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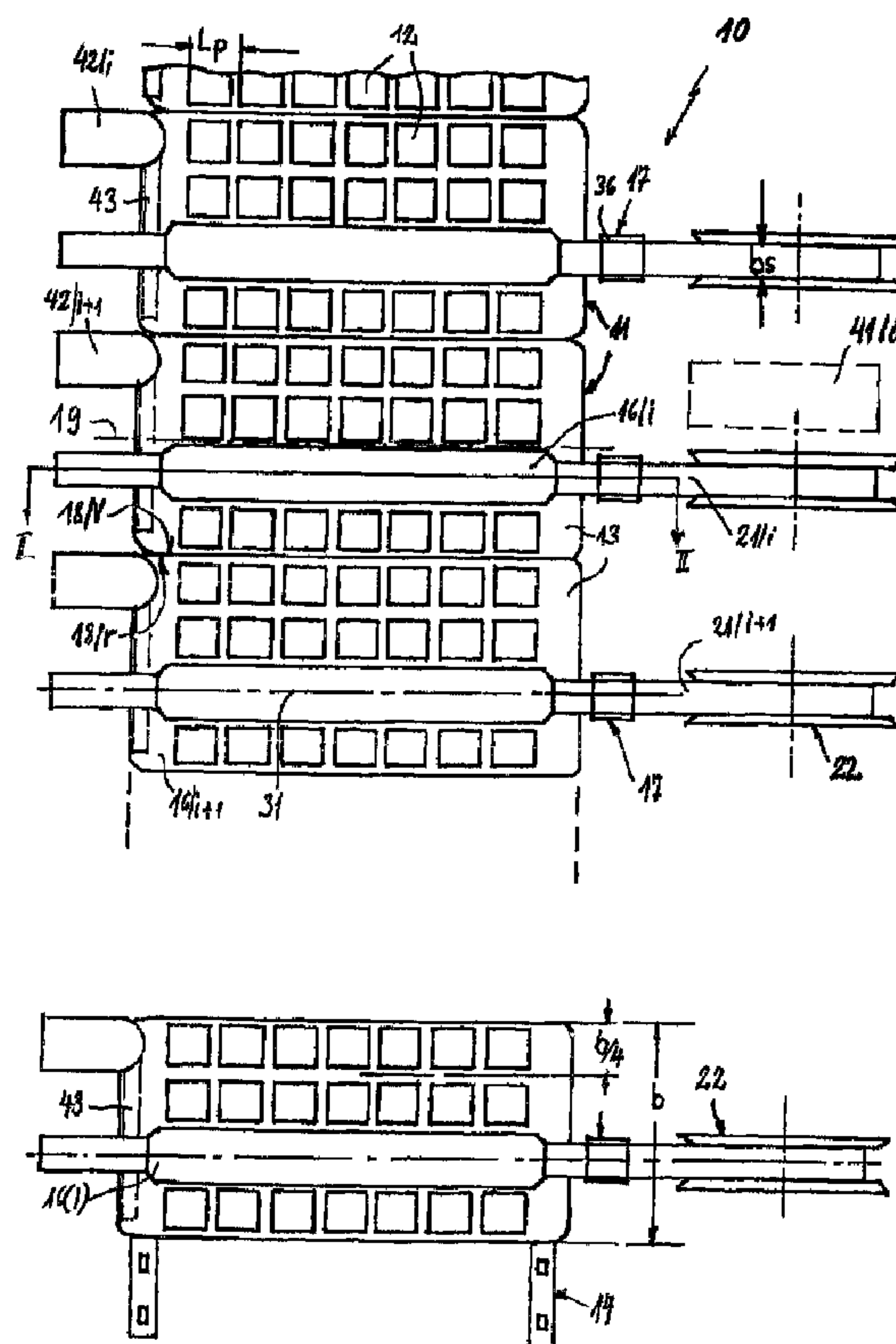
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(54) Titre : DISPOSITION PERMETTANT DE REMPLIR DES EMBALLAGES AVEC LE MEDICAMENT PRESCRIT QUI CORRESPOND AUX BESOINS HEBDOMADAIRES DES PATIENTS

(54) Title: ARRANGEMENT FOR FILLING PACKAGING UNITS WITH THE PRESCRIBED MEDICATION CORRESPONDING TO PATIENTS' WEEKLY REQUIREMENTS



(57) Abrégé/Abstract:

The invention relates to an installation for filling weekly blister packs, i.e packaging units (11), with doses of different medicaments corresponding to the weekly requirements of several patients and to be taken by the respective patient in a certain order according

**(57) Abrégé(suite)/Abstract(continued):**

to the day of the week and the time of day, according to a doctor's prescription. Said installation is provided with output stations (19) associated with the medicaments, for automatically filling all or selected compartments (12) line-by-line. A longitudinal transport device (14) is used to sequentially transport the weekly blister packs to the output stations (16) that are individually associated with the different medicaments. The medicament doses are supplied to the output stations by means of transversal transport devices (17) individually associated with the medicaments. The longitudinal transport device and the transversal transport devices are co-ordinated in terms of transport course and transport capacity, in such a way that for each transport course of the weekly blister pack (11), in the direction of the gaps of the receiving compartment arrangement, and for each transport course of the transversal transport devices, in the linear direction of the receiving compartment arrangement, the receiving compartments (12) can be filled sequentially line-by-line, during synchronised stationary phases of the blister pack and medicament transport cycles. In order to control the output stations (16) in such a way as to fill the weekly blister pack with the prescribed medicament, an electronic control unit (41) processes information about patients, said information being continuously supplied to said unit in such a way that it is synchronised with the blister pack advancing movements.

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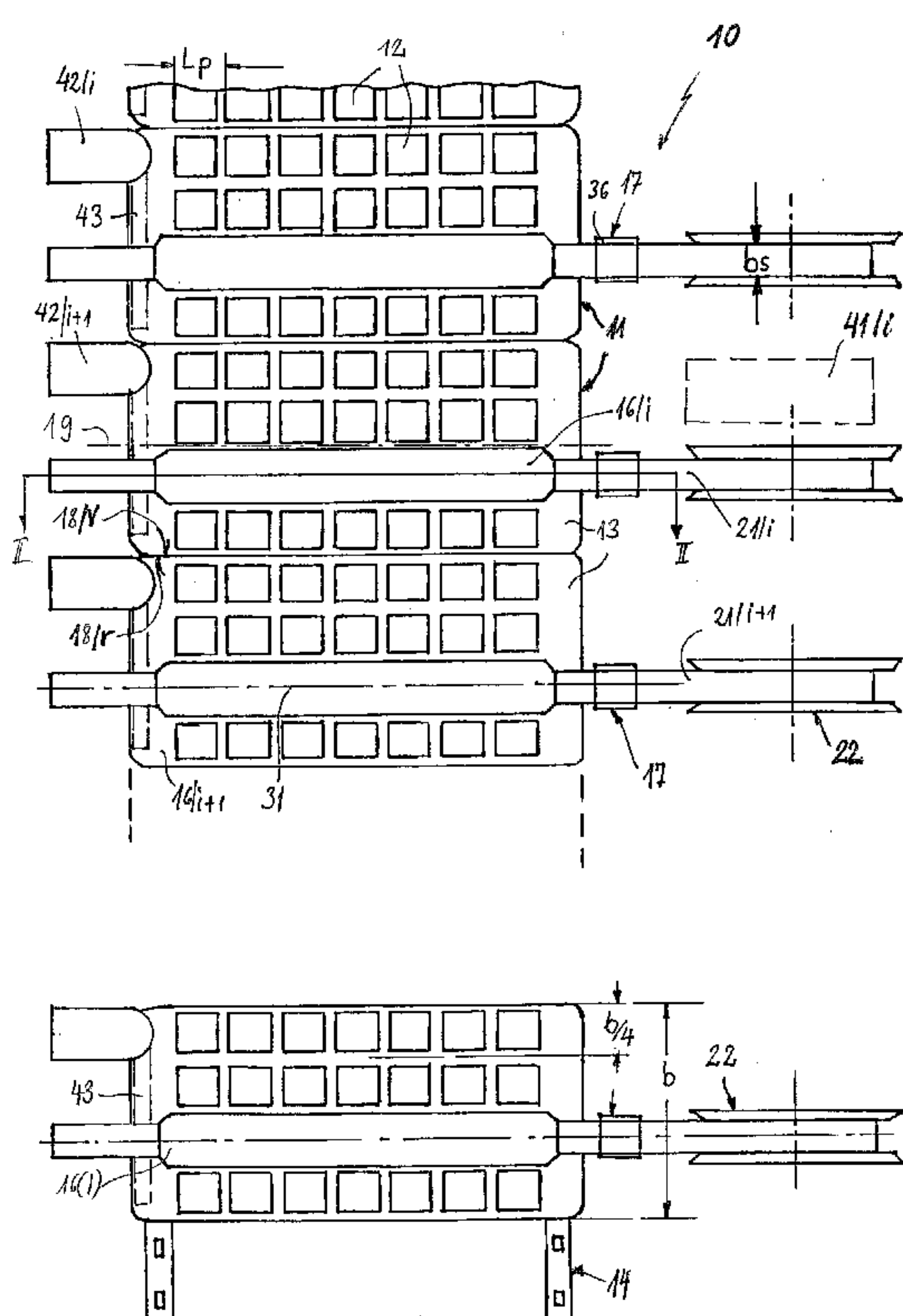
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(54) **Title:** INSTALLATION FOR FILLING PACKAGING UNITS WITH MEDICAMENTS FOR PATIENTS ACCORDING TO  
THE PRESCRIBED WEEKLY REQUIREMENTS(54) **Bezeichnung:** ANLAGE ZUR BESTÜCKUNG VON VERPACKUNGSEINHEITEN MIT DEM VERORDNUNGSGEMÄS-  
SEN WOCHENBEDARF VON PATIENTEN ENTSPRECHENDEN MEDIKAMENTEN(57) **Abstract:** The invention relates to an installation for filling weekly blister packs, i.e. packaging units (11), with doses of different medicaments corresponding to the weekly requirements of several patients and to be taken by the respective patient in a certain order according to the day of the week and the time of day, according to a doctor's prescription. Said installation is provided with output stations (19) associated with the medicaments, for automatically filling all or selected compartments (12) line-by-line. A longitudinal transport device (14) is used to sequentially transport the weekly blister packs to the output stations (16) that are individually associated with the different medicaments. The medicament doses are supplied to the output stations by means of transversal transport devices (17) individually associated with the medicaments. The longitudinal transport device and the transversal transport devices are co-ordinated in terms of transport course and transport capacity, in such a way that for each transport course of the weekly blister pack (11), in the direction of the gaps of the receiving compartment arrangement, and for each transport course of the transversal transport devices, in the linear direction of the receiving compartment arrangement, the receiving compartments (12) can be filled sequentially line-by-line, during synchronised stationary phases of the blister pack and medicament transport cycles. In order to control the output stations (16) in such a way as to fill the weekly blister pack with the prescribed medicament, an electronic control unit (41) processes information about patients, said information being continuously supplied to said unit in such a way that it is synchronised with the blister pack advancing movements.

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**(57) Zusammenfassung:** Bei einer Anlage zur Bestückung von Wochenblister, d. h. Verpackungseinheiten (11) mit dem Wochenbedarf einer Vielzahl von Patienten entsprechenden Verabreichungseinheiten verschiedener Medikamente, die in einer nach Wochentag und Tageszeit geordneten Folge gemäß einer ärztlichen Verordnung, vom jeweiligen Patienten eingenommen werden sollen, sind den Medikamenten zugeordnete Ausgabestationen (16) vorgesehen, an denen eine "zeilenweise" Bestückung aller oder ausgewählter Fächer (12) automatisch erfolgt; es ist eine Längs-Transporteinrichtung (14) vorgesehen, mittels derer die Wochenblister sequentiell zu den verschiedenen Medikamenten individuell zugeordneten Ausgabestationen (16) transportierbar sind. Die Zuführung der Medikament-Verabreichseinheiten zu den Ausgabestationen erfolgt mittels den Medikamenten individuell zugeordneter Quer-Fördereinrichtungen (17). Die Längs-Transporteinrichtung und die Quer-Fördereinrichtungen sind hinsichtlich Transporthub und Förderkapazität dahingehend aufeinander abgestimmt, dass pro - in Spaltenrichtung der Aufnahmefachanordnung erfolgndem - Transporthub der Wochenblister (11) und pro - in Zeilenrichtung der Aufnahmefachanordnung erfolgndem - Förderhub der Quer-Fördereinrichtungen eine sequentiell zeilenweise Bestückung der Aufnahmefächer (12) erzielbar ist, die jeweils in synchronisierten Stillstandsphasen der Blister-Transport und Medikament-Förderzyklenerfolgt. Zur Ansteuerung der Ausgabestationen (16) im Sinne der verordnungsgerechten Medikamenten-Bestückung der Wochenblister ist eine elektronische Steuereinheit (41) vorgesehen, die Informationen über die Patienten verarbeitet, die ihr mit den Blister-Vorschubbewegungen synchronisiert fortlaufend zugeleitet werden.

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**Arrangement for filling packaging units with the prescribed medication corresponding to patients' weekly requirements**

**5 Description**

The present invention relates to an arrangement for automatically filling packaging units of medication with administration forms - capsules, tablets, pills - of  
10 various medicaments corresponding to the individual weekly requirements of numerous patients, that are to be taken by the respective patient in an ordered sequence according to date - day of the week - and time of day - morning, midday, evening, night time - corresponding to a patient's medical  
15 medical prescription, and with the further generic.

Packaging units of the type corresponding to the prior art have been used in the public domain in the Federal Republic of Germany in the form of medicament cassettes by the  
20 company Temmler GmbH and are therefore generally known.

Such packaging units are intended to help patients who regularly have to take a plurality of different medicaments, by ensuring on the one hand that the patients  
25 do not forget to take important medicaments, and on the other hand also providing a reliable check of which medicaments they have already taken, in order to prevent an over-medication, which could be dangerous.

30 The "usual" filling of such cassettes "by hand" is very time-consuming and in practice can be carried out

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sufficiently reliably only by highly qualified staff, which involves correspondingly high labour costs.

In order to reduce such costs, a compact arrangement  
5 suitable for use in the clinical sector is known [(IV/MEDI  
CO., LTD. 390-1, Shin Won Dong, Seo Cho Gu, Seoul, Korea)],  
in which medicaments corresponding to the weekly  
requirements of a patient can be mechanically filled in a  
packaging unit, and which obviously also assists in  
10 maintaining the correct chronological sequence for taking  
the medicaments. Computer-stored data relating to the  
patient and the relevant medical medical prescription are  
used for the individualised distribution of the medicaments  
from a magazine that contains up to 400 different  
15 medicaments in separate cassettes, as well as for the  
packaging, according to the order of administration, of the  
sorted medicaments in tubular packaging units, from which  
the medicaments can if necessary be removed for further  
sorting. The patient-related choice of the medicaments and  
20 their packaging is effected serially, in such a way that  
batches of medicaments associated with various patients can  
be obtained in sequence, i.e. where the choice of the  
medicaments for a patient is started only after the choice  
of the medicaments for a previously considered patient has  
25 been completed.

The known arrangement has the disadvantage that the filling  
of a plurality of packaging units takes a relatively long  
time, since the filling of a packaging unit can only be  
30 started after a necessary packaging to be filled beforehand  
has been completely filled. The known arrangement would

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not be suitable for a more or less industrial use in the  
wholesale pharmaceutical sector, in which it would be  
necessary to be able to turn out somewhere in the region of  
50,000 packaging units per day. Such a quantitative  
5 requirement could not be practically met with the necessary  
degree of reliability.

The object of the invention is therefore to provide an  
arrangement of the type mentioned in the introduction,  
10 which enables a sharp increase in the number of  
deliverable, individually different consumption packaging  
units to be achieved, a typical order of magnitude for a  
24-hour operation of the arrangement being 100,000 units,  
obviously with the secondary condition of as high a  
15 certainty as possible of conformity with the pharmaceutical  
regulations.

This object is achieved according to the basic concept of  
the invention.  
20

According to this, in the filling arrangement according to  
the invention delivery stations individually associated  
with the medicaments are provided, in which a filling  
related to time of day or day of the week of receiving  
25 compartments of the packaging unit arranged one after the  
other in lines can be carried out; a "longitudinal"  
transporting device is furthermore provided, by means of  
which the packaging units can be transported in a  
predetermined transporting direction in sequence to

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delivery stations individually associated with the various medicaments, which stations are in this connection provided in a multiplicity corresponding to the number of medicaments and can be used to fill different cassettes;

5 the supply of the medicament administration units to the delivery stations is effected by means of transverse conveying devices individually associated with the medicaments, which can be controlled in parallel to the delivery of medicaments that are delivered for filling a

10 plurality of different packaging units; for this purpose the longitudinal transporting device and the transverse conveying devices are comprehensively matched to one another as regards transporting stroke and conveying capacity, so that in each case a line-by-line filling of

15 the receiving compartments per transporting stroke of the packaging units and per conveying stroke of the transverse conveying devices can be achieved, which in each case conveniently takes place in synchronised stoppage phases of the longitudinal transporting and medicament conveying

20 cycles; in the case of specific simple, regular filling patterns a continuous feed is possible for the "longitudinal" transportation of the packaging units as well as, alternatively or in addition, for the transverse conveyance of the medicament; by means of an electronic

25 control unit provided for controlling the delivery stations, which unit generates the necessary control signals by processing information signals that contain information on the patients and the content of the packaging units associated in each case with the patients

30 and which are continuously fed to the control unit in a sequence highly correlated to the cassette feed movements

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and unambiguously associated with the patients, the greatest possible reliability of the correct filling of the packaging units with medicaments can be obtained and also a high feeding rate per unit time can be achieved, so that  
5 fully filled packaging units that in each case correspond to an individual medical prescription can be removed from the arrangement at a rate of about one per second.

If data in machine-readable form that can be processed into  
10 the control signals are provided in a spatially fixed allocation to the respective packaging units, i.e. can be further transported with the latter and thereby reach reading stations that are associated with the delivery stations, then the filling sequence can be controlled in a  
15 simple way in the manner of a sequential control that can manage effectively with a relatively small data processing capacity and accordingly operates quickly and reliably.

In this connection an arrangement of a reading station  
20 associated with an delivery station is convenient that permits the data to be read in already before the cassette to be filled has arrived at the relevant delivery station.

The packaging units and the parts of the latter bordering  
25 the receiving compartments are conveniently also provided with printable areas, on which label-type information can be printed out by means of printing devices in each case individually associated with the delivery stations and integrated therein, on the basis of which the filling of  
30 the respective packaging unit can in each case be

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replicated, which can be of great importance for reasons of error protection and any necessary defect analysis.

In a preferred configuration of the filling arrangement according to the invention the medicaments - tablets, capsules, pills or the like - are arranged equidistantly on blister strips that are wound on a feed roll and transporting drives are arranged between the roll stations and the delivery stations, which, seen in the transporting direction of the blister, have ejection units arranged one after the other, by means of which the medicaments can be ejected from the blister wells and delivered into the receiving compartments of the respective packaging units.

15 This type of medicament stocking and provision of the arrangement and realisation of the medicament delivery to the packaging units is suitable in particular for a modular construction of the overall arrangement, in that an expansion of the arrangement to accommodate a large variety of medicaments is possible without any problem and can be achieved by inserting a unit associated with the new type of medicament. Also, a "modular" subdivision of the arrangement into groups of delivery stations and storage rolls associated with the latter, for example in groups of 20 ten delivery stations or a "master" grouping, in which for example five such groups of ten are combined to form a master modular unit, is possible without any problem, and appears advantageous for control purposes, for example from the aspect of achieving as uniform as possible filling 25 times for all medicament cassettes.

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From the control technology aspect it is particularly advantageous if also the ejection units of a delivery station are equidistantly arranged with respect to one another, preferably so that the interspacing  $L_p$  of adjacent  
5 ejection units is a whole-number multiple of the interspacing  $I_p$  of adjacent blister wells of the blister strips. With this configuration of the delivery stations a simple stepping-type transportation, achievable for example by means of a Maltese cross, can be provided for  
10 transporting the blister strip, which in functional combination with a step counter enables a reliable feed movement control to be achieved in a simple way. It is understood that, in combination with a suitably chosen path measurement system, a continuous blister strip feed can  
15 also be provided.

Pneumatic Lear cylinders, which may be designed as simple-acting cylinders equipped with restoring springs, or depending on the force requirements in the alternative  
20 movement directions may also be designed as double-acting cylinders, are particularly suitable as ejection units. Another embodiment discloses features of the blister strips that can be realised alternatively or in combination, which permit a reliable transportation and also permit in a  
25 simple way an automatic "feeding in" one after the other of blister strips to be used.

Due to the features of another embodiment, configurations of the storage blister strips are obtained that ensure a  
30 smooth delivery of the medicaments from the blister wells by ejection by means of the ejection elements, since the

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"ejection" forces that have to be exerted on the medicaments by means of the ejection elements of the respective delivery station can be kept low. Still another embodiment provides particularly smooth handling, which is  
5 protected against wear and also against contamination, of the medicaments to be delivered.

By means of a device provided according to another embodiment for a common opening actuation of release  
10 elements, a structural simplification of delivery stations as well as a time-saving implementation of the delivery of medicaments to the receiving compartments can be achieved.

In combination with drives, such as are given by the  
15 features of yet another embodiment, simple incremental path transmitters can be used to measure the path or determine the forward feed of the blister strips, the signals from which transmitters in combination with position transmitters for edge markings of the blister strips can be  
20 used to provide sufficiently accurate position determinations for controlling the movement of the blister strips, for which purpose suitable edge markings can be obtained by means of marking devices of the arrangement itself. To this end cutting stations may also be used.  
25 According to another embodiment, safety sensor devices provided for checking the functioning may be realised in an

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advantageously simple arrangement and configuration.

Thanks to a modular structure of the filling arrangement according to the invention, in which its modules in each  
5 case comprise a delivery station, a transverse conveying device, a storage roll per blister strip, as well as feed drives and auxiliary drives together with the necessary path measurement sensors and monitoring sensors, it is possible without any problem by adding such modules for  
10 statistically commonly required medicaments, to realise with comparatively little expenditure and effort "uniformly" and demand-oriented operating filling arrangements.

15 Alternatively or in addition, a demand-oriented expansion of the capacity of a filling arrangement according to the invention can also be achieved according to yet another embodiment with two or more transporting systems for packaging units.

20

By means of a configuration of the filling arrangement according to the features of still another embodiment, a continuous filling operation can then also be realised with a uniformly constant medicament flow, when the time  
25 required at the individual delivery stations is different.

A particularly efficient production of blisters for weekly requirements as packaging units can be achieved in the

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preferred configuration of the filling arrangement according to an embodiment of the invention.

Further details of the invention follow from the following  
5 description of embodiments with the aid of the drawings, in which:

Fig. 1 is a diagrammatically simplified plan view of a  
first embodiment of an arrangement according to  
10 the invention for filling packaging units of medicaments,

Fig. 2a shows details, likewise diagrammatically  
simplified, of a delivery station of the  
15 arrangement according to Fig. 1 in a section along the line II/II of Fig. 1,

Figs. 2b to 2e  
show various phases of the delivery of  
20 medicaments to the delivery station according to Fig. 1, in order to illustrate the functioning of the arrangement,

Fig. 3a shows details of a further embodiment of an  
25 arrangement according to the invention in a form corresponding to Fig. 1,

Fig. 3b is a diagrammatically simplified view of an  
incrementally operating path transmitter that can  
30 be used in the arrangement according to Figs. 1 or 3a,

Fig. 4a is a diagrammatically simplified side view of a switching device suitable for changing blister strip storage rolls,

5

Fig. 4b is a suitable light barrier arrangement for generating marking signals in an arrangement according to Figs. 1 or 3a,

10 Fig. 5a shows a drive device for the transporting drive of a blister strip according to Fig. 4a,

Figs. 5b and 5c each show a guide device of the switching device according to Fig. 4a,

15

Figs. 6a to 6d show details of the blister strip configuration in order to illustrate its functioning,

20 Fig. 7a shows a further configuration of a delivery station of an arrangement according to Fig. 1 in a view corresponding to Fig. 2a,

Fig. 7b shows details of a drive of the delivery station according to Fig. 7a and

25

Fig. 7c is a simplified sectional view of a monitoring light barrier for the delivery station according to Fig. 7a.

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The filling arrangement, identified overall by the reference numeral 10 in Fig. 1, is intended for filling packaging units 11 with medicaments that are to be taken by a patient during the course of a week, these packaging units being intended to help the patient in that the latter, in accordance with a medical prescription, takes a plurality of different medicaments in a proper regulated dosage and time sequence, and thereby does not forget a medicament and can also check in a simple way what medicaments have already been taken and/or what still remain to be taken.

The packaging units 11 are designed in the manner of blister packs comprising a plurality of receiving compartments 12 having a basic rectangular trough shape, which are combined in a regular rectangular matrix configuration to form a uniform transporting sheet 13. Corresponding to a layout as a so-called "week blister", with which the weekly medicament requirements of a patient are provided, the transporting sheet 13 comprises a total of twenty eight receiving compartments 12 of identical basic shape, which in the special embodiment chosen for the explanation are arranged in a number of columns corresponding to the number of days of the week, and in four lines associated with the various times at which the medication is taken, namely morning, midday, evening and night time.

Seen in the direction of the four lines and in the direction of the seven columns of the respective

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transporting sheet 13, the receiving compartments 12 are in each case arranged equidistantly.

By means of a longitudinal transporting device, illustrated simply diagrammatically and identified overall by reference numeral 14, which may be realised in the nature of a "linear" conveyor belt device that has its own drive, or may be realised by means of a plurality of drives that engage "directly" on the transporting sheets 13, the transporting sheets 13 to be filled with the medicaments can be transported sequentially to delivery stations identified overall in each case by the reference numeral 16, arranged sequentially along this transporting direction 14. A medicament is in each case delivered at these delivery stations, the delivery of the medicaments at the respective delivery station 16 taking place "line-by-line", in such a way that during a stopping phase of the longitudinal transporting device 14 the administration units associated in each case with the administration time, namely morning, midday, evening or night time, are fed into the receiving compartments 12 associated with the respective administration days, namely Monday and/or Tuesday, etc., up to Sunday.

The feed of the medicaments to the delivery stations 16 is carried out by means of transverse conveying devices individually associated with the medicaments and in each case identified overall by the reference numeral 17, which are arranged equidistantly along the transporting device 14 in the transporting direction of the transporting sheets 13, the interspacing between adjacent transverse conveying

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devices 17 conveniently being chosen to be equal to the width b of the transporting sheets 13 measured in the transporting direction, and the sheets 13 for their part are configured so that in a transporting configuration of the sheets 13 in which these rest directly against one another with their edges 18/r and 18/v running transverse to the transporting direction, the interspacing of the in each case adjacent rows of receiving compartments, one of which is associated with the night time medicament taking and the other of which is associated with the morning medicament taking, is the same as the interspacing of two rows of compartments adjacent to one another within a sheet 13 and corresponds to the forward feed step size with which a for example pulse-controlled forward feed of the transporting plates 13 takes place in the transporting direction of the transporting device 14. In a typical configuration of the transporting sheets 13 these are designed symmetrically in terms of their respective longitudinal mid-plane 19 that runs between the two inner rows of receiving compartments 12 associated with the midday and evening taking of medicaments, and is perpendicular to the plane marked by the opening edges of the receiving compartments 12.

The transverse conveying devices individually associated with the medicaments are realised with the aid of blister strips 21, which are wound on storage rolls 22 and can be withdrawn from these. The storage rolls 22 are accommodated by flat cassettes (not shown for the sake of simplicity), which may also form the bearings in which the

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rolls, if the exchangeable cassettes are used in the arrangement 10, are rotatably mounted.

The blister strips 21, for a description of which reference  
5 will now also be made to Figs. 2a to 2e, consist of strip-shaped plastics films 26 with semicircular or trough-shaped wells 23 formed on one side, which are provided to take one tablet or one medicament capsule each. The wells containing the respective medicaments are covered with a  
10 film-shaped cover strip 24 that is connected in a materially interlocking manner to the plastics strip 26 forming the wells 23. The cover strip 24 may for its part be formed as a plastics strip, but is however often also formed as a thin aluminium strip or as a metallised  
15 plastics strip that is provided in the region of the well openings with embossings or functionally similar perforations acting as intentional score lines, which facilitate the opening or the mechanical removal of the medicaments from the wells 23.

20

The wells 23 are, in the configuration example given for purposes of description, arranged directly - "tightly" - next to one another on the blister strips 21 so as to achieve as high a storage capacity as possible per storage  
25 roll 22. Seen in the transporting direction of the blister strips 21, which cross over the seven receiving compartments of the receiving compartments 12 arranged in each case next to one another in a daytime line, these too are as it were arranged equally tightly, i.e. immediately  
30 adjacent to one another, so that separating webs remaining between two adjacent receiving compartments 12 and running

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in the transporting direction of the week blisters are tightly up against the clear width of the receiving compartment openings measured transversely to the transporting direction of the week blisters. In a typical configuration of the week blister transporting sheets 13, the periodicity length  $L_p$  of the line arrangement of the receiving compartments 12 of the transporting sheet 13 measured transversely to the transporting direction of the week blisters 11, corresponds to three times the value  $I_p$  of the correspondingly measured periodicity length of the arrangement of the wells 23 of the blister strips 21 or to another whole-number multiple of this periodicity length  $I_p$ , preferably to an odd multiple of the latter.

15 In this matching of the periodicity lengths  $I_p$  and  $L_p$  of the blister strips 21 and the line arrangements of the receiving compartments 12 of the transporting sheets 13, it is always possible to place a well 23 of the blister strip running along the receiving compartment line, "centrally" over each of the receiving compartments 12, and in this central arrangement to deliver the medicament contained in the well 26 into the receiving compartment 12 of the transporting sheet 13 of the week blister 11 arranged immediately thereunder.

25

In order to control the delivery of medicaments from the blister strips 21 into the receiving compartments 12 of the transporting sheet 13, seven ejection tappets 27 that can move in a reciprocatory manner perpendicular to the opening plane of the receiving compartments 12 of the transporting sheets 13 are provided per delivery station 16, a pneumatic

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actuating cylinder 28/1 to 28/7 each being provided to actuate their ejection.

The actuating cylinders 28 of the respective delivery station 16 are arranged in the case of an identical configuration so that their central longitudinal axes 29, which are also the central longitudinal axes of the ejection tappets 27, span a longitudinal mid-plane 31 (Fig. 1) of the respective delivery station running perpendicular to the opening plane of the transporting sheets 13 and at right angles transversely to the transporting direction of the transporting sheets 13.

For the purposes of the description it is assumed to start with that the actuating cylinders 28/1 to 28/7 can be actuated individually at different times as well as simultaneously in a multiplicity of arbitrary combinations. It is also assumed that the actuating cylinders have a restoring spring 32 that forces the piston 33 of the respective actuating cylinder 28 and thus also the respective tappet 27 into its upper end position as base position, in which the respective actuating tappet 27 is retracted from the in each case associated receiving compartment 12 of a transporting sheet 13 to be filled, and its free end face surface 34, which conveniently has a shape that is adapted to the shape of the medicament to be ejected, for example a concavely curved shape approximately complementary to this shape, is arranged at a vertical distance from the outsides of the blister well 23, so that a blister strip 21 can be moved unhindered between a transporting sheet to be filled and the actuating cylinders

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28 of the delivery station 16 arranged thereabove, into its delivery positions, which may if necessary require a multiple reciprocatory movement of the blister strip 21 at the delivery station 16.

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The need for this exists for example if a medicament is not to be taken on each day of the week, but for example only on Monday, Wednesday and Friday, the aim being to avoid medicaments being transported beyond the delivery station  
10 due to a continuous further transportation of the respective blister strip, which would thereby involve either considerable effort in recovering these medicaments or these medicaments would have to be regarded as lost. In order in this example to realise the appropriate control of  
15 the delivery with as small an expenditure of transporting resources and time as possible, the following procedure is conveniently adopted:

For the purposes of description the starting point will be  
20 the configuration, shown in Fig. 2a, of a delivery station 16, in which all wells of the blister strip 21, which according to the illustration are arranged to the right of the well 23, which is situated underneath the tappet 27 of the actuating cylinder 28/1 one arranged furthestmost on the  
25 left, for example that associated with Monday, including this well itself, still contain the medicament administration unit to be provided at this delivery station 17. Seen in the conveying direction of the blister strip 21, all medicament administration units originally arranged  
30 on the left-hand side underneath the tappet 27 of the

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"Monday" actuating cylinder 28/1 have however already been delivered.

In this "starting" configuration the "Monday" cylinder 28/1  
5 is actuated first, whereby the medicament contained in the  
well arranged furthestmost on the left hand side according  
to the illustration of Fig. 2a is delivered into the  
"Monday" receiving compartment 12 arranged thereunder of  
the transporting sheet 13. After the tappet 27 of the  
10 ejection cylinder 28/1 has again disengaged from the  
transporting blister 21, it is retracted "to the right" in  
the direction of the arrow 36 until the well 23 now  
arranged in the furthestmost left-hand position and still  
containing a medicament is arranged underneath the tappet  
15 27 of the ejection cylinder 28/3 associated with Wednesday,  
which is then actuated. For the next ejection cycle the  
blister 21 is retracted until the well, now arranged  
furthestmost on the left hand side and still filled, is  
arranged underneath the tappet of the ejection cylinder  
20 28/5 associated with Friday, whereupon this is actuated.  
After the penultimate delivery actuation the blister strip  
21 can remain in the position it has now adopted and can be  
transported in a subsequent delivery cycle to the starting  
position that is most suitable for this.

25

For the - statistically more significant - case that at a  
delivery station 17 in each case all seven receiving  
compartments 12 are to be filled with the delivery  
medicament of this station 16, a simple possible way of  
30 controlling the delivery is as follows:

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For purposes of description the starting point is again the configuration of delivery station 16 and blister strip 21 illustrated in Fig. 2a. In the "starting" configuration given thereby, all seven actuating cylinders 28/1 to 28/7  
5 are simultaneously controlled to execute the ejection stroke of their ejection tappets 27 and after this are immediately controlled again to execute the return stroke to the illustrated base position. The configuration of the blister strip 21 after the execution of the ejection stroke  
10 is illustrated in Fig. 2b. The administration unit - tablet or pill - ejected in each case is now in one of the (in the illustrated embodiment four) receiving compartment lines of the transporting sheet 13 relating to the time of day. After the further transportation of the transporting  
15 sheet 13 by for example a "day" step size of the amount  $b/4$  (Fig. 1) and further transportation of the blister strip 21 with respect to the delivery station by a periodicity length of the well arrangement, the configuration of the blister strip 21 with regard to the delivery station 16 is  
20 that shown in Fig. 2c, in which now again by joint control of the actuating cylinder 28/1 the next receiving compartment line of the transporting sheet 13 relating to time of day can be filled with an administration unit of the medicament made available at the delivery station. The  
25 resultant configuration of the blister strip 21 is shown in a diagrammatically simplified manner in Fig. 2d.

Renewed repetition of the aforementioned transporting and incremental steps finally leads to the configuration of the  
30 blister strip 21 shown in Fig. 2e, which now requires a transporting displacement of the blister strip by the

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transporting stretch identified as St in Fig. 2e, so that the blister strip position adopted as starting position is reached again, in which the aforescribed delivery cycles can be restarted.

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Control signals for electromechanical feed drives 36 illustrated simply diagrammatically in Fig. 1 and Fig. 2a, by means of which the blister strips 21 - transversely to the transporting direction of the transporting sheets 13 - can be transported to the individual delivery stations 16 formed by the pneumatic ejection cylinders 28/1 to 28/7 and can as it were be fed to the cylinders, and in addition if necessary limited backward movements can also be controlled and furthermore control signals for magnetic valves 37, by means of which the ejection cylinders 28/1 to 28/7 can be charged individually or as a plurality, optionally all simultaneously, with pressure from a compressed air source (not shown) and/or after execution of their working stroke the pressure can again be released, as well as further control signals for electromechanical auxiliary drives 38 that can be used to transport away emptied blister sections and/or to clamp the blister strips underneath the ejection cylinders 28/1 to 28/7, are generated by means of electronic control units 41 individually associated with the delivery stations 16, which units can be controlled in the pulse cycle of the forward feed transporting movements of the transporting sheets 13 in the signal generation operation in such a way that the operating phases of the electronic control units 41 are as it were synchronised by the transporting cycle of the transporting device 14. The transporting device 14 is conveniently designed as an

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incremental device, with short transporting phases, and compared to these temporarily very much longer stoppage phases, in which per transporting cycle in each case the next "line" - group of seven receiving compartments 12 - reaches the delivery position underneath the delivery cylinders 28/1 to 28/7 of the respective delivery station 16.

The electronics control units 41 of the delivery station 16 generate the control signals for the blister feed drives 36, for the control valves 37 of the ejection cylinders 28/1 to 28/7, as well as for the respective auxiliary drives 38 of the delivery station 16 by processing patient-related data that are stored in a machine-readable form on a data carrier, which is "fixedly" associated with each transporting sheet and can as it were be entrained by the latter. The data carrier contains in suitably coded form, e.g. as a binary number, the name of the medicament that is to be delivered to the addressed delivery station 16. The corresponding delivery station 16 is as it were addressed through this information, i.e. is prepared for a delivery cycle. Accordingly a reading head 42(i), simply diagrammatically illustrated in Fig. 1, is arranged with respect to the delivery station 16i associated with it [(i=1...n; n=number of the delivery stations of the arrangement 10)], so that between the reading of the information and the addressing of the delivery station 16 (i) to be controlled, sufficient time is available for a reliable processing of the information data.

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In the special embodiment chosen for the description, the data carrier 43 is arranged on one transverse edge, according to Fig. 1 the left-hand edge, running in the transporting direction, of the respective transporting  
5 sheet 13. Apart from the identification of the respective medicament, data individualising the patient, as well as data containing the - chronological - administration pattern, are also stored in a machine-readable form on the data carrier 43.

10

In the aforescribed arrangement of reading head 42i and delivery station 16i, the time window within which the ejection cylinders 28/1 to 28/7 of the respective delivery station 16 are actuated is determined by the number of the  
15 incremental steps of the transporting device 14 by which the reading head 42 is traversed earlier by the respective receiving compartment line than their receiving compartments are filled with the respective medicament at the delivery station.

20

The control of the feed movements of the blister strips 21 is explained for the embodiment chosen for the description on the basis of the function of the control and drive elements involved therewith, whose technical implementation  
25 can then be effected in various ways without any problem by the person skilled in the art; accordingly the apparatus details will be discussed only insofar as they are specific to the filling arrangement 10 according to the invention.

30 The "addressing" - preparation of the filling operating phase at a selected delivery station 16i - is carried out

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in that the information signals to be processed by the electronic control unit 41i are already read into the control unit 41i by means of a reading head 42i associated with the said unit, while the transporting sheet 13 to be  
5 filled at the delivery station 16i is still in the region of that delivery station 16(i-1) that, seen in the transporting direction, is arranged upstream of the delivery station 16i.

10 Already in this situation, if the delivery station 16i is not for its part still working in the loading operation, the loading operation for the transporting sheet 13 still situated at the station 16(i-1) can be prepared in that the blister strip 21i that can be taken from the storage roll  
15 22i is transported into the starting position suitable for the filling procedure, for example the position illustrated in Fig. 2a, which for the function example illustrated on the basis of Figs. 2a to 2e would require the blister strip 21i to be retracted by the stretch St (Fig. 2e).

20

On the basis of the data read into the control unit 41i, this generates the batch of control signals that trigger the forward feed and return movements of the blister strips, which have to be executed at the "line" tracks  
25 associated with the various times of taking the medicament - morning, midday, evening, night - as well as the data for the selection of the ejection cylinders to be activated. The output of the control signals representing these data then takes place in a pulse-controlled manner by electrical  
30 signals that are continuously generated with execution of the incremental movements of the transporting sheets 13.

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In this connection the various feed movements to be executed within a delivery cycle of the delivery station 16i, likewise in alternating directions, is predetermined according to the amount and direction.

5

In order to determine the transporting path executed in a predetermined direction, an "incremental" path measurement system diagrammatically illustrated in Fig. 3a and identified overall by the reference numeral 44 is provided, which issues a counting pulse to the electronics control unit 41i for each "small" path increment travelled in a predetermined direction, which pulses are summated with a positive or negative sign depending on the direction of movement - forwards / backwards - so that the sum reached within a delivery cycle is a measure of the length of the thereby withdrawn blister strip.

Fig. 3a shows a simple way of realising an incremental measurement path system, in which successive "dash" markings 47 are provided one after the other at a small interspacing  $\delta$ s along an edge strip 46 of the blister strip 21 that is to be monitored as regards its movements, which move past one or more sensors 48, shown simply diagrammatically, of a stationary measurement head 49, in order thereby to trigger the generation of a counting pulse. Perforations that can easily be recognised optically are suitable as edge markings 47, though magnetic markings known from magnetic tape technology that can be detected with standard reading heads and are suitable for emitting incremental counting pulses, can also be used.

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An incremental path measurement system 51 suitable for a filling arrangement according to the invention can, as can be seen from Fig. 3b alternatively be designed as an "independent" functional unit that manages without marking  
5 measures on the respective blister strip 21.

The path measurement system 51 according to Fig. 3b has two castors 54 and 56 freely rotatable about parallel axes 52 and 53, which are arranged facing one another and are  
10 pressed with a minimum force against the oppositely facing edge strip boundary surfaces of the blister strip 21 and are frictionally coupled to the latter in movement. One of the sliding rollers 52, namely the upper one illustrated in the embodiment, engages in an interlocking manner via a  
15 flat circumferential toothed region with a gear 57 of smaller diameter, which for its part is rotationally fixedly connected to a bladed wheel 58 whose blades 59 can be used to generate counting pulses to interrupt light barriers or for a position-dependent tuning of inductive  
20 sensor circuits, wherein by using suitable transmission ratios an as it were high-resolution splitting of the blister strip displacement path into a plurality of path increments can be achieved, which are small in size compared to the dimension of the blister well 23 in the  
25 transporting direction.

By means of the circumferential toothed region with which the sliding roller 54 is supported on the edge strip of the blister strip 21, thanks to a constantly existing  
30 flexibility of the blister strip material an interlocking

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engagement of the roller 54 with the blister strip 21 is achieved, which permits a precise path measurement.

Also, the drive and guide rollers 60 and 61 of the feed  
5 drive 36 used to achieve an at times pulling and at times pushing drive of the blister strip, as well as the drive and guide rollers 62 and 63 (Fig. 2a) of auxiliary drives 38, are conveniently provided with "flat", i.e. radially only slightly extended and also substantially edge-free  
10 toothed regions, which on account of an elastic deformability of the carrier material of the blister strips 21 can engage therewith in a quasi-interlocking manner, which promotes the reliability of the transportation.

15 If an incremental measurement system is used to control and monitor the position, it is necessary to be able to generate from time to time a characteristic indicating signal for a defined, selected reference position that for the selected arrangement and configuration of the employed  
20 incremental path measurement system is coupled to a defined counter state, in order to be able to check on the basis of the occurrence of this signal whether the measurement system has also reached that counter state that has to be given at the position of the blister strip recognised by  
25 the signal. In the case of a deviation the occurrence of the position-characteristic signal can be used to carry out a "post" calibration of the measurement system, in that the counter of the measurement system is set to the position-characteristic value. Conveniently a post-calibration or  
30 check of this type is always independently carried out when the blister strip has reached the referenced position.

With the embodiment used in the above description a light barrier identified overall by the reference numeral 64 (Fig. 2a) is used to generate the reference mark indicating signal, the reference signal being generated when the light barrier is interrupted by the blister carrier. This signal occurs as soon as a free transverse edge of the "consumed" blister strip end section, from which previously a consumed end piece of the blister strip 21 has been cut off by means of a cutting device identified overall by the reference numeral 66, interrupts the sensor light beam of the light barrier 64.

It is understood that suitable reference marks may also be applied in another way, for example by stamping out a perforation hole "somewhere" on the edge of the blister carrier, through which the sensor light beam of a light barrier can pass for the purposes of triggering a position indicating signal. Imprints which can be optically detected, or inductively-detectable metal marks, may also be used as reference marks as appropriate.

It is expedient if, seen in the transporting direction, the position of the blister strip 21 can be determined before it enters the delivery station 16 as well as after it has left the latter, i.e. if it can be used to emit a "calibration" control signal.

The ability to determine the forward feed and possible backward movements of the blister strips 21 and to be able to control the magnitude of the movements as well as their

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speed is utilised in a configuration represented by the detailed diagram of Fig. 4a, of a filling device according to the invention for an independent transfer from one storage roll 22/1 to a second storage roll 22/2, so that at  
5 a delivery station 61 with which both storage rolls 22/1 and 22/2 are associated, after the blister store on the first used storage roll 22/1 has been exhausted, a changeover to the blister strip store wound on the second storage roll 22/2 can be effected without having to  
10 interrupt the filling operation of the filling arrangement 10.

A changeover device provided for this purpose and identified overall by the reference numeral 68 here  
15 performs the function that, as soon as the blister strip store that can be withdrawn from the store roller 22/1 is exhausted, a changeover to the removal of the blister strip 21 from the second storage roll 22/2 is effected, and a common transportation of both blister strips 21/1 and 21/2  
20 is achieved in such a way that a free "backward" end 69 of the "consumed" blister strip 21/1 and the free "starting" front side 71 of the next blister strip 21/2 to be used are brought together and, while the end section of the exhausted blister strip 21/1 and the starting section of  
25 the following blister strip 21/2 are transported through the delivery station 16, are held adjacent to one another until the transfer to the second blister strip 21/2 has been completed, and in this way sufficient time is available so as to be able to replace the "exhausted"  
30 storage roll 22/1 for a new storage roll at the delivery

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station 16 in question, which can then be used when the other storage roll 22/1 is exhausted.

A suitable configuration of the changeover device 68 for the implementation of these functions is explained in turn on the basis of the functions of sub-units of the changeover device, with the aid of which a person skilled in the art in precision engineering and control technology can realise the changeover device 68, so that a detailed description of structural details appears unnecessary.

The changeover device 68 consists essentially of a "Y" guide system identified overall by the reference numeral 72, which comprises two guide branches 73/1 and 73/2 associated with each of the two blister strips 21/1 and 21/2 and transporting drives 74/1 and 74/2 associated individually with each of these, and also comprises a continuing guide branch 73/3 derived from the combination of the two guide branches 73/1 and 73/2, via which the blister strip strands that can be withdrawn from the various storage rolls 22/1 and 22/2 can be transported by means of the feed drive 36 alternately to the delivery station 16.

The transporting drives 74/1 and 74/2 may be largely similar as regards their construction and the drive concept used in each case for the feed drives 36 and the further auxiliary drives 38; however, these transporting drives 74/1 and 74/2 should be able to be controlled so that they can be operated at least part of the time at a higher transporting speed than the in each case following feed

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drive 36 that determines the transporting speed of the in each case used blister strip in the combined guide branch 73/3, as well as in the following delivery station 16, so that the blister strip end section that has been withdrawn  
5 from the exhausted storage roll 22/1 or 22/2, and subsequent starting sections of the blister strips 21/2 or 21/1 to be threaded in, as it were "overtake" the end section of the blister strip that has reached the combined guide section 73/3, i.e. can be brought into engagement  
10 therewith, so that these blister strip strands continue one another as it were "uninterruptedly" and in the delivery station 16 a gap is avoided in the blister well 23 used to fill the medicament cassette 11.

15 In the embodiment chosen for the above description, the transporting drives 74/1 and 74/2 each have on the "smooth" delivery side 76 of the blister strips 21/1 and 21/2 sliding rollers 79/1 and 79/2 mounted freely rotatably on shafts 78/1 and 78/2 running parallel to the axes of  
20 rotation of the storage rolls 22/1 and 22/2, in each case arranged on sections of the changeover device 68 free of guide elements, on a frame 77 shown simply diagrammatically, the said sliding rollers extending over the whole width of the blister strips 21/1 and 21/2 pressed  
25 against them, as well as drive rollers 81/1 and 81/2 that can be driven by electric motors (not shown), which drive rollers are arranged opposite the sliding rollers 79/1 and 79/2 and can roll on an edge strip of the well sides 82/1 and 82/2 of the blister strips 21/1 and 21/2 respectively  
30 lying opposite the sliding rollers 79/1 and 79/2, which engage with the drive rollers 81/1 and 81/2 in a frictional

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or frictional-interlocking manner, i.e. in a substantially slip-free manner apart from elastic deformations.

In the advantageous configuration of the transporting  
5 drives 74/1 and 74/2 reproduced in Fig. 5a, their drive rollers 81 are designed and arranged so that they engage on only one of the two edge strips 83/1 and 83/2 of the respective blister strip 21, between which the blister wells 23 are arranged, wherein the blister strips 21 are in  
10 each case designed symmetrically with respect to their longitudinal mid-planes 84 that extend between the edge strips 83/1 and 83/2.

The guide branches 73/3 of the "Y" guide system 72 leading  
15 according to Fig. 4a to the feed drives 36 are, as can be seen directly from Fig. 5b, formed in each case by a pair of "U" profiled sections 86/1 and 86/2, which are arranged with their parallel arms 87/1 and 87/2 pointing towards one another so that the clear "horizontal" interspacing of  
20 their yoke arms 88 corresponds, apart from a play necessary for the slight displacability of the blister strips, to the width  $b_s$  of the blister strips 21, these guide U-shaped profiled sections 86/1 and 86/2 surrounding the edge strips 83/1 and 83/2 of the blister strips over most of the width  
25 of the edge strips; the clear interspacing  $a_f$  on the well side narrow front edges 89 of the well-side U-shaped arms 87/1 is sufficiently dimensioned so that the blister wells 23 cannot touch the guide profiled sections.

30 The "vertical" interspacing of the parallel profiled arms 87/1 and 87/2 of the guide U-shaped profiled sections 86/1

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and 86/2 is slightly, for example by 10% to 20%, larger than the sum of the thicknesses of the guide edge strips 83/1 and 83/2 of the blister strips 21/1 and 21/2 and of the blister cover strips 91 sealing the blister wells 23  
5 "downwardly", so that although a smooth sliding-type guidance of the blister strips 21/1 and 21/2 in the horizontal combined guide branch 73/3 of the respective "Y" guide system 72 is ensured, an overlapping of two blister strips in the region of an end section of a blister strip  
10 arranged in the delivery station region with a starting region of a blister strip "pushed from behind" is however definitely excluded.

The construction of the guide branches 73/1 and 73/2  
15 extending between the transporting drives 74/1 and 74/2 on the one hand, and the combination point 92 of the respective "Y" guide system 72 on the other hand, is similar to that of the combined section 73/3, where instead of U-shaped profiles provided as in Fig. 5b to implement  
20 the guide branch 73/3 leading directly to the delivery station 16, simple angle-shaped profiles 93 (Fig. 5c) can be used to realise the two "convergent" guide branches 73/1 and 73/2 arranged above one another, which are secured to sides of frame metal sheets 94/1 and 94/2 facing one  
25 another, which form housing elements of a changeover device 68 designed as a function module.

What has been said regarding the construction of the "Y" guide system 72 also applies as appropriate to a "vertical"  
30 connection guide identified overall by the reference numeral 96, by means of which the blister strip 21/1 that

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can be withdrawn from one storage roll 22/1 is fed to the associated transporting drive 74/1 of the changeover device, as well as to the "horizontal" connection guide 97 according to Fig. 4a, via which the blister strip 21/2 that  
5 can be withdrawn from the second storage roll 22/2 can be fed to the associated transporting drive 74/2 of the changeover device 68.

These connection guides 96 and 97 can also conveniently be  
10 realised within the framework of the changeover device 68.

In the version of the changeover device 68 used for the above description, the connection guides 96 and 97 are equipped with end sensors 98/1 and 98/2 diagrammatically  
15 illustrated as light barriers, which emit an output signal that can be evaluated in order to control the arrangement 10 when the end of a blister strip 21/1 or 21/2 withdrawn from the respective storage roll releases a barrier light beam - which is no longer blocked off - or generates a  
20 characteristic signal to interrupt the barrier light beam when the start of a blister strip that can be withdrawn from the respective roller blocks off the barrier light beam.

25 These signals can be used to calibrate or check the displays of path transmitters, as explained according to the basic concept for example on the basis of Figs. 3a and 3b.

30 A suitable light barrier arrangement 99 to detect the position of a blister strip may also be realised with the

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structure illustrated diagrammatically in Fig. 4b, in which the barrier light beam 101 is released when it can pass through the gap between two blister wells 23, though the blister well itself is largely cut off. By evaluating a  
5 sequence of detector output signals of this light barrier arrangement 99 in correlation with path transmitter output signals that can be obtained with an arrangement described with the aid of Fig. 3b, the end of the blister strip 21/1 or 21/2 can be determined very precisely, obviously taking  
10 into account the geometrical dimensions of the arrangement 10 and its delivery stations 16.

In a typical configuration of blister strips 21 reproduced in Figs. 6a to 6d, the wells 23 that receive the  
15 medicaments are formed as one-sided, trough-shaped indentations 102 of a strip 100 consisting of a transparent plastics material. These indentations 102 are formed for example by thermoforming the thermoformable plastics material, wherein in the region of the indentations a  
20 material weakness is produced in such a way that the trough-shaped regions have a flexible, loose consistency, so that they can easily be deformed by means of the tappets 27 of the delivery cylinders 28, whereas in the remaining "flat" strip region that forms the longitudinal edge strips  
25 46 used for the transportation and borders the openings 103 of the wells 23, they have a stiffer, flexural elastic consistency. These openings are, in the blister strip 21 prepared ready for use, covered by a cover strip identified overall by the reference numeral 104, which is tightly  
30 secured to the trough-forming, transparent plastics strips

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100 after the medicaments have been added to the trough-shaped indentations.

The cover strip 104 too conveniently consists of a plastics material that is flexularally elastic in the envisaged dimensions.

According to Fig. 6c the cover strip 104 is narrower than the trough-forming plastics strip 100, though is broad enough for the trough openings 103 to be arranged completely within the strip width of the cover strip 104. The cover strip 104 is provided in each case in the area of its regions covering the trough openings 103, with narrow longitudinal slits 106/1 and 106/2 and transverse slits 107 running between the latter, which in the special embodiment used for the description form in the region of the respective opening 103 the H-shaped slit profile that can be seen in Fig. 6c, which is symmetrical with respect to the longitudinal mid-plane 106 of the blister strip 21 and in each case is also symmetrical with respect to the transverse mid-plane 109 (Fig. 6b) of the respective blister well 23.

The tight material securement of the cover strip 104 to the trough-forming plastics strip 100 is effected in such a way that a rigid connection is formed between these two plastics strips only in the region of the longitudinal edge strips 111/1 and 111/2 of the cover strip, as well as in the region of transverse bands 112 of the cover strip 100, which run between blister wells 23 arranged adjacent to one another in the longitudinal direction.

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In this way, in each case the two rectangular wings 113/1 and 113/2 staggered with respect to one another by the transverse slit 107, which, running in a coplanar manner, cover the trough opening 103, are movable and can, if the respective ejection cylinder is actuated, open in the manner of a pair of folding doors (Fig. 6d) through which the respective medicament can leave and, in the case of a configuration of the arrangement as illustrated in Fig. 2a, can be delivered into the arranged receiving compartment of the transporting sheet 13.

In the course of the retraction of the ejection tappet 27 to its starting position, the two "door" wings 113/1 and 113/2 also return on account of their elasticity to their starting positions, in which they do not prevent the further transportation of the blister strip 21, which can also be guided in the region of the ejection cylinder into U-shaped guide elements, as has already been explained on the basis of Fig. 5b.

In contrast to the delivery station 16 according to Fig. 2a, in the delivery station 16 according to Fig. 7a, the details of which will now be referred to, the medicaments 122 ejected from the blister wells 23 from the blister strip 21 by means of the ejection cylinders 28/1 to 28/7 are held at an intermediate level above the transporting sheet 13 before they are delivered - preferably simultaneously - into the receiving compartments 12 of the transporting sheet 13.

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This intermediate level is determined by the arrangement of a movable cover strip identified overall by the reference numeral 117, which is arranged at a vertical distance from the blister strip 21 underneath the latter and runs

5 parallel to this immediately above the transporting sheet 13, and can be displaced transverse to the transporting direction of the sheet 13 in a transverse guide (not shown in detail), which is constructed similarly to the guide described with the aid of Fig. 5b.

10

This cover strip, with which the receiving compartments 12 of the transporting sheet 13 arranged in a line adjacent to one another at the respective delivery station 16 can be covered, has a configuration similar to the cover strip

15 (Fig. 5b as well as Figs. 6a to 6d) of the blister strip 21, with wing-shaped flaps 119/1 and 119/2 bordered by H-shaped slits, wherein the periodicity length  $L_p$  of this periodic flap structure of the cover strip 117 corresponds to that of the receiving compartments 12 of the

20 transporting sheet 13 within a line of such compartments. A transporting drive, not shown in detail for the sake of simplicity, for the cover strips 117 is on the other hand configured so that the transporting step size corresponds to the periodicity length  $L_p$  or to a proper fraction

25 thereof, and so that the step-by-step transportation is controlled in such a way that when the cover strip 117 stops, the transverse slit 118 between the two cover wings 119/1 and 119/2, which in the stop state each cover one of the receiving compartments 12, runs in the respective

30 "vertical" longitudinal mid-plane 121 in which also runs the transverse slit 107 of the blister strip cover strip

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arranged thereabove in the delivery position of the blister strip 21.

In the embodiment used for the description the periodicity  
5 length  $L_p$  of the cover strip 117 is double the periodicity length of the blister strip 21.

In the configuration of the delivery station according to Fig. 7a, the medicament administration units 122 ejected  
10 from the respective wells 23 of the blister strip first of all lie "centrally" on the upper side of the cover strip 117 and are supported by the edges, arranged on both sides of the longitudinal mid-plane 121, of the swivellable wings 119/1 and 119/2 of the cover strip 117. The delivery of  
15 the medicaments 122 into the receiving compartments 12, arranged underneath the cover strip 117, of the respective transporting sheet 13 takes place in the illustrated embodiment by swivelling by  $90^\circ$  the hammer-shaped expulsion elements illustrated in Fig. 7a, which can be swivelled  
20 from a base position illustrated in the right-hand part of Fig. 7a, in which they are accommodated by receiving slits of a housing block 124 extending between the blister strip guide and the guide for the cover strip 117, into the expulsion position illustrated in the left-hand part of  
25 Fig. 7, in which the medicament 122 falls between the forced-apart transverse edges 125/1 and 125/2 into the respective receiving compartment, following which the respective expulsion element 123 is swivelled back again into its "vertical" base position.

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For the ejection actuation of the expulsion elements 123, in the embodiment used for the description a common drive is provided that is realised by means of a double-acting pneumatic cylinder 126, by means of which a flat bar 127 on the housing block 124 can be displaced backwards and forwards. This flat bar 127 is provided with vertically running longitudinal guide holes 128, in which a driving pin 129 of the expulsion elements 123 engages in a slidable-interlocking manner in such a way that 90° swivelling movements of the expulsion elements 123, running in the direction of the double arrow 132 of Fig. 7, can be achieved with the "horizontal" forwards and backwards movements of the flat bar 128 taking place in the direction of the double arrow 132 of Fig. 7b.

15

In order to check the functioning of the delivery station 116 light barriers (Fig. 7c) identified overall in each case by the reference numeral 133 are provided, which are individually associated with the delivery cylinders 28/1 to 28/7, the respective optical axis 134 of the barriers running in the vertical longitudinal mid-plane 121 between the transverse edges 125/1 and 125/2 of the wing-shaped flaps 119/1 and 119/2 of the "lower" cover strip 117 and at a clear distance above the latter that corresponds to about half the diameter of the medicament 122 to be delivered in each case.

The cover strip 117 consists of an elastic material, so that the wing-shaped flaps 119/1 and 119/2, after the medicament 122 has been ejected downwardly, return again to

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their starting position, in which the flaps 119/1 and 119/2 are again arranged coplanar.

A suitable material may be an elastic plastics material, in which connection the cover strip 117 may in addition be metallised.

The cover strip 117 is a functional element of a device for monitoring the function as well as for quality control that is integrated as it were in the arrangement 10, and must therefore not be exposed to the danger of damage.

Accordingly the cover strip is displaceable - "renewable" - in such a way that the delivery station 16 is filled at least from time to time with a "new" cover strip section, wherein the cover strip is displaced in a pulsed manner by a periodicity length  $L_p$ , for example after completion of ten delivery cycles of the respective delivery station, obviously subject to the proviso that a conceivable danger due to damage of the cover strip in the delivery station region is prevented.

Filling arrangements falling within the scope of the invention may, as explained hereinbefore, be modified in various ways. Modifications that have not been illustrated include for example the following:

In the case of variously required medicaments, a plurality of delivery modules may be provided that comprise in each case a delivery station and a storage roll.

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A configuration of a filling arrangement according to the invention is also possible in which a double delivery station is supplied from one blister storage roll if one storage roll is sufficient in a filling arrangement

5 containing two filling units in order to serve both filling lines, in which in such a case the more frequently required medicaments are each supplied by their own storage roll and a delivery station associated therewith.

10 A convenient modification may also consist in the fact that in the configuration containing two transporting lines, the matrix lines of the cassette arrangement are associated with the times of the day, and the daily sequence as it were corresponds to the gaps of the matrix arrangement of

15 the pairs of transporting sheets 13 to be filled in parallel. In this case the delivery station has eight ejection elements for the case where the daily subdivision is morning, midday, evening and night time, which was represented by the matrix lines in the embodiments

20 illustrated with the aid of Figs. 1 to 7c.

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Patent Claims

1. Arrangement for filling packaging units with a  
5 plurality of medicaments, which in each case  
correspond to the weekly requirements of a plurality  
of different patients who have to take these  
medicaments in an ordered sequence according to date  
(day of the week) and time of day (morning, midday,  
10 evening, night time) corresponding to a patient-  
related medical prescription, in which the packaging  
units have receiving compartments for the medicament  
administration units - capsules, tablets, pills -  
arranged in a matrix configuration of lines and  
15 columns, which medicaments have to be taken in each  
case within the time spans of the respective patient  
identified by the arrangement of the compartments  
within the matrix,  
with the following features,
- 20 a) delivery stations (16) individually associated  
with the packaging units (11) are provided, at  
which a line-by-line filling of all or only a  
proportion of selected compartments (12)  
25 automatically takes place;
- b) a longitudinal transporting device (14) is  
provided, by means of which the packaging units  
(11) can be transported in a predetermined  
30 direction sequentially to the delivery station

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(16) associated individually with the various medicaments;

- 5 c) the feed of the medicament administration units to the delivery stations takes place by means of transverse conveying devices individually associated with the medicaments;
- 10 d) the longitudinal transporting device (14) and the transverse conveying devices (36, 38) are matched to one another as regards transporting stroke and conveying capacity so that a sequential line-by-line filling of the receiving compartments (12) can be achieved per transporting stroke of the
- 15 packaging units (11) in the column direction of the receiving compartment arrangement, and per conveying stroke of the transverse conveying devices in the line direction of the receiving compartment arrangement, the said filling taking
- 20 place in each case in synchronised stoppage phases of the longitudinal transporting and transverse conveying cycles;
- 25 e) to control the delivery stations (16) within the context of the medical prescription-oriented filling of the packaging units (11) with medicaments, an electronic control unit (41) is provided that generates the necessary control
- 30 signals in this respect by processing information signals that contain information on the patients and on the contents of the packaging units

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associated in each case with the latter, which signals are continuously passed to the control unit (41) in a sequence unambiguously associated with the patient and synchronised with the forward feed movements of the packaging units (11), wherein the administration units are delivered to the respective delivery stations by means of blister strips (21) unwound from a storage roll (22).

10

2. Filling arrangement according to claim 1, characterised in that within a spatially defined configuration relating to the packaging units (11), data carriers associated with the latter are provided, which contain the patient-related data in machine-readable form.

15

3. Filling arrangement according to claim 2, characterised in that reading stations (42) for the data carriers of the packaging units are provided at the delivery stations (16) and are integrated in the latter.

20

4. Filling arrangement according to claim 2 or claim 3, characterised in that the reading station (42) provided for a delivery station (16), seen in the transporting direction of the packaging units (11), is arranged at a delivery station (16) arranged upstream of the delivery station to be controlled.

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5. Filling arrangement according to one of claims 1 to 4, characterised in that the packaging units (11) have printable areas on which label-type information, in particular on the procedures occurring at the delivery station, can be printed by means of printing devices associated, preferably individually, with the delivery stations (16).
6. Filling arrangement according to one of claims 1 to 5, characterised in that the administration units - tablets, capsules, pills - are arranged equidistantly on the blister strips (21) that are wound on the storage roll (22) and can be withdrawn from the latter, that transporting drives for the transverse conveyance of the blister strips (21) are arranged between the storage rolls (22) and the delivery stations (16), and that the delivery stations (16), seen in the transporting direction of the blister strips (21), have ejection units (28) arranged in succession one after the other, by means of which the medicaments can be ejected from the blister wells (23) and delivered into the receiving compartments (12) of the packaging units (11).
7. Filling arrangement according to claim 6, characterised in that the interspacing  $L_p$  of ejection units (28) adjacent to one another corresponds to an integral multiple of the interspacing  $l_p$  of adjacent blister wells (23) of the respective blister strip (21).

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8. Filling arrangement according to claim 6 or claim 7, characterised in that the ejection units (28) are designed as pneumatic linear cylinders.
- 5 9. Filling arrangement according to claim 8, characterised in that piston rods projecting from the housing of the pneumatic cylinders (28) are provided with tappet heads that have an approximately concave shape complementary to that of the medicaments to be  
10 ejected.
10. Filling arrangement according to one of claims 6 to 9, characterised in that the blister strips (21) have edge strips (83/1 and 83/2) running preferably on both  
15 sides of a strip-shaped middle region in which the blister wells (23) are arranged, the said edge strips being engaged by the drive devices (36, 38).
11. Filling arrangement according to claim 10,  
20 characterised in that U-shaped guide elements (86/1 and 86/2) that at least in sections surround the edge strips (83/1 and 83/2) of the blister strips (21) are provided for the transportation guidance of the latter, the said guide elements providing an  
25 interlocking guidance of the blister strips (21) on both sides of drive devices.
12. Filling arrangement according to claim 10 or claim 11, characterised in that the clear distance of the  
30 mutually parallel guide arms (87/1 and 87/2), of the U-shaped profiles (86/1 and 86/2) is less than double

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the thickness of the edge strips of the blister strips.

13. Filling arrangement according to one of claims 6 to 12, characterised in that the blister strips (21) have plastics strips (100) forming the wells (23) for the medicaments, as well as flexularly elastic cover strips (104) covering the well openings (103), which cover strips are provided in the region of the openings with embossings and/or perforations and/or narrow slits to facilitate the ejection of the medicaments.
14. Filling arrangement according to claim 13, characterised in that the embossings and/or slits have a H-shaped configuration, in which covering wings (113/1 and 113/2) staggered with respect to one another by means of a transverse slit (107) and staggered with respect to the edge strips (47) of the blister strip (21) by longitudinal slits (106/1 and 106/2), form cover flaps that open and close again in the manner of a pair of double doors.
15. Filling arrangement according to one of claims 6 to 14, characterised in that a guide for a movable cover strip (117) is arranged at a vertical distance (h) from the blister strip guide, at a level running parallel thereto between the blister strips (21) and the transporting guide for the packaging unit (11), which cover strip is likewise provided with embossings, perforations or slits facilitating the

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release of passage openings, as well as with a device (123, 126, 127) for actuating the opening of cover flaps bordered by such embossings, perforations and/or slits.

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16. Filling arrangement according to claim 15, characterised in that the cover strip (117) arranged at the intermediate level has the same periodicity length  $L_p$  as the blister strip (21), and is independently further transported per delivery cycle that takes place at the respective delivery station, after completion of the cycle, by a defined stretch, preferably by a step corresponding to the periodicity length  $L_p$ .

15

17. Filling arrangement according to claim 15 or claim 16, characterised in that L-shaped or T-shaped release elements (123) that can swivel by at least  $90^\circ$  are provided, which can be swivelled from a base position, in which vertical passage channels of a housing block (124) that extend between the blister strip (121) and the guide for the cover strip (117) are released, into a position in which these channels are blocked and the medicaments are delivered into the compartments (12) of the respective packaging unit (11) arranged underneath the cover strip (117).

20

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18. Filling arrangement according to claim 17, characterised in that a device is provided for a common opening actuation of the release elements (123).

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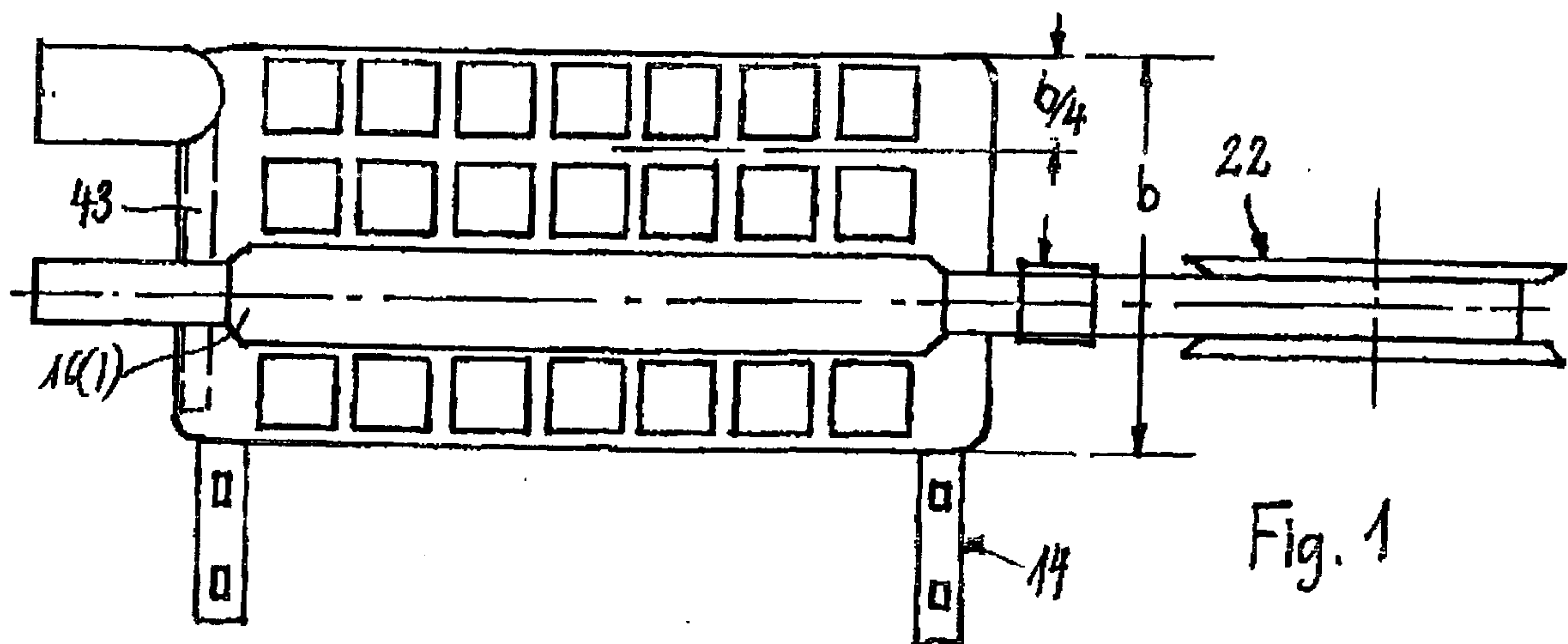
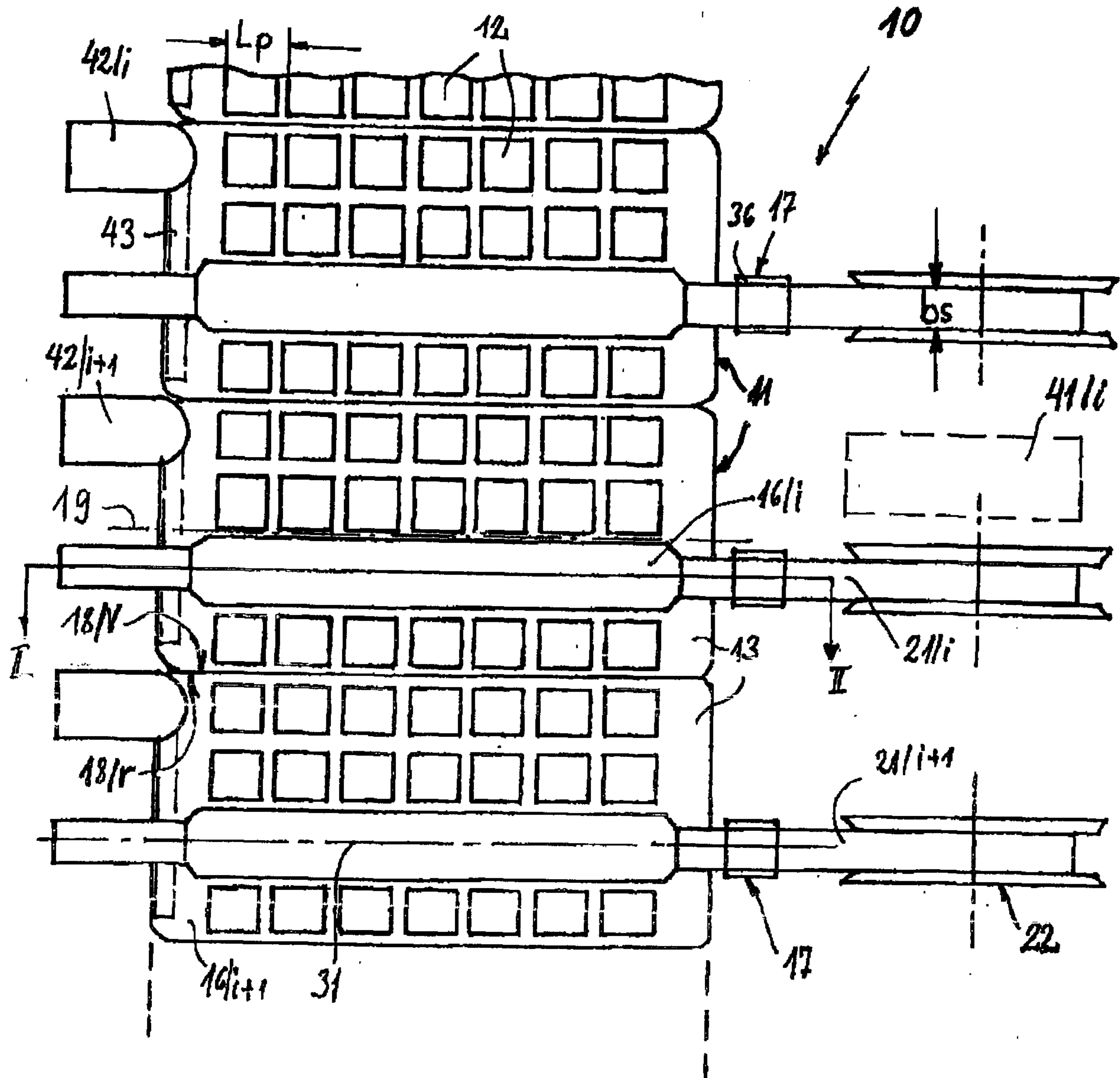
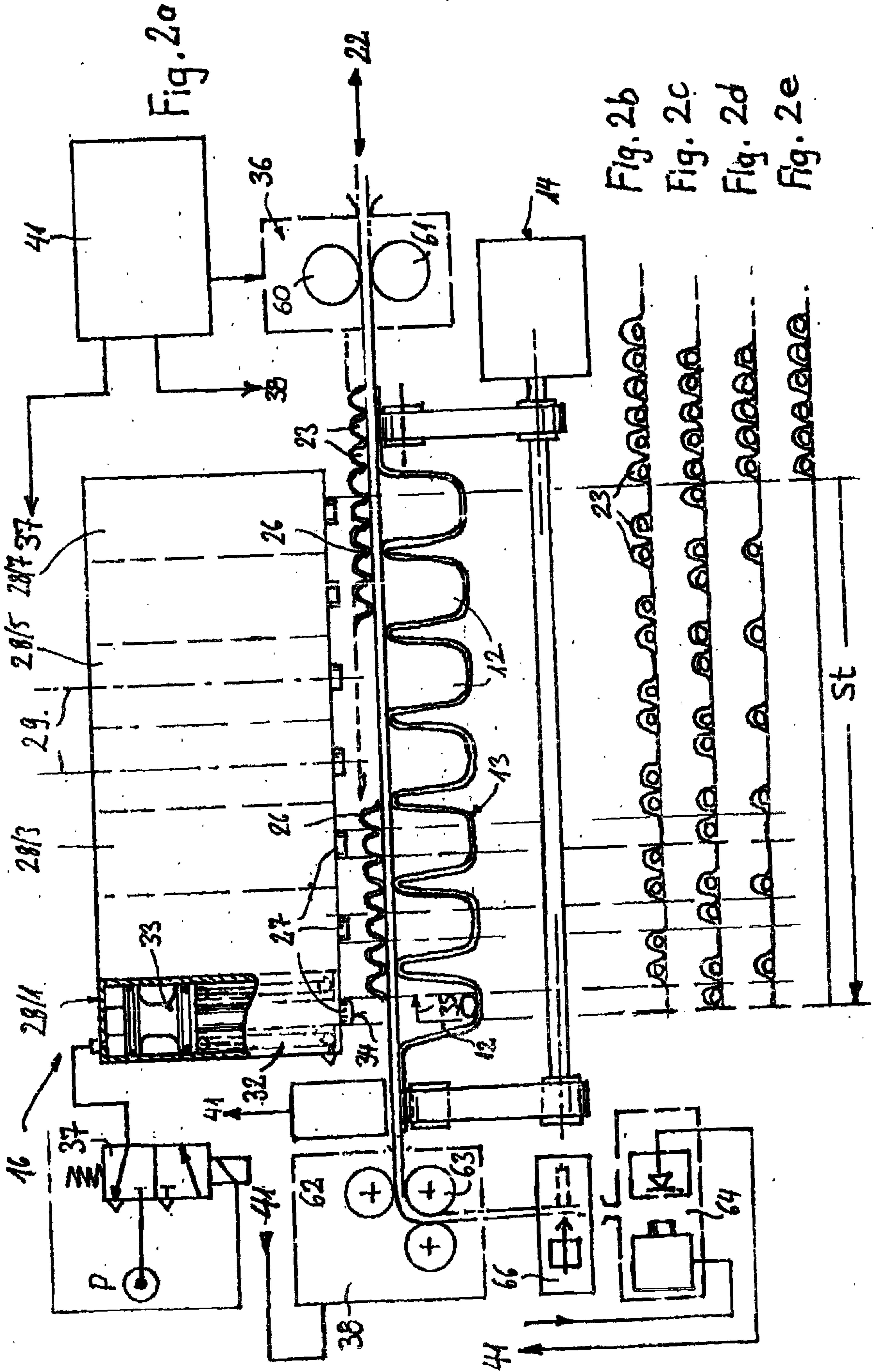
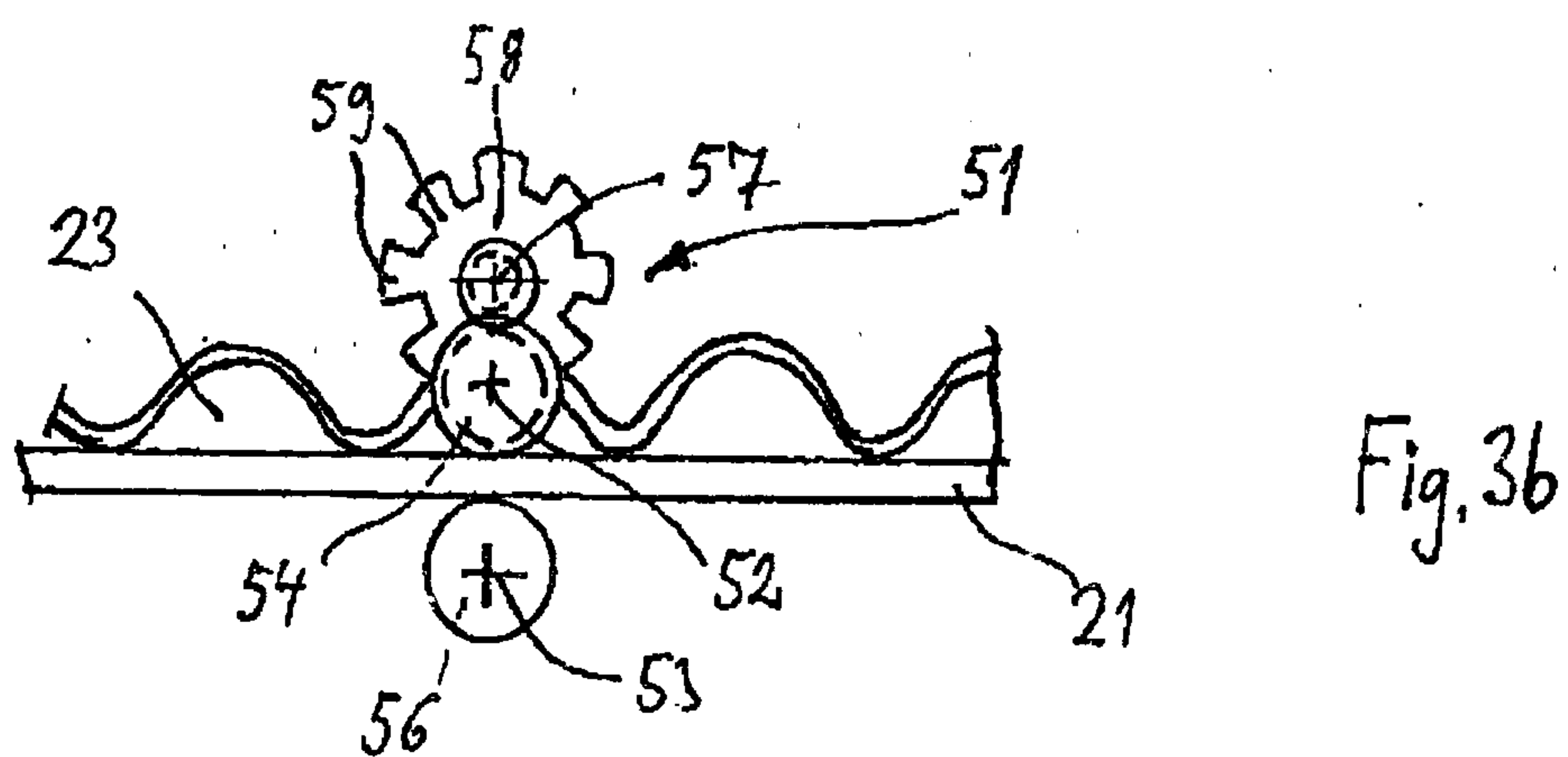
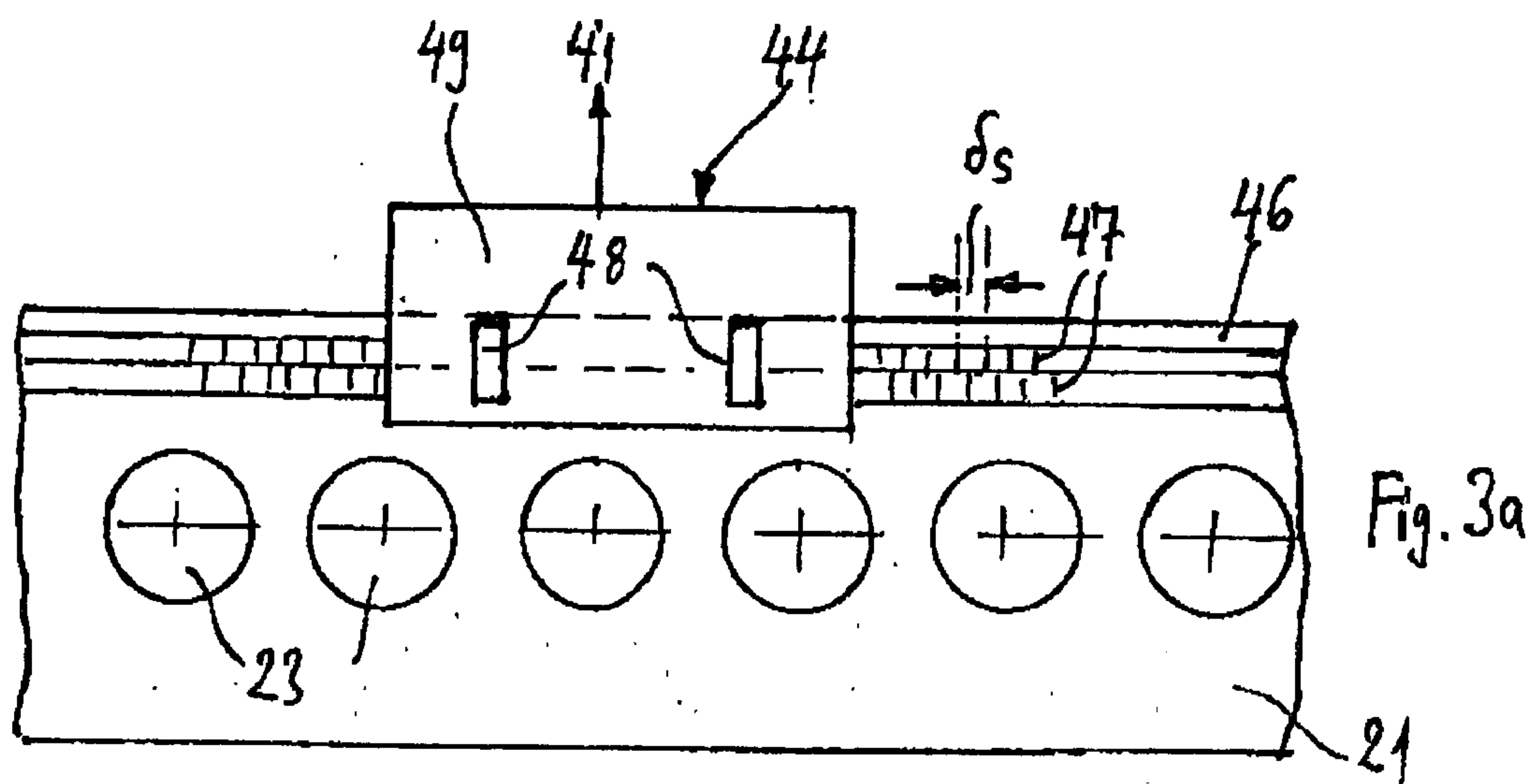
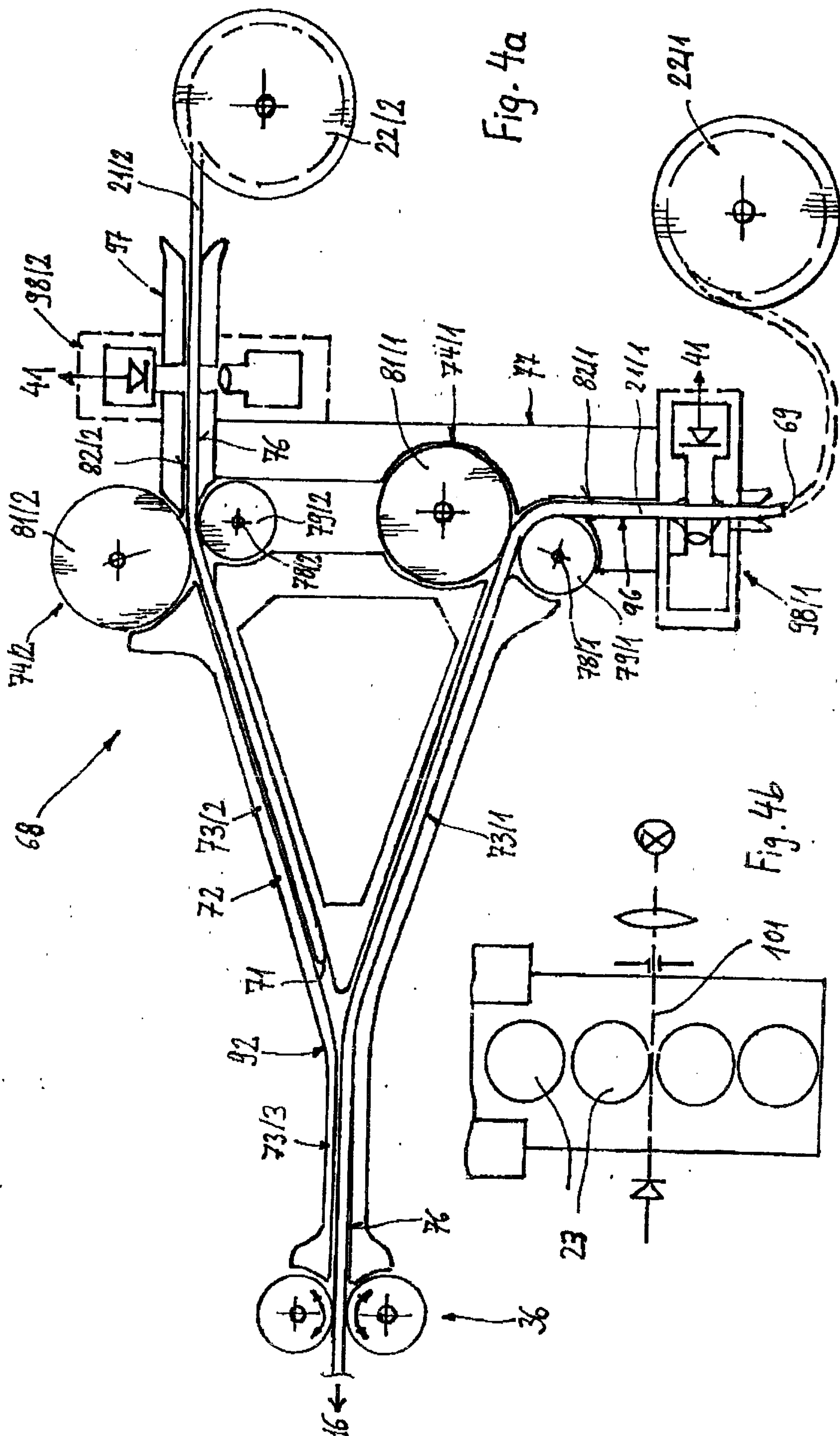


Fig. 1







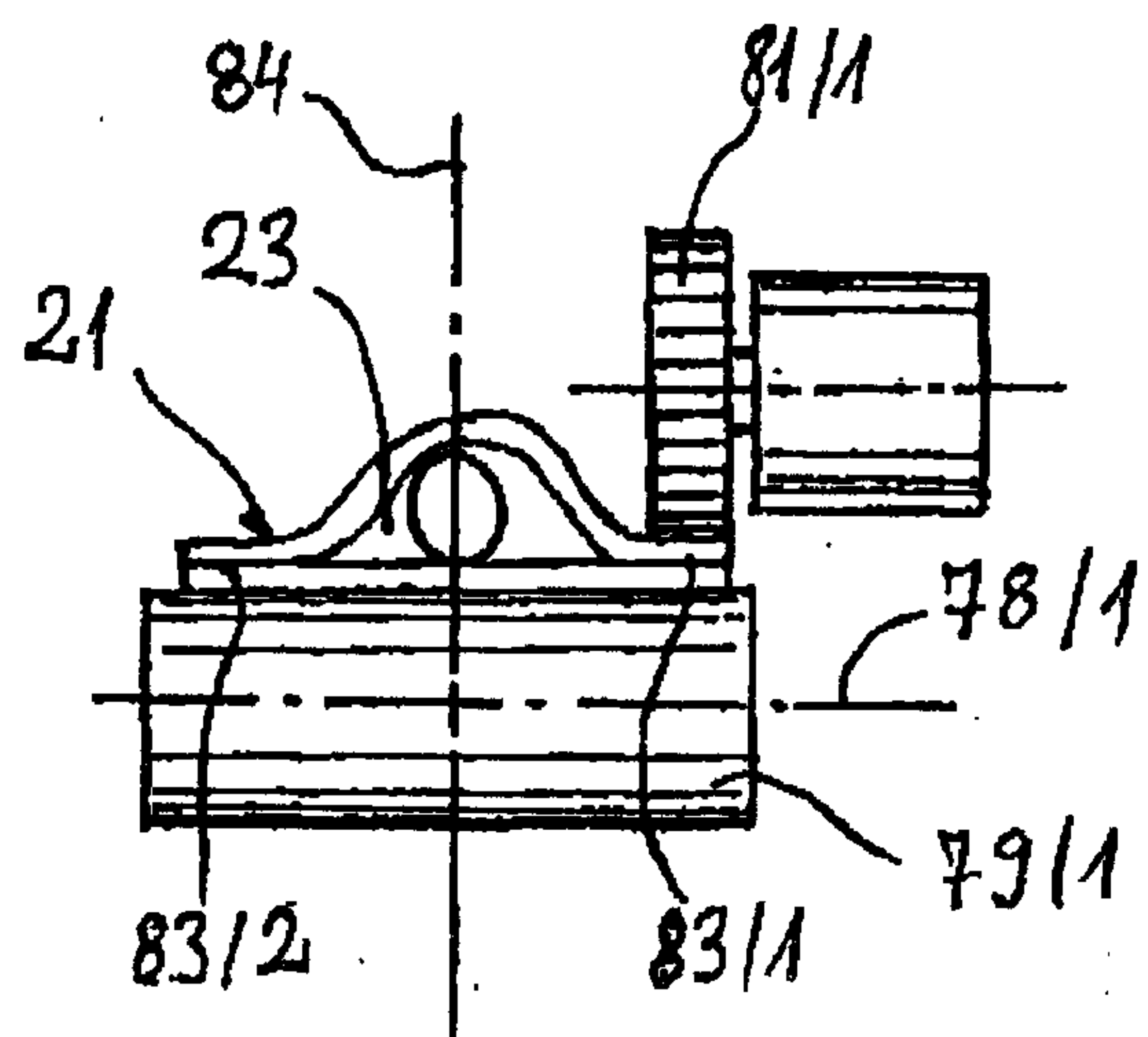


Fig. 5a

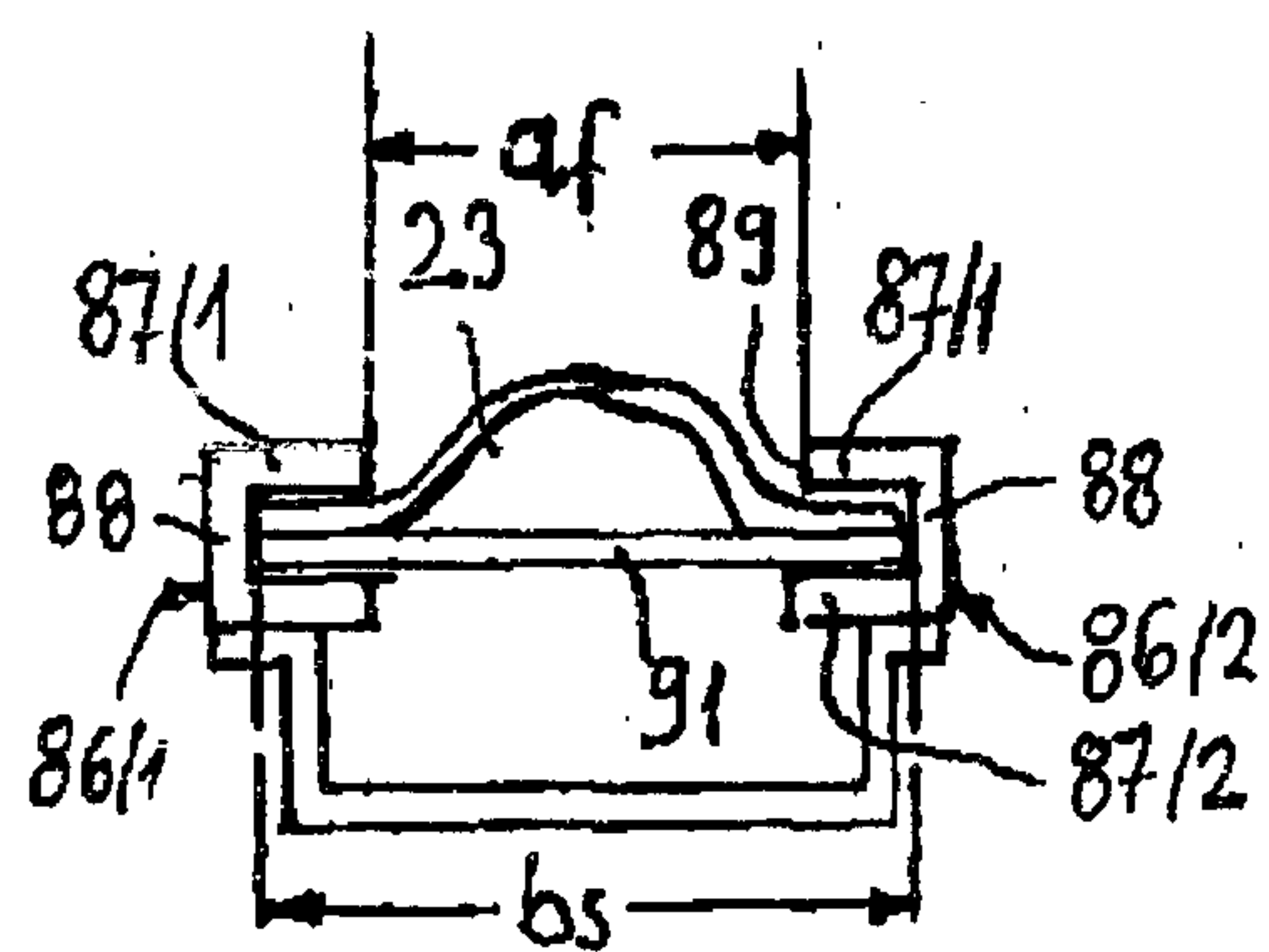


Fig. 5b

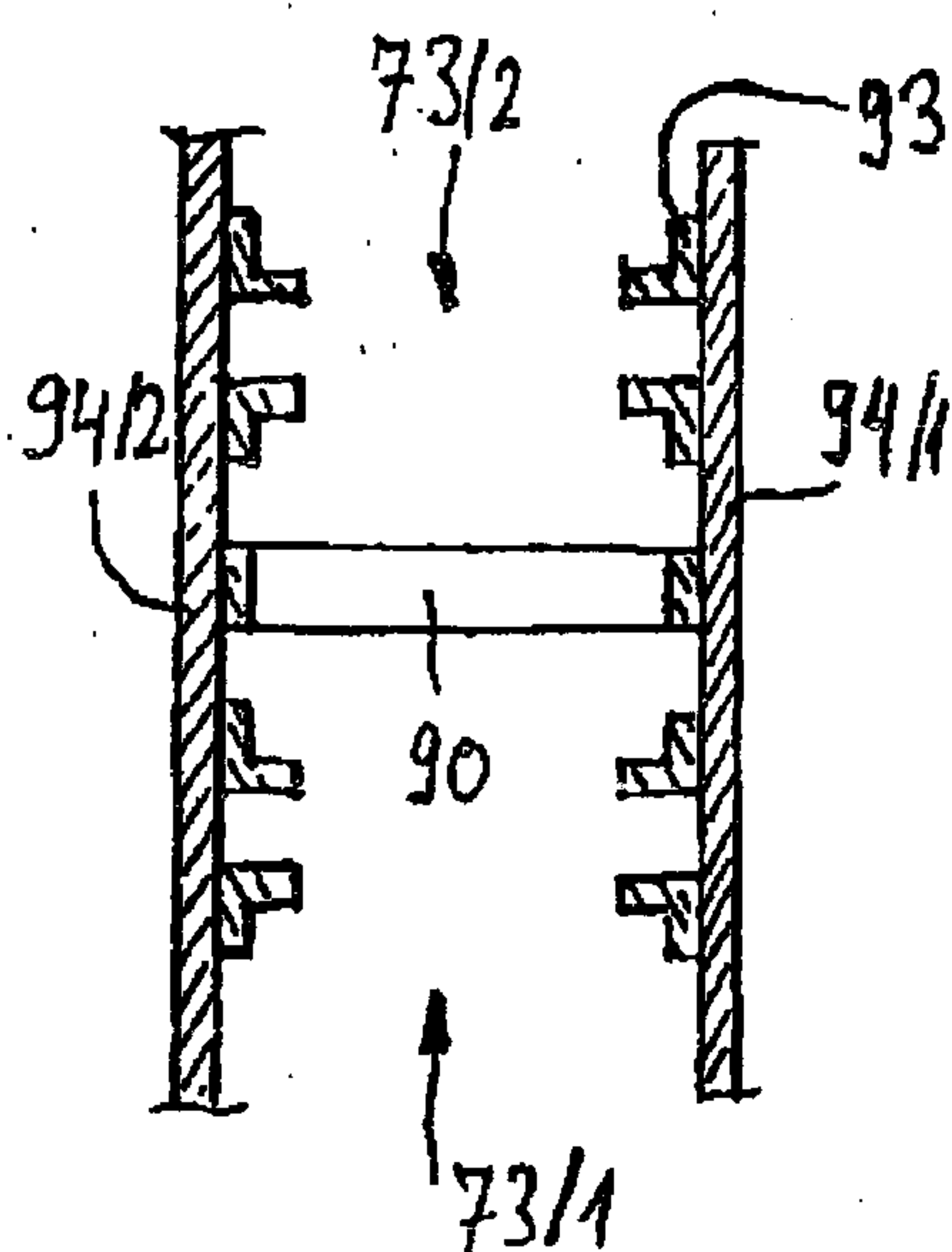


Fig. 5c

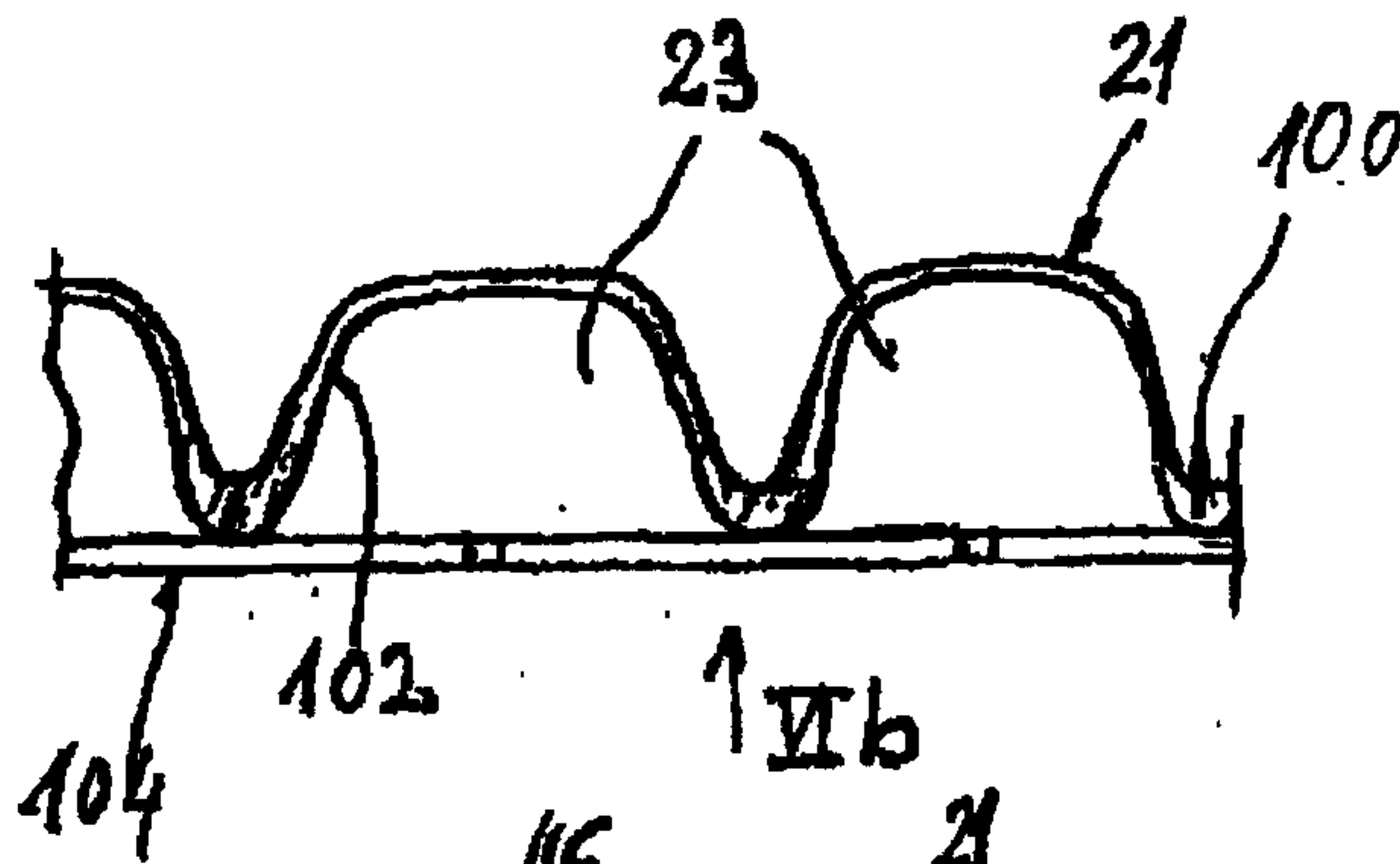


Fig. 6a

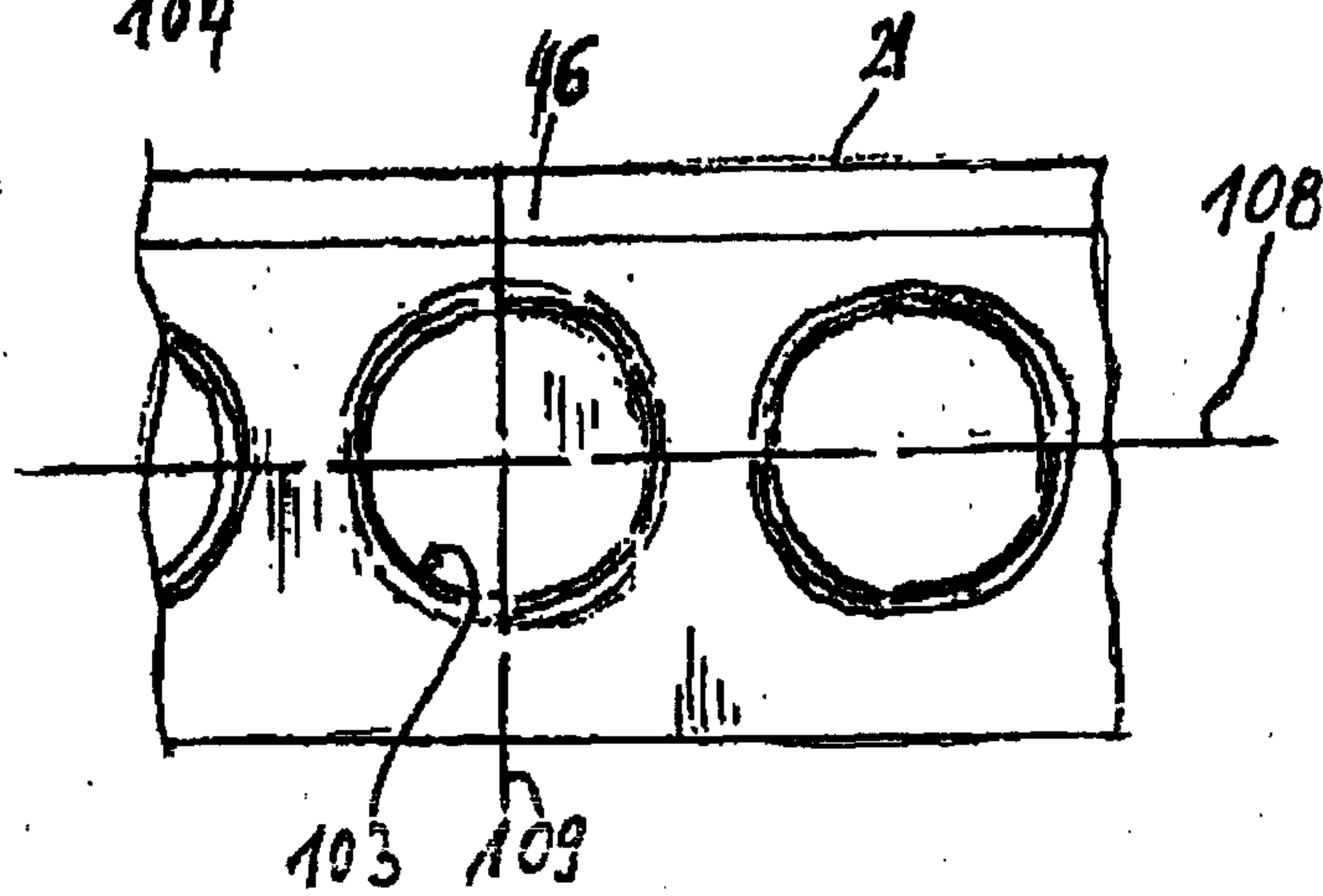


Fig. 6b

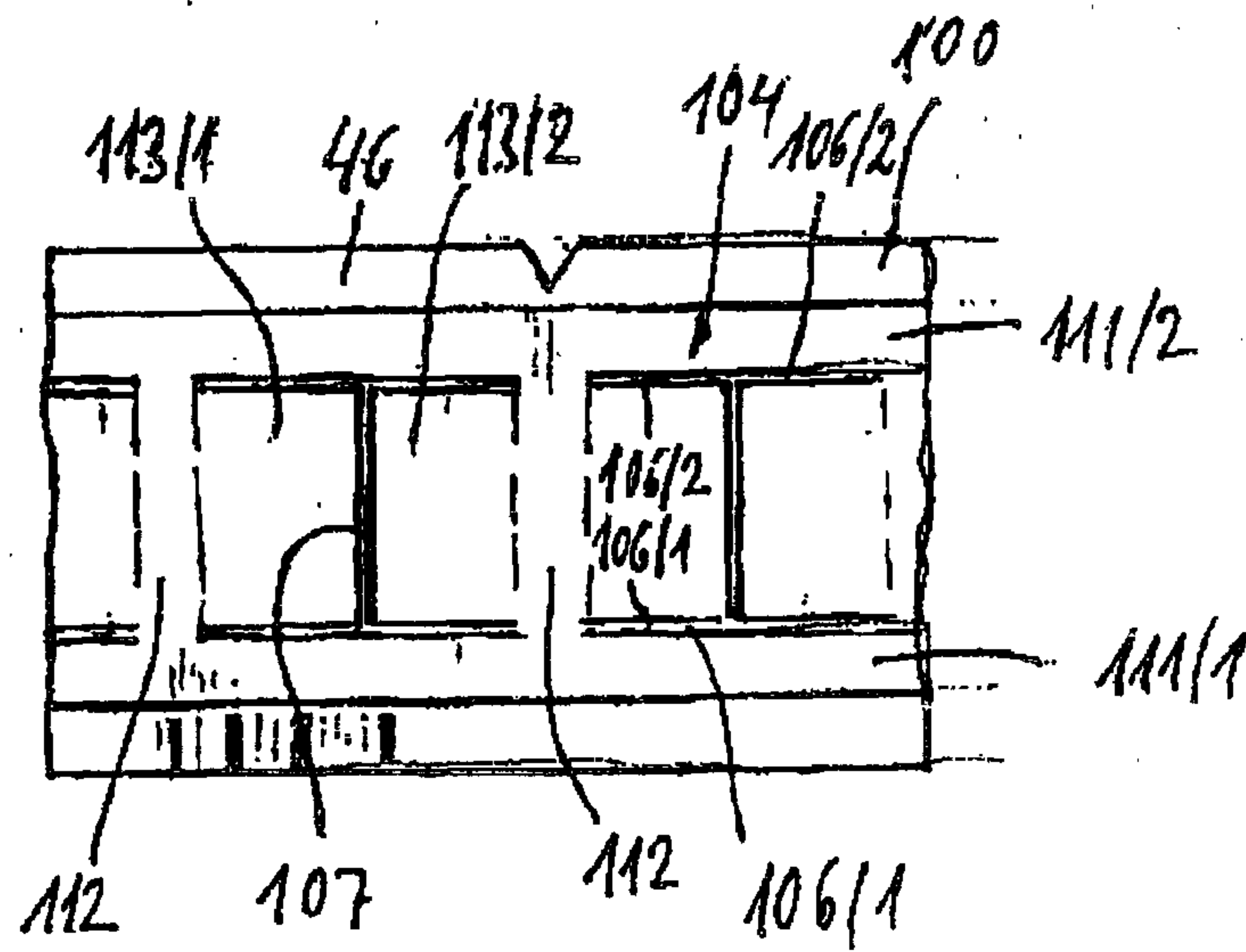


Fig. 6c

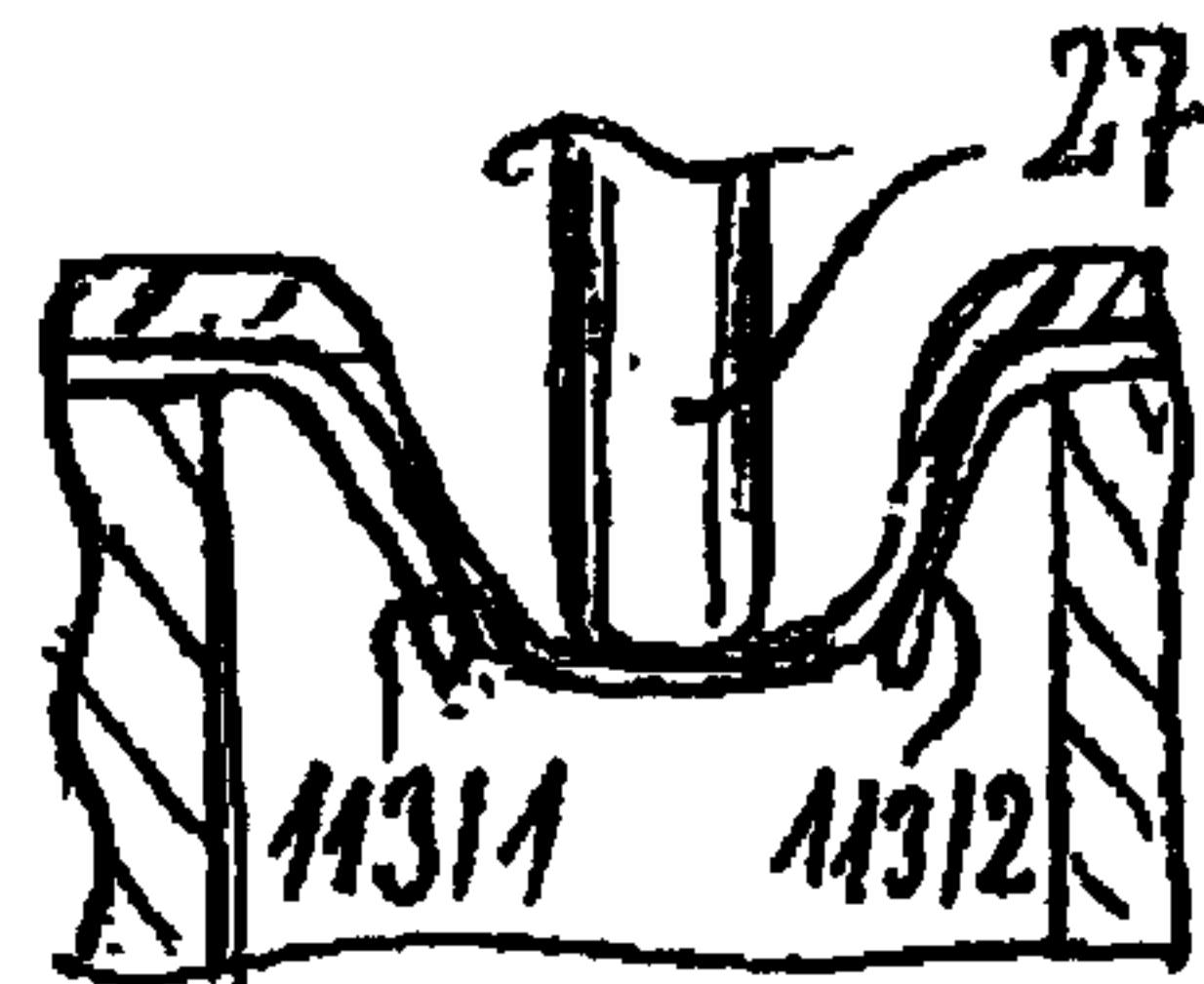


Fig. 6d

