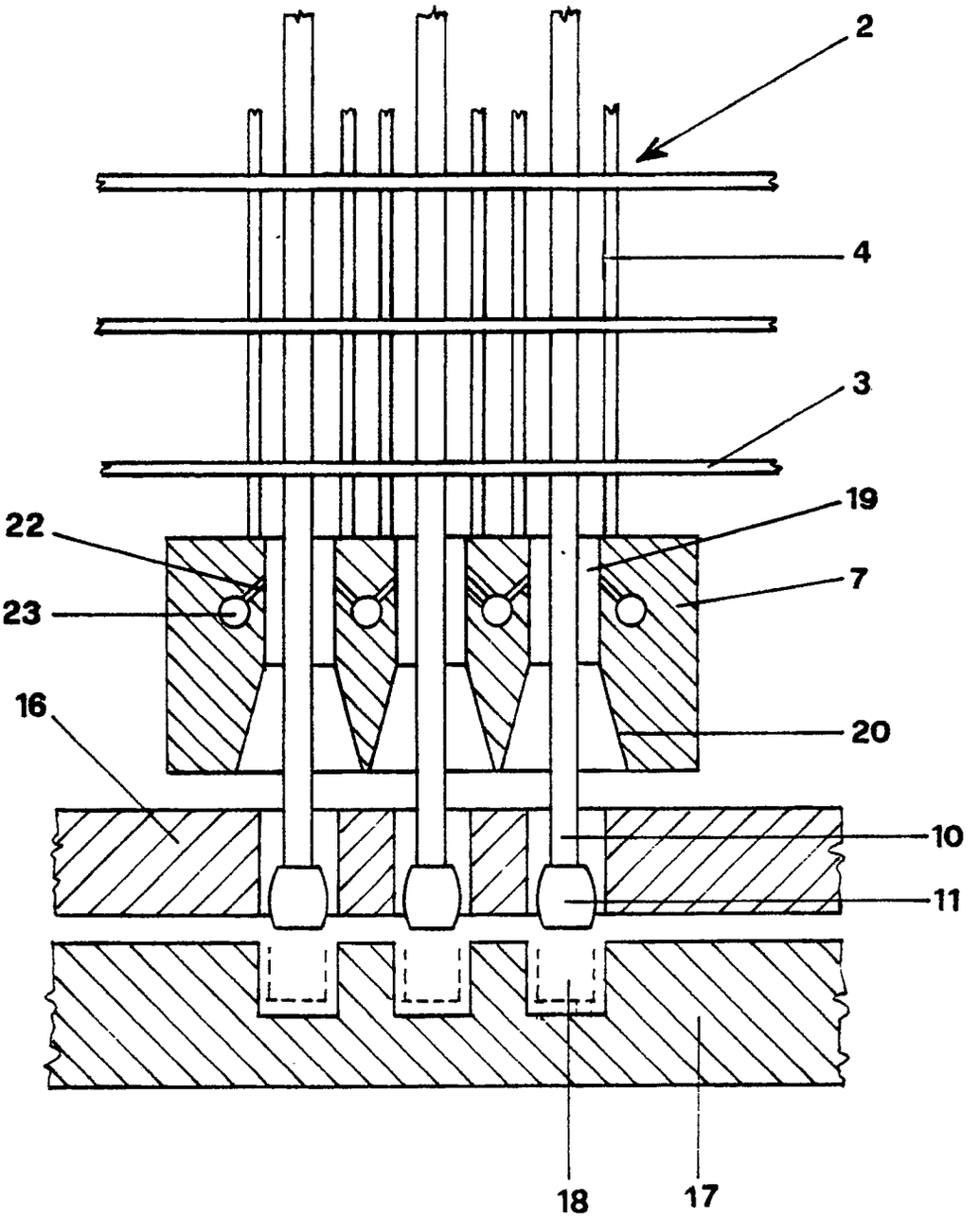
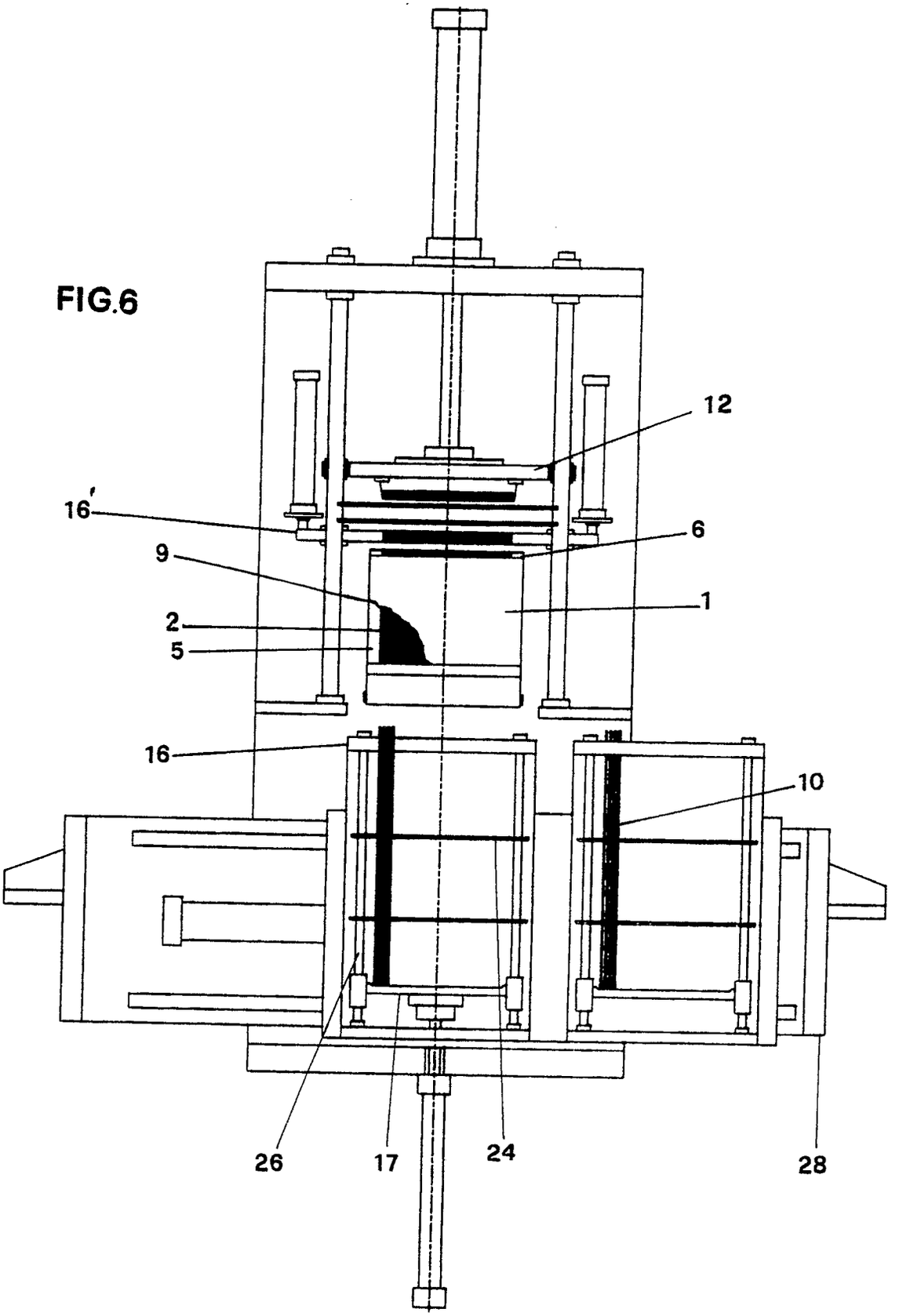
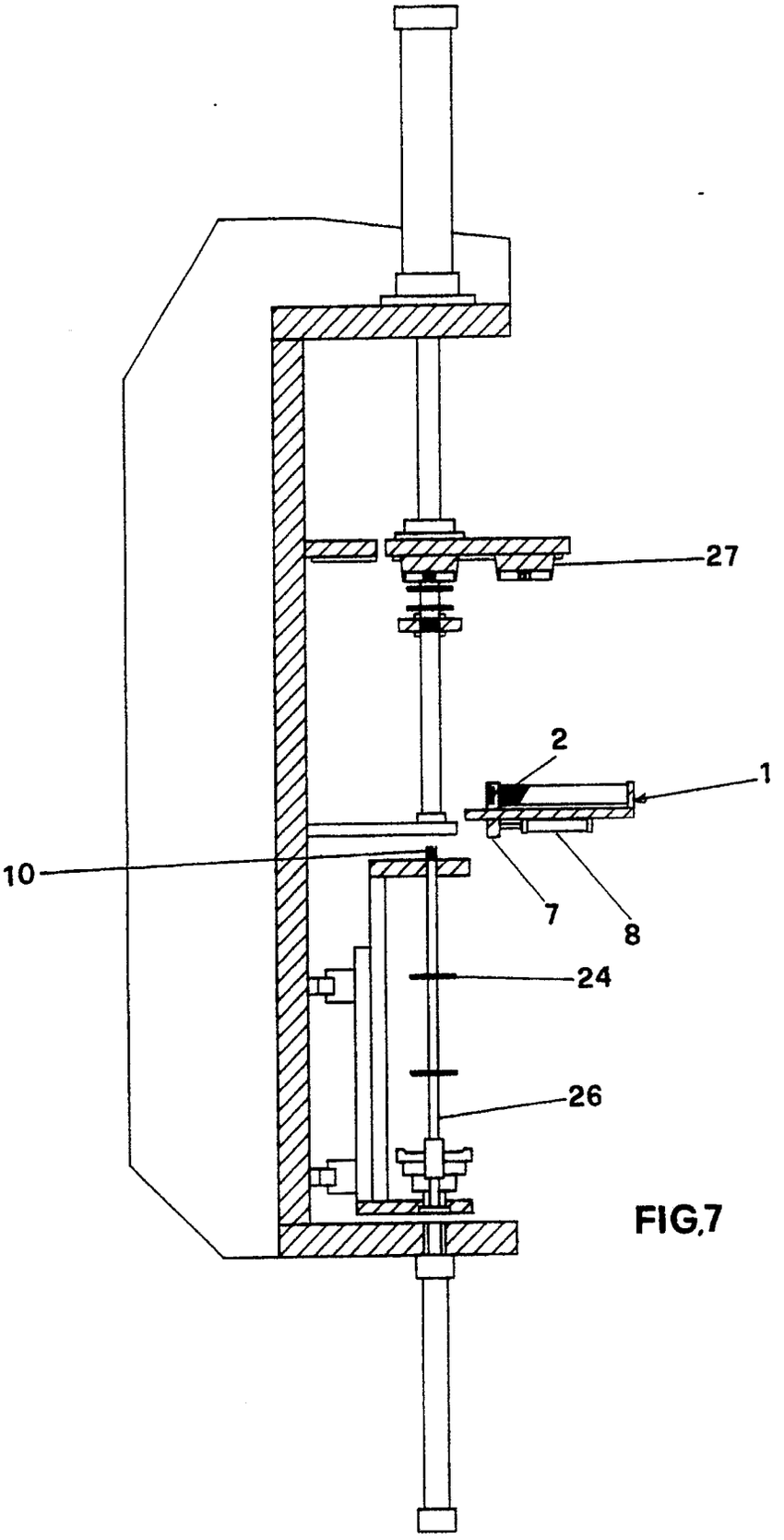


FIG.5

FIG.6





FIG,7