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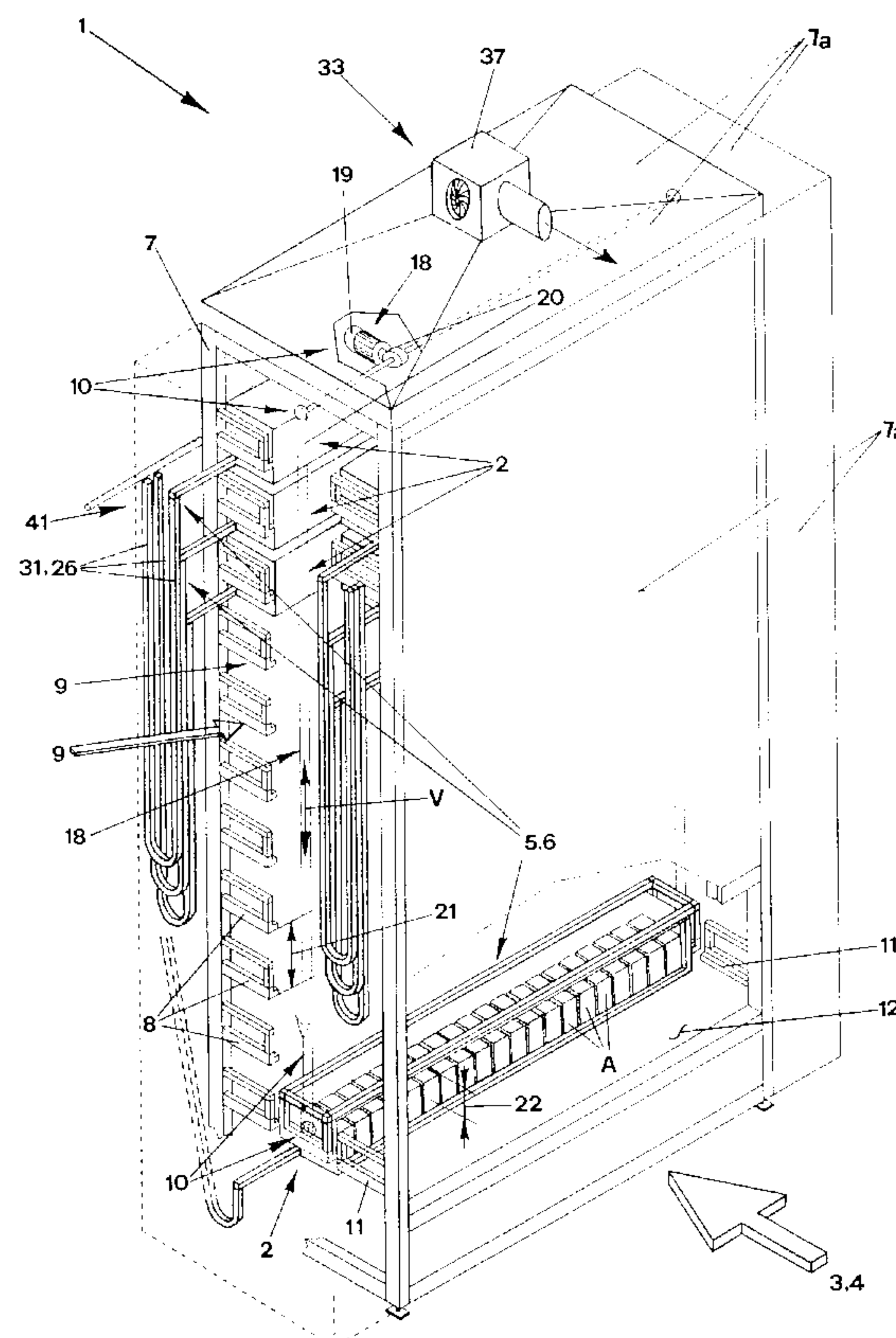
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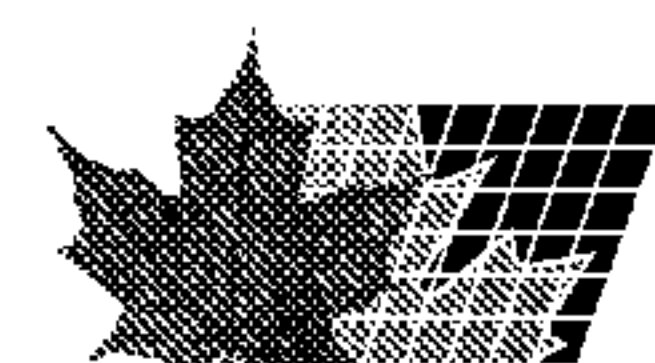
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(54) Title: ACCUMULATOR FORMING INSTALLATION



(57) Abrégé/Abstract:

The invention is an installation (1) for the forming of accumulators (A), comprising a plurality of pallets (2) suitable for supporting the accumulators (A), a loading station (3) for the loading of the accumulators to be formed and an unloading station (4), power supply means (5), electrolyte feeding means (6). The installation comprises a casing (7), provided with projecting supports (8) positioned side by side and aligned in vertical direction, suitable for supporting said pallets (2) to create the same number of accumulator (A) forming stations and handling means (10) to move the pallets (2).



## **ABSTRACT**

The invention is an installation for the forming of accumulators, comprising a plurality of pallets suitable for supporting the accumulators, a loading station for the loading of the accumulators to be formed and an unloading station, power supply means, electrolyte feeding means. The installation comprises a casing, provided with projecting supports positioned side by side and aligned in vertical direction, suitable for supporting said pallets to create the same number of accumulator forming stations and handling means to move the pallets.

-1-

## **ACCUMULATOR FORMING INSTALLATION**

### **Field of the Invention**

- 5      The invention concerns an installation for the forming of accumulators, particularly suitable for the rapid forming of lead accumulators.

### **Background of the Invention**

- 10     The forming process of the accumulators has to be understood as the charge of electricity of the accumulators before the use of them.

According to the known installations used for the forming of lead accumulators, a plurality of accumulators is placed on roller support  
15     surfaces that make it possible to move them along the production line.

In particular, in a first type of installations the accumulators reach a first filling station, where the electrolyte is fed into the accumulator.

- 20     Successively, an operator connects the poles of each accumulator to an electric network that, powered by a suitable power unit, supplies the electric energy that is necessary to charge the accumulators.

After the charging phase, which lasts from 18 to 24 hours in total, an  
25     operator disconnects the accumulators from the electric network and conveys them to a second filling station, where each accumulator is first emptied and then filled again with electrolyte with final density.

Another known type of installation features the forced circulation of the  
30     electrolyte inside the accumulator, during the charging phase.

This ensures considerable reduction in the accumulator charging time,

-2-

provided that some parameters like the density and temperature of the acids are kept constant.

5 It is important to consider that the complex electric and hydraulic networks constituting the installation make it necessary to develop it on a substantially horizontal plane.

10 The main drawback of the described installations is represented by the fact that, being substantially developed on a horizontal plane, they occupy large surfaces, which considerably influences the implementation and maintenance costs of the installation itself.

15 In particular, the cost of the racks constitutes a considerable share of the total expenses required for the implementation of the structure.

Another drawback is represented by the fact that the operators inhale noxious substances deriving from the evaporation of the acid solutions present inside the accumulator.

20 A main aspect of the present invention is to overcome the above mentioned drawbacks.

### **Summary of the Invention**

25 One of the first aspects of the invention is the implementation of an accumulator forming installation that, though maintaining the number of accumulators treated at the same time unchanged, should occupy a quite smaller surface than the known installations, thus reducing the installation costs considerably.

30 A further aspect is the implementation of an installation that should make it possible to reduce the necessary personnel, though maintaining

-3-

the same productivity as the known installations.

Another aspect of the present invention is that the installation, during the forming of the elements, should make it possible to control the  
5 noxious gases developed during the process in the best possible way, so that the operators in charge with the installation don't have any contact with these gases.

The present invention is also directed at implementing a modular  
10 installation that may be adapted and enlarged according to the needs.

According to a preferred embodiment, there is provided in an apparatus for filling and charging accumulators including a plurality of pallets adapted to support a plurality of accumulators aligned in a side-by-side  
15 relationship on a pallet, at least one loading station for loading of the accumulators to the pallets, at least one unloading station for unloading the accumulators from the pallets, power supply means for charging the accumulators and electrolyte feeding means for feeding electrolyte to the accumulators, the improvement comprising a housing  
20 for filling and charging the accumulators, the housing including a plurality of supporting means positioned in a side-by-side relationship and aligned in a generally vertical orientation such that positioning of the supports in a vertical orientation provides a plurality of filling stations, the supporting means further adapted to support the pallets in  
25 a substantially horizontal positioned arranged one on top of the other in a vertical orientation, the housing further including electrolyte feeding means operatively associated with accumulators for feeding electrolyte to the accumulators aligned on the pallets, and power supply means being operatively associated with the accumulators when aligned on the  
30 pallets, and transfer means for moving the pallets between loading and unloading stations and the filling stations .

-4-

According to another preferred embodiment, there is provided a method of filling and charging accumulators, comprising the steps of providing a plurality of pallets being adapted to support a plurality of accumulators aligned in a side by side relationship on a pallet, providing at least one loading station to load the accumulators on the pallets, providing at least one unloading station to unload the accumulators, providing a source of power for charging the accumulators and a source of electrolyte for feeding electrolyte to the accumulators, providing a housing for filling and charging the accumulators including a plurality of supporting means positioned in a side by side relationship and aligned in a generally vertical orientation such that the positioning of the supports in a vertical orientation provides a plurality of filling stations, the support means adapted to support the pallets in a substantially horizontal position in the housing and arranged one on top of the other in a vertical direction, providing transfer means to move the pallets between the loading and unloading stations and the filling stations, and filling and charging the accumulators while in the housing.

To advantage, the installation subject of the invention makes it possible to considerably increase the productivity of the accumulator forming process compared with the known installations.

Still to advantage, the installation subject of the invention can be introduced in a continuous accumulator production line.

Furthermore, the installation subject of the invention makes it possible to concentrate the accumulator filling process and the effective charging in the rapid charging phase, thus reducing production times.

The aspects and advantages described above will be highlighted in greater detail in the description of one among many possible applications of the invention in question, illustrated in the attached

drawings, wherein:

### **Brief Description of the Drawings**

- 5           FIG. 1 is an axonometric view of the accumulator forming  
installation subject of the present invention;  
FIG. 2 is a side view of the installation shown in FIG. 1;  
FIG. 3 is a partial side view of a detail of the installation shown in  
FIG. 1;
- 10          FIG. 4 is a side view of an element of the installation of FIG. 1;  
FIG. 5 is a plan view of the element of FIG. 4;  
FIG. 6 is a side view of the installation of FIG. 1 during an  
operational phase, where the handling means is in position to load  
a pallet;
- 15          FIG. 7 is a side view of the installation of Figure 1 during an  
operational phase, where the handling means has collected a  
pallet for conveyance;  
FIG. 8 is a is a side view of the installation of Figure 1 during an  
operational phase, where the handling means has conveyed the
- 20          pallet proximate a free filling station;  
FIG. 9 is a is a side view of the installation of Figure 1 during an  
operational phase, where the handling means has conveyed and  
placed a pallet within the free filling station;
- 25          FIG. 10 is a plan view of a variant application of the installation of  
FIG. 1;  
FIG. 11 represents a further variant application of the installation  
of FIG. 1.

### **Detailed Description of the Preferred Embodiments**

- 30          The accumulator forming installation of the invention is represented in  
FIG. 1, where it is indicated as a whole by 1, and comprises a plurality

-6-

of pallets 2 on/from which the accumulators A to be formed are placed/collected in correspondence with the loading/unloading stations 3 and 4, power supply means 5 and electrolyte feeding means 6 for the accumulators A to be formed.

5

The invention comprises a casing 7 provided with a plurality of projecting supports 8 positioned side by side and aligned in vertical direction, suitable for supporting the pallets 2 by placing them one on top of the other, in such a way as to create the same number of forming stations 9 for the accumulators A to be formed, and handling means, indicated as a whole by 10, suitable for moving the pallets 2 among the loading and unloading stations 3 and 4 and the forming stations 9.

In particular, in the example described herein, the loading station 3 and the unloading station 4 coincide and are defined by the pair of lower projecting supports 11 arranged on the two sides of the casing 7 and by the plane 12 situated between them.

In each one of said pallets 2 the power supply means 5 and the electrolyte feeding means 6 are positioned, as shown in detail in FIG. 2, below the ideal line, indicated by 8L, along which each pallet 2 is suspended from the respective projecting supports 8 and handling means 10.

In this manner special routes shown in FIG. 2 and indicated by P are created, which are free from hindrances and ensure the continuous feeding of the accumulators A, even during the handling phases of the pallets 2.

As far as the handling means 10 are concerned, they comprise travel means 13, visible in detail in FIG. 3, and lifting means 18, visible in detail in FIG. 1.

-7-

In particular, the travel means **13** comprise first powering means **14** and first kinematic units **15** provided with coupling means **16** suitable for mating to second coupling means **17** present on each pallet **2**, in order to ensure the coupling and the successive shifting of the pallet **2** along the horizontal direction **O**, while the lifting means **18** comprise second powering means **19** and second kinematic units **20** that permit the movement of each pallet **2** along the vertical direction **V**.

It is important to consider that the pallets **2** are vertically spaced from one another of a distance **21** that cannot be shorter than the height **22** of the accumulators **A** supported by each pallet.

It is also important to observe that each pallet **2**, as it can be seen in FIG. 3, is provided with sliding means, indicated as a whole by **23**, suitable for facilitating its movement towards or away from the loading/unloading stations **3** and **4** and towards or away from each projecting support **8** and constituted by idle rollers **24**, and said sliding means, according to a variant application of the invention, can be present on the projecting supports **8** or on the handling means **10** or on both of them.

As to the power supply means represented in detail in FIGURES 4 and 5, where they are indicated as a whole by **5**, they comprise a collector cable **25** integral with each pallet **2** and connected, by means of a flexible cable **26** visible in FIG. 1, to a continuous power unit not shown in the figure and provided with a plurality of electric terminals **27** with removable connectors **28** for the connection to the respective poles, positive and negative, of each one of the accumulators **A** to be formed.

The removable connectors **28** connect the accumulators **A** to be formed preferably, but not necessarily in series.

-8-

As to the electrolyte feeding means **6**, also visible in FIGURES **4-5**, they comprise two manifolds for the feeding and return of the electrolyte, indicated respectively by **29** and **30**, each one integral with each pallet **2** and connected, through the same number of flexible pipes **31** shown in FIG. **1**, to a feed and return unit that is not represented in the figure.

The feed and return unit provides for the forced circulation of the electrolyte inside each accumulator **A**, as required by the forming and charging process, also preventing the accumulation of hydrogen. It is well known, in fact, that during the forming process hydrogen is developed, which is highly flammable if present in the atmosphere in a percentage exceeding 4%.

Each manifold **29** and **30** is also provided with a plurality of pipes connected to the same number of filling elements **32** that can be removably connected to the filling holes of each accumulator to be formed **A**.

Each filling element **32** is preferably of the already known type. As to the pallets **2**, they comprise a support surface **35** for the accumulators **A** to be formed, said support surface being developed longitudinally and being visible in particular in FIG. **3**. Said surface is supported at the ends by a substantially U-shaped bearing structure **36**, in which the second coupling means **17** are provided and which supports the collector cable **25** and the two manifolds **29** and **30**.

Furthermore, as shown in FIG. **1**, the installation is provided with suction means, indicated as a whole by **33**, for the gases developed in each accumulator, comprising in particular an aspirator **37** positioned above the casing **7**.

-9-

The suction means is necessary, since it permits the elimination of any toxic vapours that may be inhaled by the operator in charge with the installation. The suction is more effective thanks to the presence of a plurality of panels 7a positioned on the casing perimeter and surrounding the installation.

An automatic fire fighting system, not represented in the figure, may be placed inside said space, and it should preferably be of the type with chemical extinguisher.

It must also be observed that either the flexible cable 26 and the flexible pipes 31 are supported by a releasing/retrieving unit, indicated as a whole by 41 in FIG. 1.

From an operational point of view, the installation is designed so that the accumulators A to be formed coming from the assembly line reach the loading station 3, for example by means of a conveyor belt. An operator P places them on the pallet 2, connects each removable connector 28 to the corresponding poles of each accumulator A and inserts the filling element 32 in the corresponding electrolyte filling holes of each accumulator A, thus guaranteeing the supply of power and electrolyte.

Successively the operator P, through a control panel that is not represented in the figure, operates the handling means 10, which first get near the loading station 3 and then collect the pallet 2 through the mating of the first coupling means 16 and second coupling means 17, as shown in FIG. 7, to convey said pallet 2 to a free forming station 9a, as shown in FIGURES 7 and 8.

Once the free forming station 9a has been reached, the travel means 13 automatically provide for shifting the pallet 2 horizontally and placing it

-10-

in the free forming station **9a**, as shown in FIG. **9**.

The accumulators **A** to be formed positioned on the respective forming stations **9** undergo the filling, forming and charging cycle, after which,  
5 with a procedure analogue to that described above, but performed in the reverse order, are collected from each forming station and brought to the unloading station **4**, where the operator provides for removing them.

10 In particular, the cycle of the accumulators **A** to be formed positioned on each forming station **9** is controlled by an intelligent unit, not represented in the figures, which provides for the coordination of the travel means **13** and lifting means **18** and controls the operation of the suction installation and the capacity of the electrolyte feeding  
15 installation and of the power supply installation.

A variant application of the described installation, represented in FIG. **10**, where it is indicated as a whole by **100**, is differentiated from the previous one by the fact that the handling means do not belong to the  
20 casing **7**.

In particular, said handling means **10a** are constituted by a trilateral forklift **M** that makes it possible to collect the accumulators, previously positioned side by side on a surface **44**, and then places them on each  
25 forming station defined by the casings **70**.

In a further variant application represented in detail in FIG. **11** and indicated as a whole by **170** the filling element **32** and each removable connector **28** are integral with a bearing element **45** developed  
30 longitudinally and supported at its ends by actuators, comprising for example a pair of pneumatic jacks **46** fixed to the support structure **170**.

-11-

In particular, each pneumatic jack **46**, controlled by the intelligent control unit, has the cylinder **46a** fixed to the support structure **170** and the rod **46b** hinged to the bearing element **45**.

- 5 From an operational point of view, once the accumulators **A** to be formed have been positioned on the forming station, the control unit operates the jacks **46** and moves the bearing element **45** in a substantially vertical direction, until each filling element **32** is connected to each electrolyte filling hole and each removable connector
- 10 **28** is connected to each pole.

Even though the invention has been described with reference to the enclosed drawings, upon implementation changes may be made that are all included in the inventive concepts expressed in the following claims.

**I CLAIM:**

1. In an apparatus for filling and charging accumulators (A) (1), the apparatus including a plurality of pallets adapted to support a plurality of accumulators (A) aligned in a side-by-side relationship on said pallet; at least one loading station (3) for loading of said accumulators to said pallets; at least one unloading station (4) for unloading said accumulators (A) from said pallets; power supply means (5) for charging said accumulators (A) and electrolyte feeding means (6) for feeding electrolyte to said accumulators (A), the improvement comprising :

a housing (7) for filling and charging said accumulators (A), said housing including a plurality of supporting means (8) positioned in a side-by-side relationship and aligned in a generally vertical orientation such that positioning of said supports in said vertical orientation provides a plurality of filling stations (9), said supporting means further adapted to support said pallets in a substantially horizontal positioned arranged one on top of the other in said vertical orientation;

said housing further including said electrolyte feeding means (6) operatively associated with accumulators (A) for feeding electrolyte to said accumulators (A) aligned on said pallets (2);

said power supply means being operatively associated with accumulators when aligned on said pallets; and

transfer means (10) for moving said pallets (2) between

said loading (3) and unloading stations (4) and said filling stations (9).

2. An apparatus (1) according to claim 1, wherein in each of said pallets (2), said power supply means (5) and said electrolyte feeding means (6) are positioned at a point (8L) below that of said support means (8) and said transfer means (10).
3. An apparatus (1) according to claim 1 or 2, further including first (16) and second (17) co-operating coupling means, travel means (13) having first power means (14) therefore, and first kinematic means (15), wherein said transfer means (10) includes said travel means (13) and said first power means (14) together with said first kinematic means (15), said kinematic means including said first coupling means (16) and being adapted for mating with said second coupling means (17), said second coupling means being associated with said pallets (2) to thereby move said pallets (2) in a substantially horizontal direction.
4. An apparatus according to claim 3, said transfer means including lifting means (18), having second power means (19) and second kinematic means (20) for moving said pallets (2) in a generally vertical direction.
5. An apparatus (1) according to any one of claims 1 to 4, wherein

said pallets (2) are vertically spaced from one another at a distance (21) substantially equal to or greater than the height (22) of the said accumulators (A) supported by each of said pallets.

6. An apparatus (1) according to any one of claims 1 to 5, wherein said pallets include sliding means (23) to assist in moving said pallets (2) away from and onto said transfer means (10), and onto and away from said loading (3) and unloading (4) stations, and onto and away from said projecting supports (8).
7. An apparatus (1) according to any one of claims 1 to 5, wherein said transfer means, said loading and said unloading stations, and said projecting supports include sliding means (23) to assist in moving said pallets (2) onto and away from said transfer means (10), and onto and away from said loading (3) and unloading (4) stations, and onto and away from said projecting supports (8).
8. An apparatus (1) according to claim 6 or 7, wherein said sliding means (23) are idle rollers or idle balls (24) in a substantially horizontal plane.
9. An apparatus (1) according to any one of claims 1 to 8, wherein said power supply means includes at least one collector cable (25) associated with each pallet, said collector cable being connectable to a power source by a flexible tube (26) and being

provided with a plurality of electric terminals (27), said electric terminals (27) having removable connectors (28) for connection to corresponding holes of each accumulator.

10. An apparatus (1) according to claim 9, wherein said removable connectors (28) connect said accumulators (A) in series.
11. An apparatus (1) according to claim 9, wherein said removable connectors (28) connect said accumulators (A) in parallel.
12. An apparatus (1) according to any one of claims 1 to 11, wherein said electrolyte feeding means comprises at least one electrolyte feed manifold (29), and at least one electrolyte return manifold (30), said at least one feed manifold and said at least one return manifold being integrally associated with each pallet and being connected to a releasing/retrieving unit (41) by means of a plurality of flexible tubes (31), said feed and return manifold being connected to at least one filling element (32), releasably connected to one or more filling holes of each accumulator.
13. An apparatus (1) according to claim 12, wherein each pallet includes operatively associated therewith a collector cable (25), and at least one support surface (35) of an elongated nature for supporting a plurality of accumulators in said side-by-side relationship, and at least one elongated bearing assembly (36),

being adapted to support said collector cable (25), said feed manifolds (29) and said return (30) manifolds.

14. An apparatus (1) according to claim 13, said bearing assembly (36) further including actuators for automatic connection of said electric terminals to said accumulators (A).
15. An apparatus (1) according to any one of claims 1 to 14, further including suction means (33) adapted to remove or eliminate gases developed in said accumulators (A) during a charging phase.
16. An apparatus (1) according to claim 15, wherein said suction means includes at least one aspirator (37) positioned above said housing (7).
17. An apparatus (1) according to any one of claims 1 to 11, further including at least one flexible cable (26) and at least one flexible tube (31) supported by a corresponding releasing/retrieving unit (41).
18. An apparatus (1) according to any one of claims 1 to 17, wherein said housing includes a plurality of panels (7a) about the perimeter thereof to delimit the volume of said apparatus (1).

19. An apparatus (1) according to any one of claims 1 to 18, further including fire extinguishing means.

20. A method of filling and charging accumulators, comprising the steps of :

providing a plurality of pallets being adapted to support a plurality of accumulators aligned in a side by side relationship on said pallet:

providing at least one loading station to load said accumulators on said pallets;

providing at least one unloading station to unload said accumulators ;

providing a source of power for charging said accumulators and a source of electrolyte for feeding electrolyte to said accumulators;

providing a housing for filling and charging said accumulators including a plurality of supporting means positioned in a side by side relationship and aligned in a generally vertical orientation such that said positioning of said supports in said vertical orientation provides a plurality of filling stations, said support means adapted to support said pallets in a substantially horizontal position in said housing and arranged one on top of the other in said vertical direction,

providing transfer means to move said pallets between said

**loading and unloading stations and said filling stations, and  
filling and charging said accumulators while in said housing.**

- 21. A method according to claim 20, wherein said step of handling further includes lifting said pallets in a substantially vertical direction in said housing.**
- 22. A method according to claim 21 or 22, further including the step of lifting said pallets such that each of said pallets are vertically spaced from each other by a distance substantially equal to or greater than the height of said accumulators when supported on each of said pallets.**

1/8

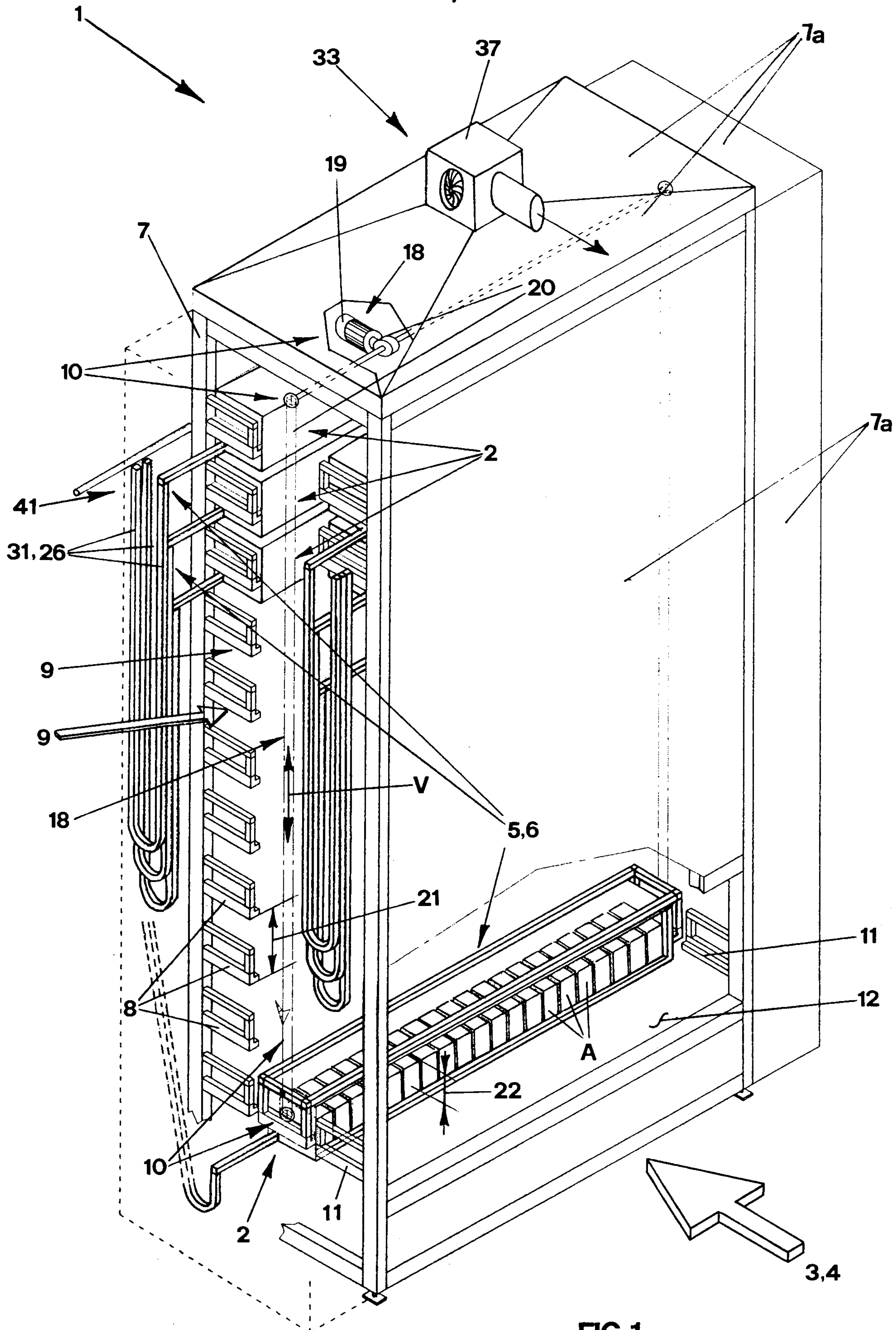
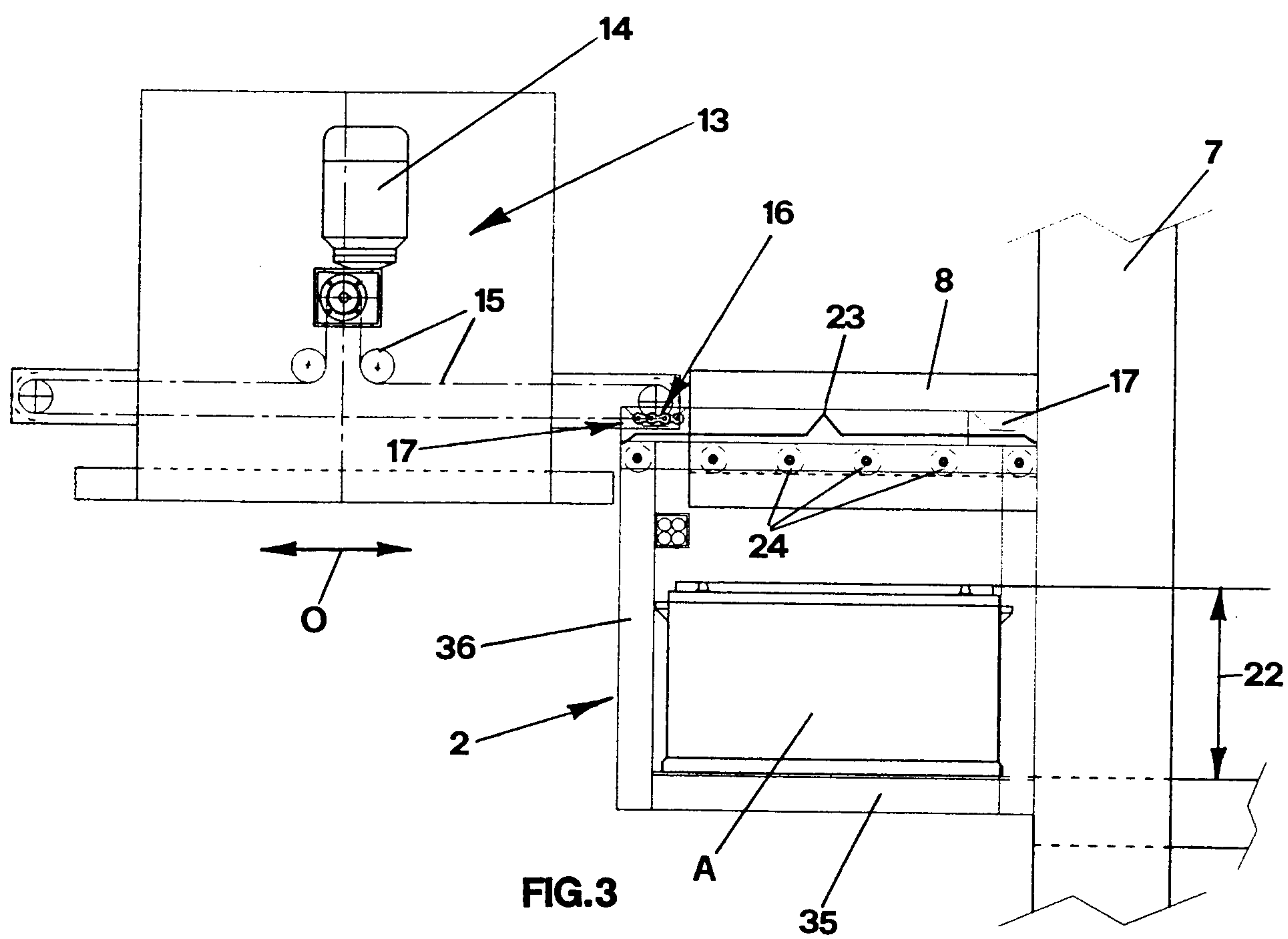
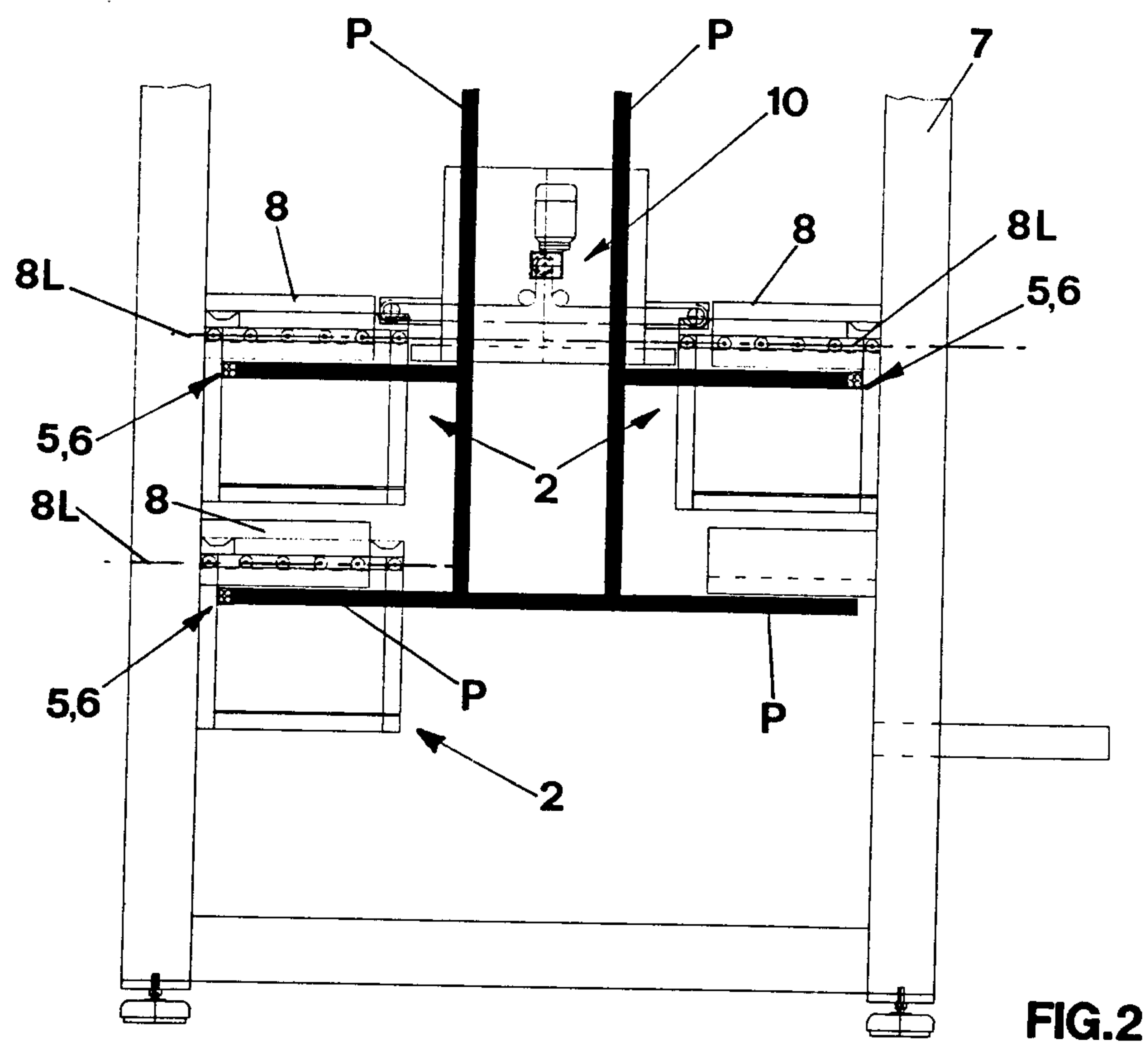
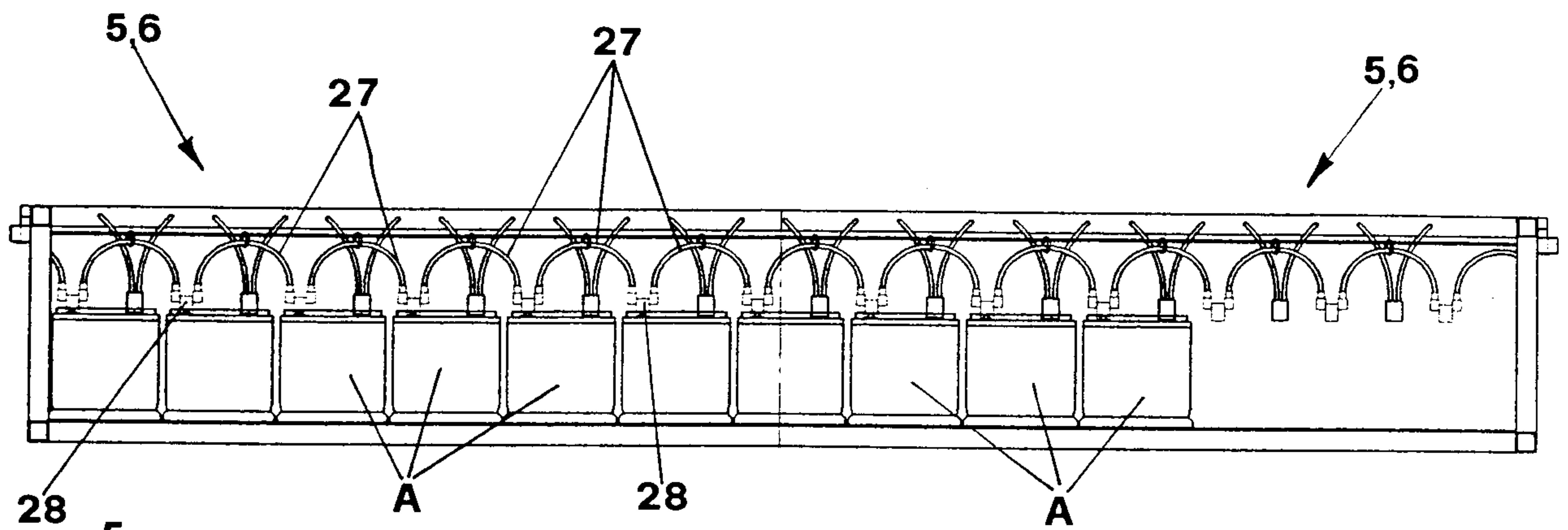
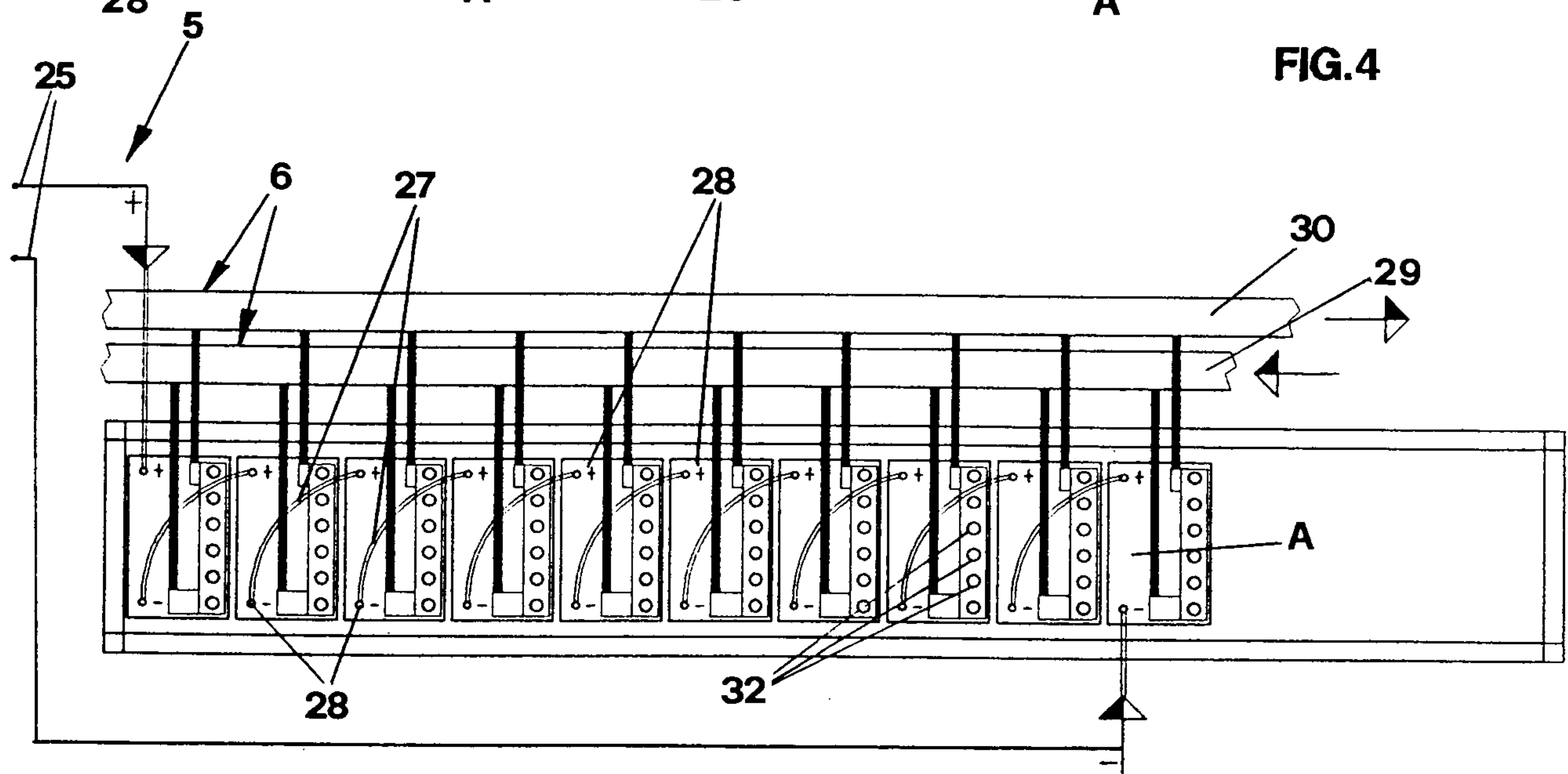


FIG.1

**2/8**

**3/8****FIG.4****FIG.5**

4/8

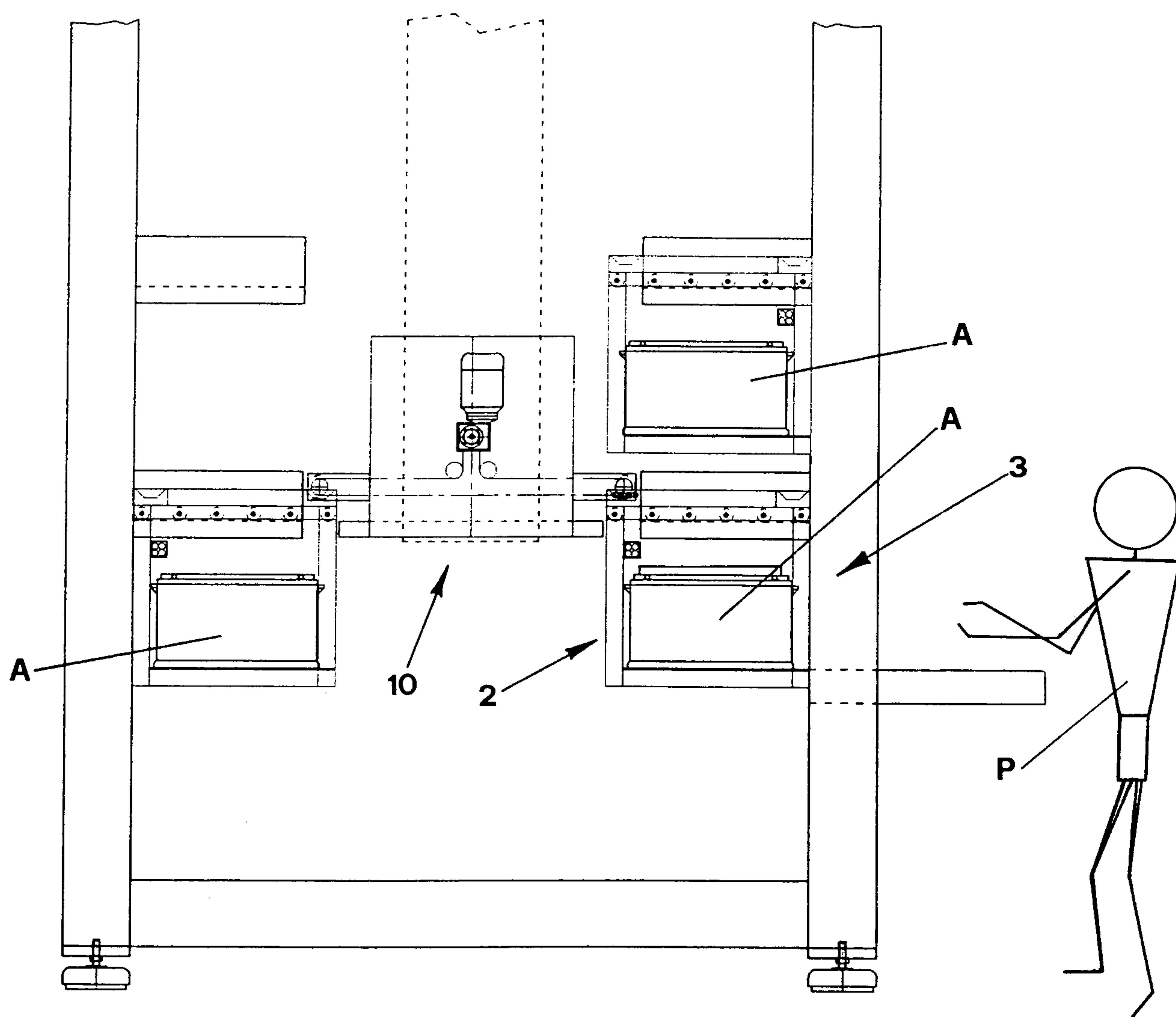


FIG. 6

5/8

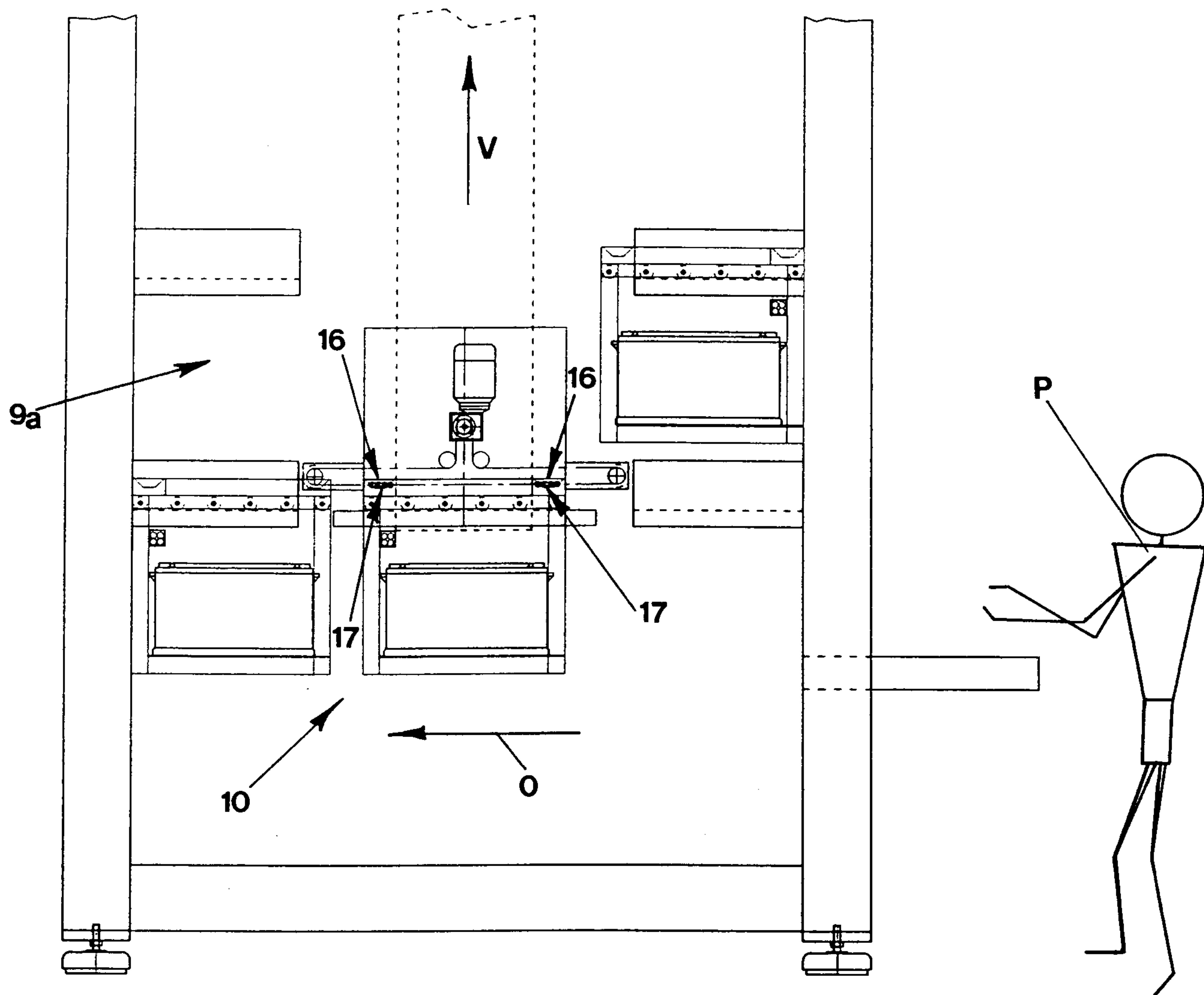


FIG.7

6/8

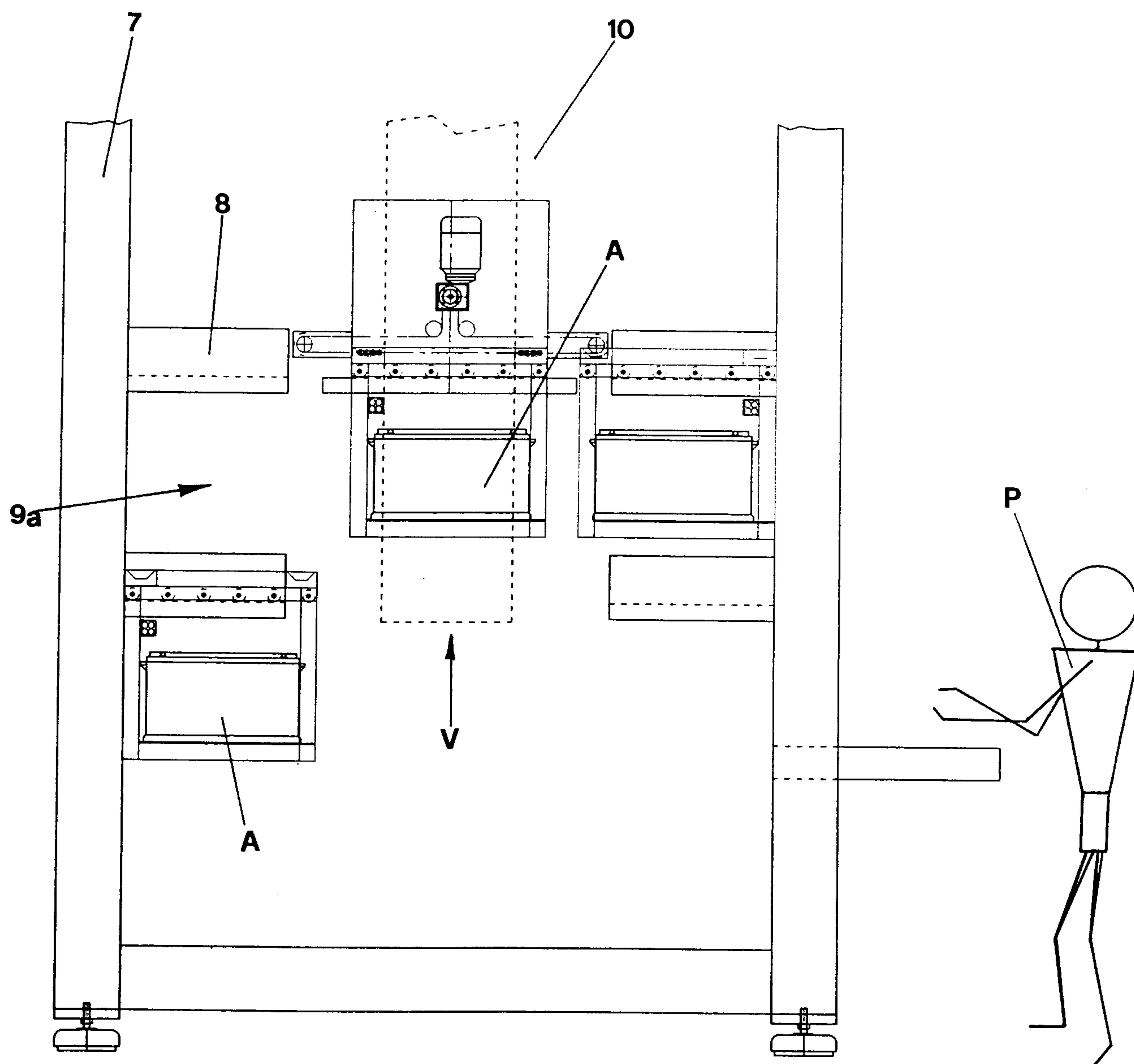


FIG.8

7/8

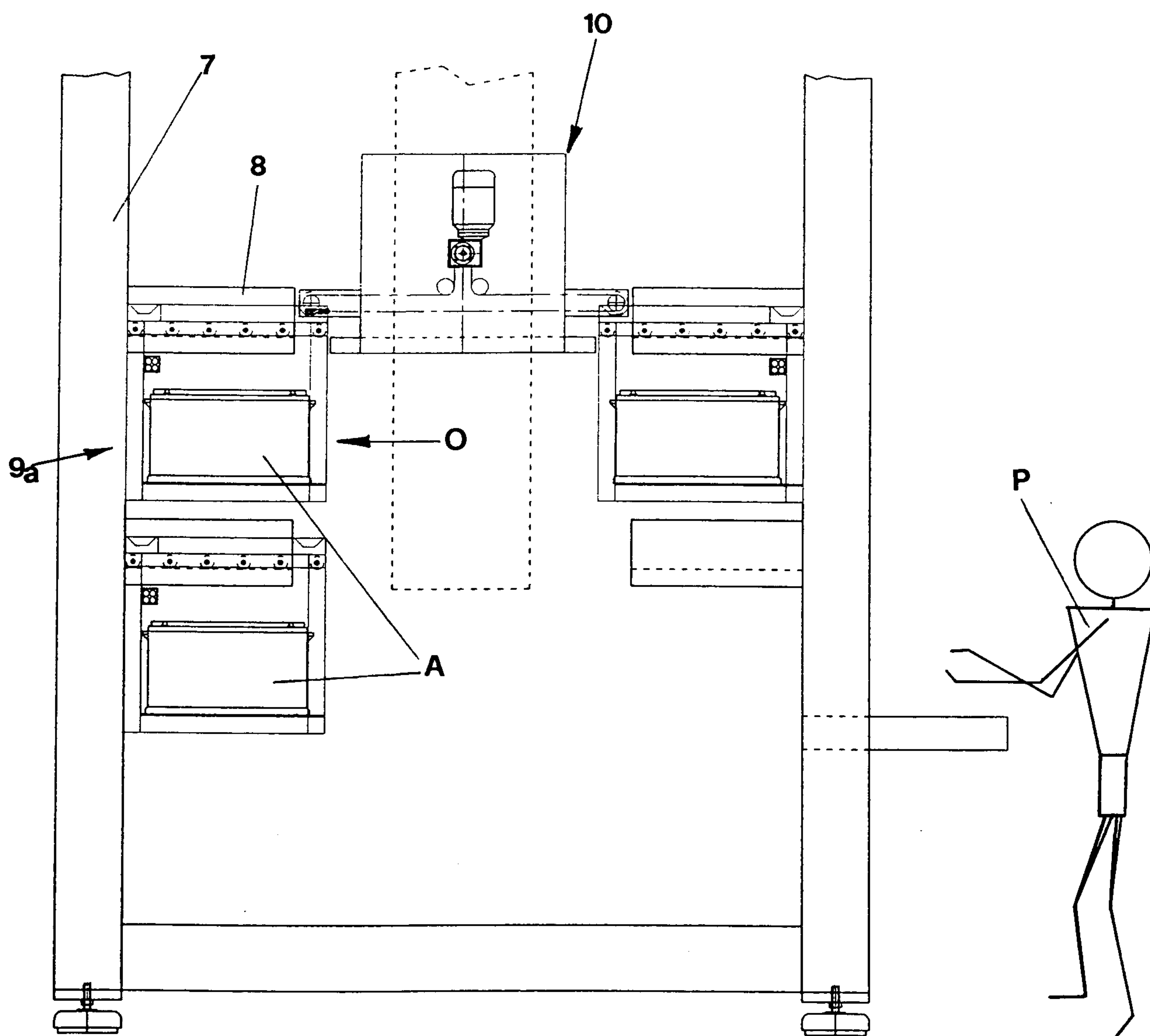
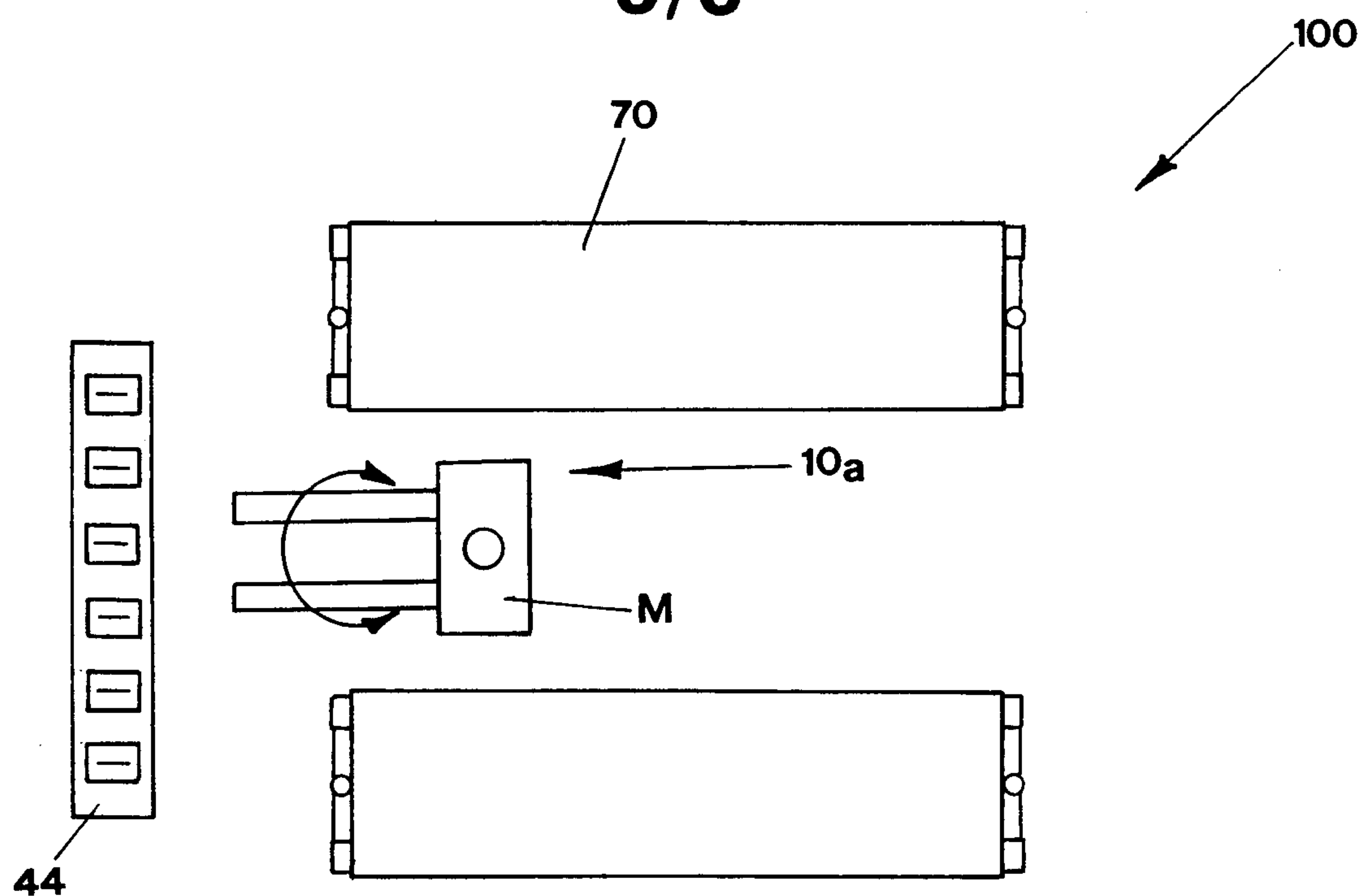
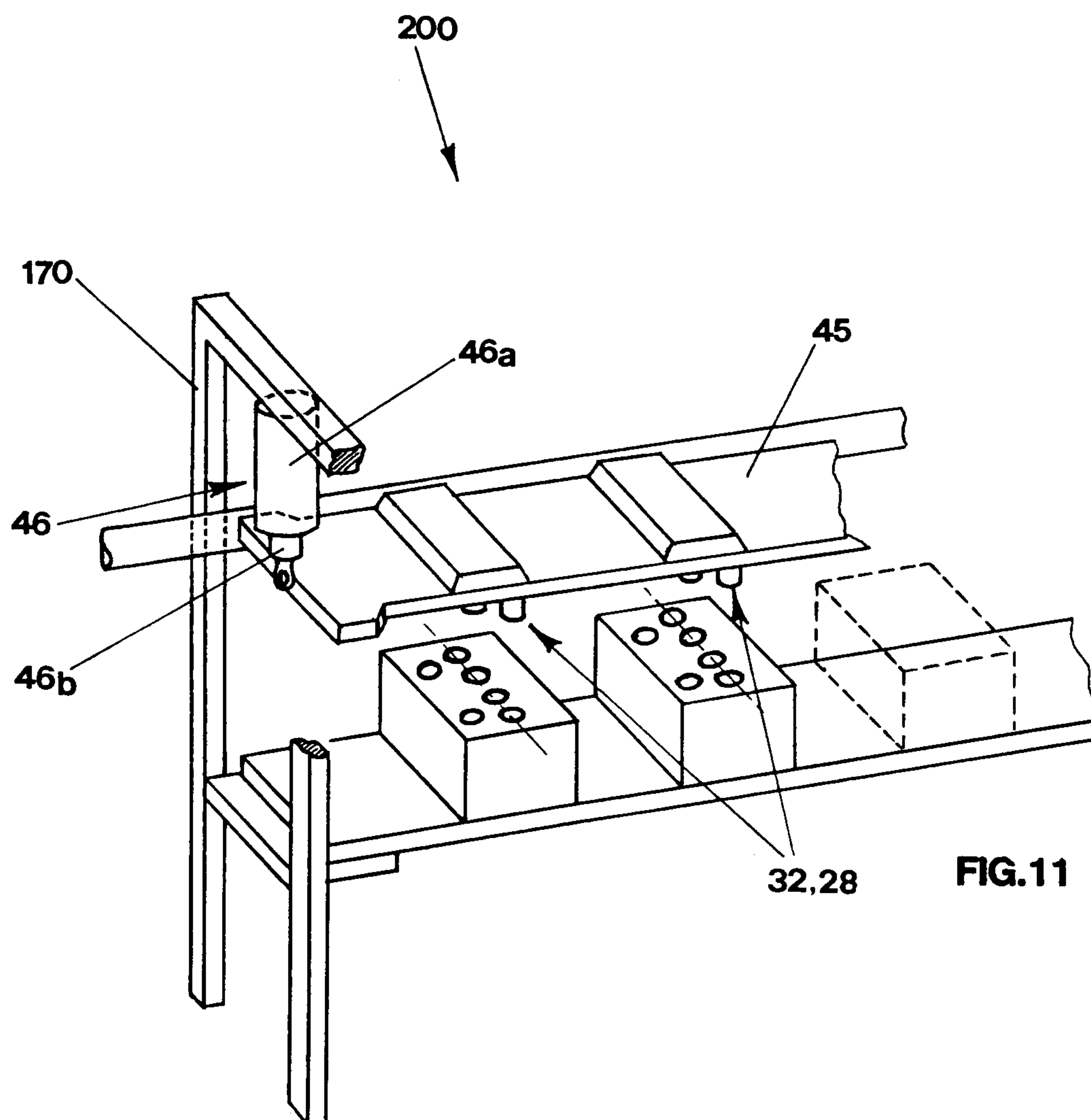


FIG. 9

**8/8****FIG.10****FIG.11**

