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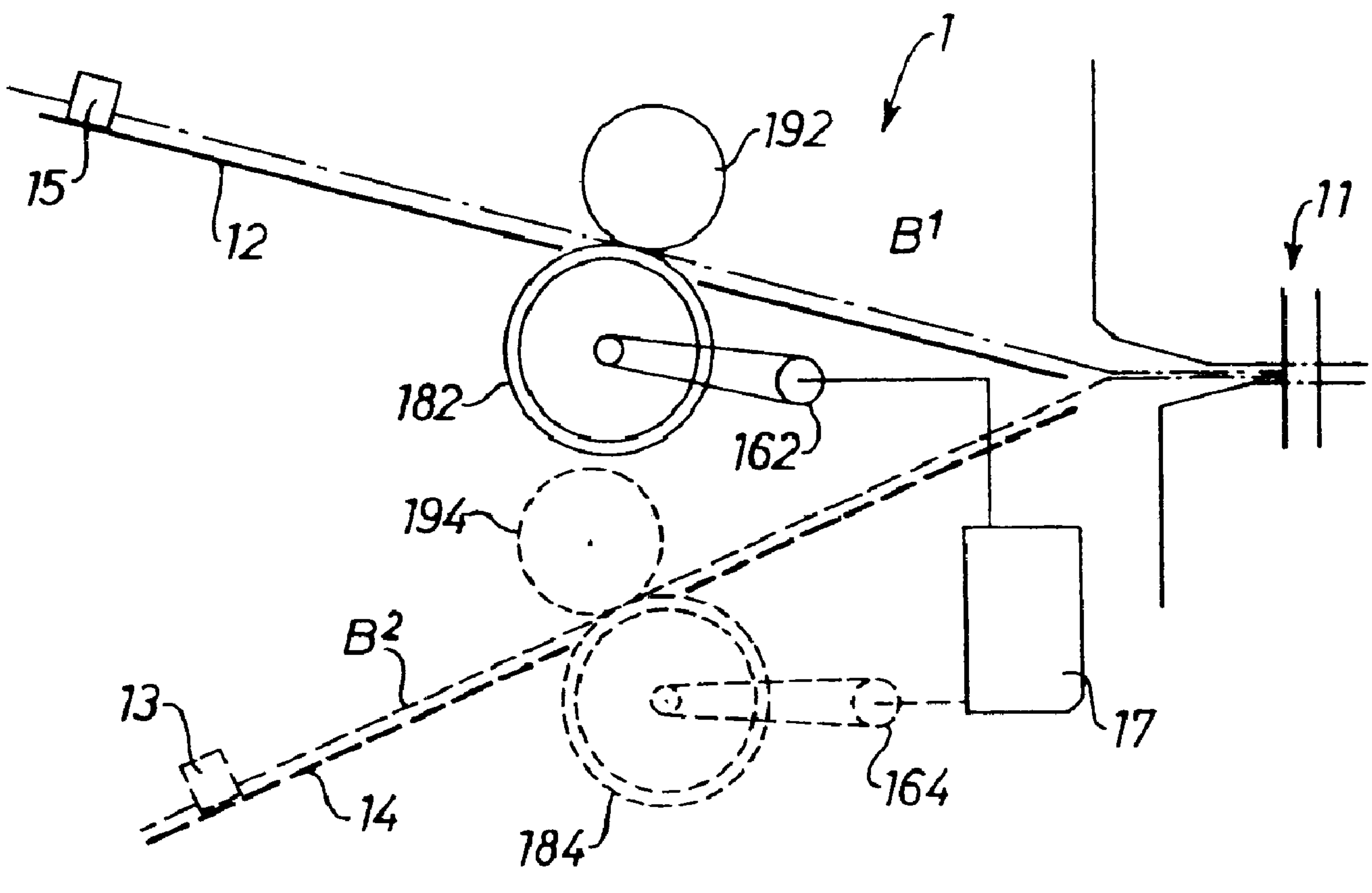
(54) Titre : DISPOSITIF DE TRAITEMENT D'UNE BANDE DE FORMULAIRES
(54) Title: DEVICE FOR PROCESSING STRIPS OF FORMS



(57) **Abrégé/Abstract:**
The device (1) for processing at least one continuous sheet of forms by means of controlled or clocked advancement of the continuous sheet of forms (B_1) has at least one guide (12) for the web extending towards a cross-wise separating device (11) therefor. The device comprises a mechanism (17; 162) for controlling the advancement of the web. The mechanism for advancing the web has a driven roller (182) for each continuous sheet, extending perpendicularly to the working direction over the working

(57) Abrégé(suite)/Abstract(continued):
width of the device and cooperates with at least one pressing device (192), i.e., at least one non-driven idling roller or several of such rollers, in order to advance the web. The driven roller has a continuous main shaft (20) which is joined on the ends thereof to a drive for rotation of the continuous main shaft. At least one pair of cylindrical bushings (21; 22) which can rotate around said main shaft and interact with each other by means of a differential gear (24) are borne on the main shaft.

(PCT/CH00/00256 – WO 00/69764)
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ABSTRACT

The device (1) for processing at least one continuous sheet of forms by means of controlled or clocked advancement of the continuous sheet of forms (B_1) has at least one guide (12) for the web extending towards a cross-wise separating device (11) therefor. The device comprises a mechanism (17; 162) for controlling the advancement of the web. The mechanism for advancing the web has a driven roller (182) for each continuous sheet, extending perpendicularly to the working direction over the working width of the device and cooperates with at least one pressing device (192), i.e., at least one non-driven idling roller or several of such rollers, in order to advance the web. The driven roller has a continuous main shaft (20) which is joined on the ends thereof to a drive for rotation of the continuous main shaft. At least one pair of cylindrical bushings (21; 22) which can rotate around said main shaft and interact with each other by means of a differential gear (24) are borne on the main shaft.

(Fig.2)

(PCT/CH00/00256 – WO 00/69764)
with Article 34 amendments

DEVICE FOR PROCESSING A CONTINUOUS SHEET OF FORMS

The present invention concerns a device for processing continuous sheet of forms through strokewise advancing and cutting; such devices are known, e.g., from the German utility model G 85 04 658 (1985) and from EP-A-0 156 775. Devices of this type are used especially for automated processing of continuous forms, i.e., for the separation of the forms and for bringing together the sections that belong together and usually also for enveloping.

EP-A-0 510 324 also concerns the processing of continuous forms. In this connection the forms are transported with the help of adjoining, rotating bands.

Finally, EP-A-0 556 640 belongs to the technological background; it describes a Capstan roller for thermal printers. The roller for the paper to be printed consists of three segments, which are connected through a differential drive to adjust the average speed of the two end segments to the speed of the middle segments.

In the case of devices of the type described in the opening paragraph, the sheet of forms, which are advanced continuously or discontinuously, are separated crosswise to the working direction in single sections of the predetermined length. The advancement is carried out in these devices by means of sprocket feeds, i.e., pin-feed wheels or bands whose sprockets interlock into the conventional marginal perforation on one or both side(s) of the continuous sheet of forms. The control of the advancement can be carried out mechanically or electrically or electronically and, for example, electro-optically, e.g., through a program and/or through markings on the forms and in accord with the respective requirements on the formula length.

In general, persons experienced in the art assumed that such a type of advancement can be obtained with pinfeed wheels or bands and with sheets of forms that are perforated on the sides. This approach had the disadvantage that perforated paper must be used and devices for separating the perforated sheets were necessary. Moreover, the separated perforated sheets cause a considerable volume of waste paper that must be taken away and disposed of.

It would therefore be desirable to have a device available of the type named in the introduction, which avoids the use of sheets of paper perforated on the sides and yet makes possible an accurate advancement of the continuous sheet of forms. The problem addressed by the invention is to provide a device that fulfills these requirements so that sheets of paper without side perforations can be used, no waste through separated perforated sheets is created, and no devices for cutting the sides of the sheets or forms, created by it are necessary.

Attempts that did not lead to the desired result were those that, instead of using the sprocket feeds for advancing the forms, used the conventional transport devices with roller pairs, as are used with the continuous processing of sheets of paper, plastic, or textile, and which typically have at least one roller pair with a counter-rotating drive for strokewise advancement of the strips to a processing or cutting station.

US-A-4,555,967 concerns a continuous sheet guiding device wherein the advancement of the sheet is not interrupted for crosswise cutting.

US-A-3,552,903 discloses sheet guiding device having an equalizing gear in a continuously driven sheet winding system.

The investigations leading to the present invention have shown, in particular, that in this way the necessary high processing speeds of 1-4 m/sec and the necessary accuracy of advancement for up-to-date devices for processing printed continuous sheets of paper cannot be attained, especially not during long operation with the inevitable change of the interaction between the continuous sheet of forms (or web) and the roller, e.g., as a consequence of contamination, fluff, and the like.

Surprisingly, we found that the above-defined problem can be solved by guiding the continuous sheet of paper so they are advanced accurately in the right direction on the driven roller, which has at least one pressing device, e.g., at least one adjoining roller but not a driven feeder roller lying near it or one other equally acting device that cooperates and has two parts that are connected to each other through an equalizing gear to equalize irregularities of the advancement, such as can result, e.g., through impurities or other attendant phenomena when the device is operated quickly and continuously.

In this connection according to a first, general, preferred embodiment of the invention, there is arranged on the continuous main axis, which extends over the working width of the device (i.e., over the width of the processing web) and is connected only on one side with a drive for the rotation of the axis, at least one bushing pair, which is pivoted and is essentially symmetrical with respect to the longitudinal center line of the respective sheet of forms, whereby the neighboring bushings are connected to an equalizing gear on the longitudinal center line. The equalizing gear has two bevel wheels, each of which is connected, so it is stiff against torsion, with the neighboring bushings of at least one of the bushing pairs; the working connection of these bevel wheels occurs by means of two equalizing bevel wheels, which rotate freely around a common axis, which is positioned vertical to the main axis, e.g., in a corresponding boring of the main axis that runs transversely.

The equalizing gear according to the invention has an effect analogous to the known differential gear on the driven wheels of an automobile that is taking a curve, in which the driving speed of the tires adjusts to the different radii of the curve taken by each wheel. Only when driving a straight route – in this case with the exactly straight run of the respective sheet of forms – are both bushings driven with exactly the same speed. The equalizing gear used according to the invention between the neighboring bushings on the main axis causes a deviation to be compensated and corrected automatically through the equalizing gear if a side deviation occurs from the normally straight running direction of the strip of form.

According to a first embodiment of the invention, there is provided a device for processing continuous sheet of forms through strokewise advancement and cutting of at least one sheet of form with the properties specified in the patent claim. Preferred embodiments of the device according to the invention have the properties specified in the claims 2 - 7.

The equalizing gear according to a preferred embodiment of the invention is a mechanical gear of known type, which has two drive bevel wheels and two equalizing bevel wheels; each of the drive bevel wheels is connected to a bushing so it is stiff against torsion; the two equalizing bevel wheels are pivoted about a transverse axis, which is connected to the main axis and, e.g., is guided through it; in this case each of the drive bevel wheels is interlocked into the two bevel equalizing wheels.

With such a mechanical gear the drive bevel wheels and/or equalizing bevel wheels according to a preferred embodiment are formed as toothed bevel wheels, preferably autolubricating, i.e., at least in each case one of the interlocked bevel wheels or toothed bevel wheels consists of an autolubricating polymer such as polyamide, polyacetal, polyester at least on the outside. The optimization of the choice of material for the wheels of the equalizing gear and also for all other parts of the device according to the invention lies within the scope of persons skilled in the art.

In general the frictional surfaces, i.e., the surface coming into contact with the associated strip of form, which through the bushings that are connected so they move through the equalizing gear is covered with a nonabrasive elastomer, especially a rubber-elastic material, e.g., a synthetic or natural elastomer such as rubber, polyurethane, polyisoprene, or the like, which typically has a Shore hardness of A in the range of 80-100, typically 90-95.

Moreover, the frictional effect of the bushing surface can also be obtained through the surface condition or the surface structure–e.g., it can be obtained as the result of surface roughness and/or pattern-type or statistically distributed patterns. For this purpose surfaces or surface areas of abrasion-resistant materials can be used, including metal, ceramic, glass, and mechanically resistant materials (sintered metal, metal carbide, nitride coatings, diamonds, boron nitrides), e.g., in the form of imbedding sufficiently fine particles of such mechanically resistant materials in a layer of metallic or nonmetallic fillers.

For the choice of the frictional surface, an optimizing choice of material with a consideration of the above information also lies within the scope of persons skilled in the art.

Generally at least two contact sites lying opposite each other on both edges of the sides of the continuous sheet of forms serve to guide the continuous sheet in the longitudinal direction. Preferably, contact site pairs in the working direction of the device, i.e., the running direction of the continuous sheet, are placed at intervals from one another at least around the working width of the device, namely, before the appropriate driven roller. It is clear that these contact sites or contact site pairs can be positioned–whether it be to adjust the various form widths or to finely control the form insertion.

To operate the new device with the strokewise advancement of the continuous sheet of forms, an acceleration phase, a movement phase, and a braking phase can be assigned to each advancement stroke of the sheet of forms; the acceleration phase is triggered through a corresponding signal of the desired form length and the adjustment of the advancement of the sheet of forms follows on a certain point through the form length.

In this connection the continuous sheet of forms has a known method, e.g., through printing produced markings whose optical reading triggers a corresponding control signal; the movement is controlled by a known control electronics, which compares the actual value of the advance trigger point with its target variable and brings about the control of the operation from the difference.

The invention is now explained by referring to the drawings showing preferred embodiments, but not limited by them.

Figure 1 is a diagrammatic representation of the device according to the invention with a first and an optional second continuous sheet of forms;

Figure 2 is a half-diagrammatic cross-section view of the driven roller of a device according to the invention;

Figure 2a is an enlarged representation of the equalizing gear of the roller in Figure 2;

Figure 3 is a diagram of the advancement stroke; and

Figure 4 is a diagrammatic top view of the guiding mechanism with a continuous sheet of forms and the respective driven roller.

The device represented in Figure 1 has a first guiding mechanism 12 for the continuous sheet of forms B^1 and an optional (in dotted lines) second guiding mechanism 14 for a second continuous sheet of forms B^2. The number of guiding paths is limited only through constructive data and the number of continuous sheet of forms to be processed. In an analogous (not represented) manner three or more continuous sheet of forms can be run together if desired, provided sufficient space is provided. The number of paths processed simultaneously with the device according to the invention is not critical and lies within the discretion of one skilled in the art.

When using more than one guiding mechanism the guiding mechanisms can be arranged in a known way in which they converge over one another. In so doing with the use of more than one roller (and the simultaneous processing of more than one continuous sheet of forms) it is not significant whether the guiding mechanisms in each case form an angle with the horizontal or one of the guiding mechanisms runs close to it horizontally. When using a single sheet of forms the guiding mechanism 12 can be positioned horizontally or at an angle to the horizontal. The size of this angle is, again, at the discretion of the skilled artisan.

The continuous sheet of forms B^1 and, if applicable, each further available continuous sheet of forms is fed to the device from a source that is not represented, e.g., a hopper or a longitudinal separating device for a 2-sided printed sheet of forms. Each continuous sheet of forms lies on its side on a guiding mechanism 13 or 15 (only the guiding mechanism lying at the front is represented in each case).

Each continuous sheet of forms travels between the respective rollers 182 and 184 and under the light pressure of typically 50 - 500 g of the adjoining pressing device, e.g., the non-driven adjoining and feeder rollers 192 and 194 or similarly working devices, to the separating device 11, which, can be a "guillotine" with a cutter bar or blade and one or two cutting edges, as a rotating knife, or its equivalent structure. As already briefly indicated, several adjoining rollers can also be used for each roller and/or these can be replaced or supplemented according to their effect through the same or similarly working devices, e.g., adjoining springs, clamps, or the like.

The roller 182 or 184 is connected to the appropriate drive 162 or 164, e.g., an electric motor whose activity is controlled by a control 17 to guide at least one continuous sheet of forms to the separating device 11.

The construction of the driven roller 182 is explained in Figure 2 by using a half-mechanical cross-sectional view. The roller has a one-piece, main axis or shaft 20 made of a rigid material, typically steel, aluminum, or the like, which is guided through both ends 201, 202 so it rotates in the bearings 204, 205 and is connected on one side, in this case, e.g., on the end 201, to a non-illustrated drive motor.

On the main axis 20 are two bushings 21, 22 between two stop-motion parts 206, 207, connected with the axis 20 and guided on it so they rotate around the axis. Each bushing typically consists of a rigid material such as steel, aluminum, or thermosetting plastic and is provided with a frictional covering 219, 229, e.g., made of an elastic polyurethane (e.g., Vukollan® of the firm Bayer AG) or a coating of a fine-grained mechanically resistant material in a suitable matrix material.

On each bushing the appropriate pressure roller 29a, 29b adjoins the area of its frictional coating 219, 229 to press the continuous sheets of forms against the frictional coating sufficiently so that the continuous sheets of forms (not seen in Figure 2) is transported by actuating the drive (not illustrated in Figure 2) practically without slippage.

Both bushings 21, 22 are connected with each other in the area of the center of the main axis 20 through the equalizing gear 24, as shown in enlarged view in Figure 2a. The equalizing gear 24 consists of two drive bevel wheels 211, 221, which are formed as bevel toothed wheels and each is connected so it is stiff against torsion to the appropriate bushing 21, 22. The working connection of the drive bevel wheels 211, 221 or the bushings 21, 22 firmly connected to them takes place by means of two equalizing bevel wheels 261, 262, which are also formed as toothed wheels and which can be rotated around the additional axis 28 and are interlocked into the drive bevel wheels 211, 221.

The additional axis 28 lies in a cross hole of the main axis 20 and is carried along with its rotation, i.e., rotated in a radial direction. The additional axis 28 can be rotated axially, but this normally does not have practical significance. It is essential that the equalizing gear 24 is only effected when the bushings 21, 22 adjoining the continuous sheet of forms are not involved to the same extent in the transport. Such an inequality can occur during continuous operation by contamination with fluff or the like, which will cause the continuous sheet of forms to no longer travel in a straight path, i.e., perpendicular to the separating device. In this event the equalizing gear 24 brings about an immediate correction and ensures it a reliable guiding of the continuous sheet of forms even during continuous operation with typical web speeds of 1 to 4 m/sec.

A preferred control or adjustment of the drive of the main axis 20 is shown in Figure 3. In this connection the electric motor is controlled in such a way that the continuous sheet of forms, which is initially at rest, accelerates at start-up and is then guided at constant speed through the movement or advancement phase B_{mov} to the beginning of the braking phase B_{br}. To control the drive according to a preferred embodiment according to the invention, stopping occurs during the transition of the B_{mov} phase to the B_{br} phase and the braking action is measured in such a way that the web is properly positioned on the separating device, which, e.g., is controlled through printed markings in the conventional way.

In practice this occurs advantageously so that each sequential-selective advancement stroke of the continuous sheet of forms is produced through a signal corresponding to the desired form length and released through markings on the continuous sheet of forms, and the control of the advancement takes place on the trigger point determined through the length of the form. The reading can be made in a known way, e.g., through the optical reading of the markings on the continuous sheet of forms. The movement is controlled through control electronics, which compares the actual value of the position of the trigger point with the target value and effects the control of the operation by using the difference.

Figure 4 shows a part broken off of the guiding mechanism 42 of a device according to the invention with the continuous sheet of forms (or web) 43, which has a center line M and a width B, lying on it. The guides 45a, 45b on the sides are arranged at a distance L in the running direction (arrow A) in front of the driven roller 44, whereby the distance L is preferably at least as large as the width B of the web 43. The pressing rollers 49a, 49b are positioned so they are symmetrical to the center line M of the strip of form and press the continuous sheet of forms into the area of the frictional coatings against the rollers, which are connected through the axis 40 to the drive 46, and the activation of the roller in the above-represented way controls and adjusts.

The embodiment described above serves to explain, but not limit, the invention and offers in general a device for processing at least one continuous sheet of forms through the continuous or strokewise advancement and cutting of at least one continuous sheet of forms; the device has at least one guiding mechanism running to a separating device for at least one continuous sheet of forms. If more than one continuous sheet of forms is to be processed, the number of the guiding mechanisms naturally is correspondingly larger; the device has a center for controlling the advancement of the continuous sheet of forms and at least one driven roller, which stretches crosswise to the working direction over the working width of the device and interacts with at least one printing device, e.g., one or two non-driven feeder rolls; the driven roller has an uninterrupted main axis, which is connected only on one side with a drive for rotating the uninterrupted main axis; this main axis has at least one pair of cylindrical bushings that rotate around the main axis and that are connected to each other through a mechanical or another type of equalizing gear.

In the above description the preferred embodiments of the invention are described. It is nonetheless clear that in this case it involves not limiting specifications but only those serving to explain. The specified special materials and elements of the device and the construction or operation parameters can best be modified consistent with conventional techniques.

CLAIMS

1. Device for processing at least one continuous sheet of forms through controlled, strokewise advancement and cutting of at least one continuous sheet of forms (B_1), said advancement defining a working direction, this device having a working width and at least one guiding mechanism for the continuous sheet of forms running to a separating device and the device has mechanisms to control the advancement of at least one continuous sheet of forms, wherein the device to advance the continuous sheet of forms has at least one driven roller, which stretches crosswise to the working direction over the working width and interacts with at least one pressing device, whereby the driven roller has an uninterrupted main axis, which is connected on only one of its two ends to a drive for rotating the uninterrupted main axis; and whereby the main axis has at least one pair of cylindrical bushings that rotate around the main axis and that are connected to each other through an equalizing gear.

2. Device according to claim 1, wherein the equalizing gear is a mechanical gear, which has two drive bevel wheels and two equalizing bevel wheels, whereby each of the drive bevel wheels is connected so it is stiff against torsion to the corresponding bushing and the two equalizing bevel wheels are arranged so they can rotate around the transverse axis, which is connected to the main axis, whereby each of the drive bevel wheels are interlocked in the two equalizing bevel wheels.

3. Device according to claim 2, wherein the drive bevel wheels and/or the equalizing bevel wheels are formed as toothed bevel wheels.

4. Device according to one of claims 2 or 3, wherein the drive bevel wheels are autolubricating.

5. Device according to any one of claims 1-4, wherein each of the bushings is coated with frictional surfaces made of a rubber-elastic material.

6. Device according to claim 5, wherein the frictional surfaces consist of a practically rigid material and a structured surface.

7. Device according to any one of claims 1-6, wherein each guiding mechanism for the continuous sheet of forms (B_1) has two contact sites opposite each other to adjoin on both sides of the continuous sheet of forms and the contact sites in the running direction are positioned before the roller placed at intervals at least around the working width of the device.

8. Device according to claim 4, wherein the drive bevel wheels include autolubricating polymers on at least their interlocking surfaces.

9. Device according to claim 5, wherein said rubber-elastic material has a Shore hardness A of 80-100.

10. Device according to claim 6, wherein said structured surface has a roughness provided by an adhesive including a fine-ground mechanically resistant material.

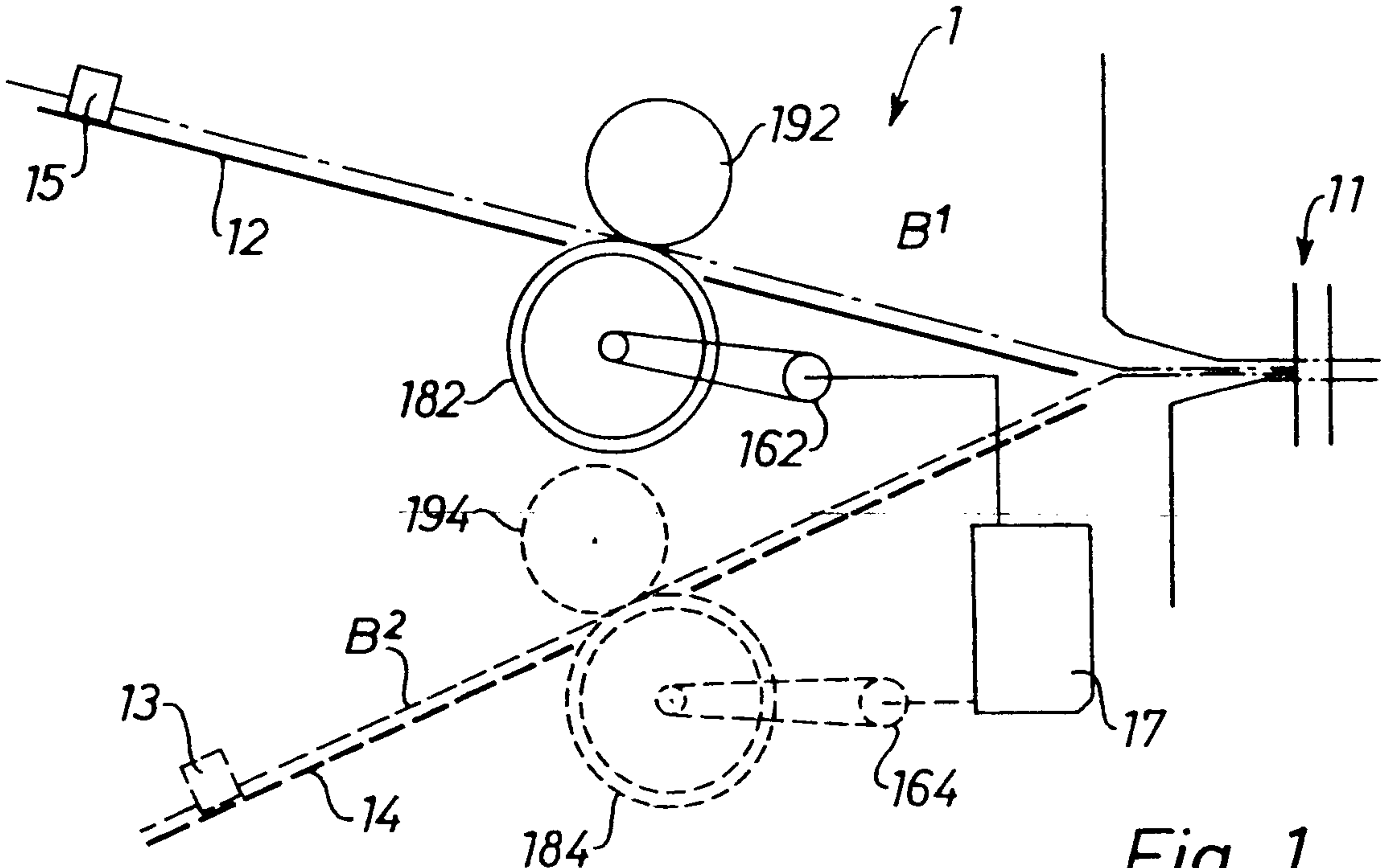

Fig. 1

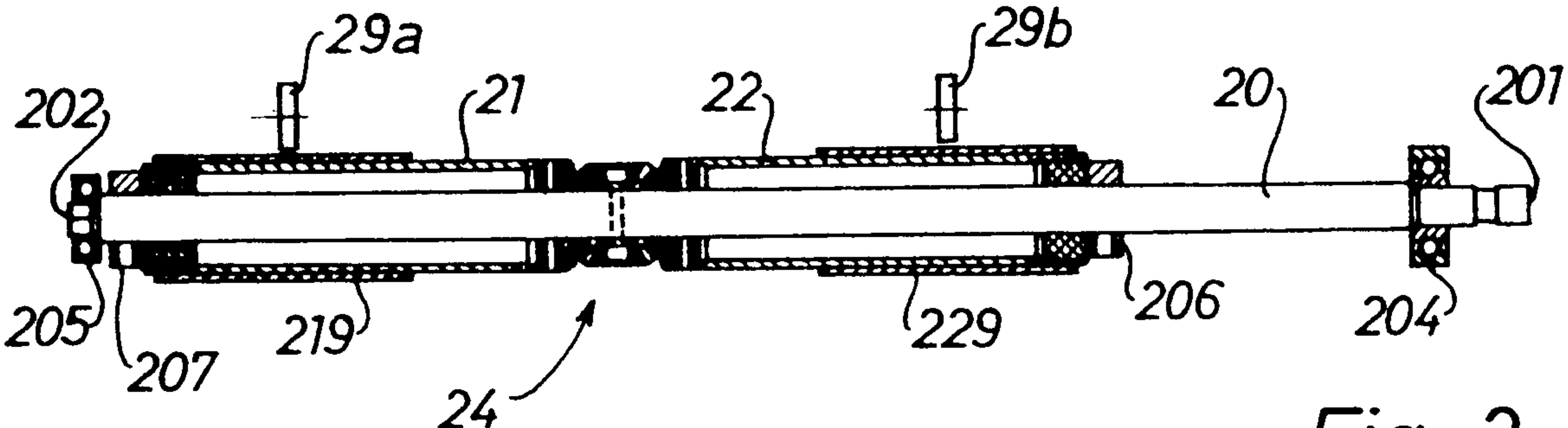

Fig. 2

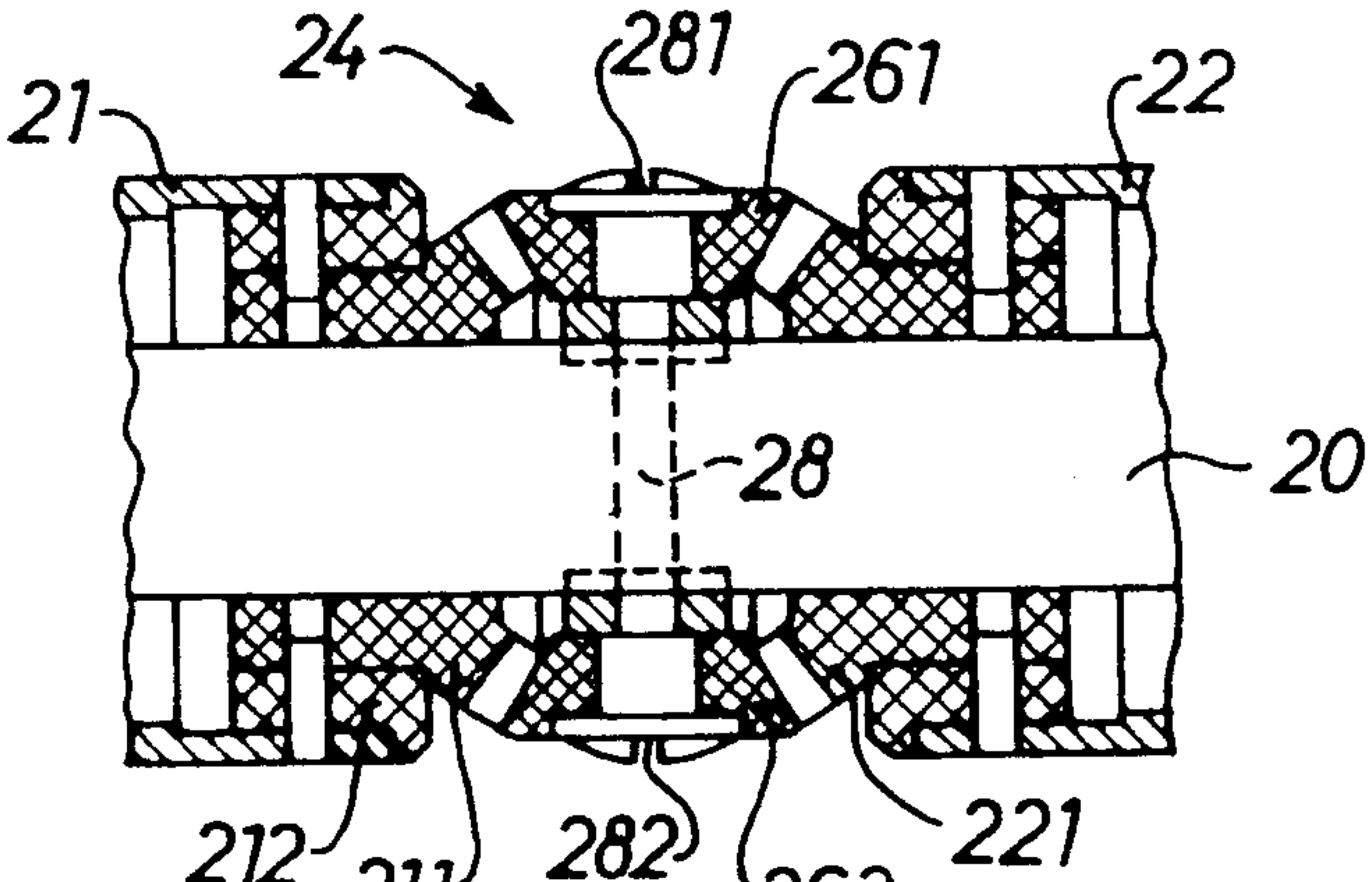

Fig. 2a

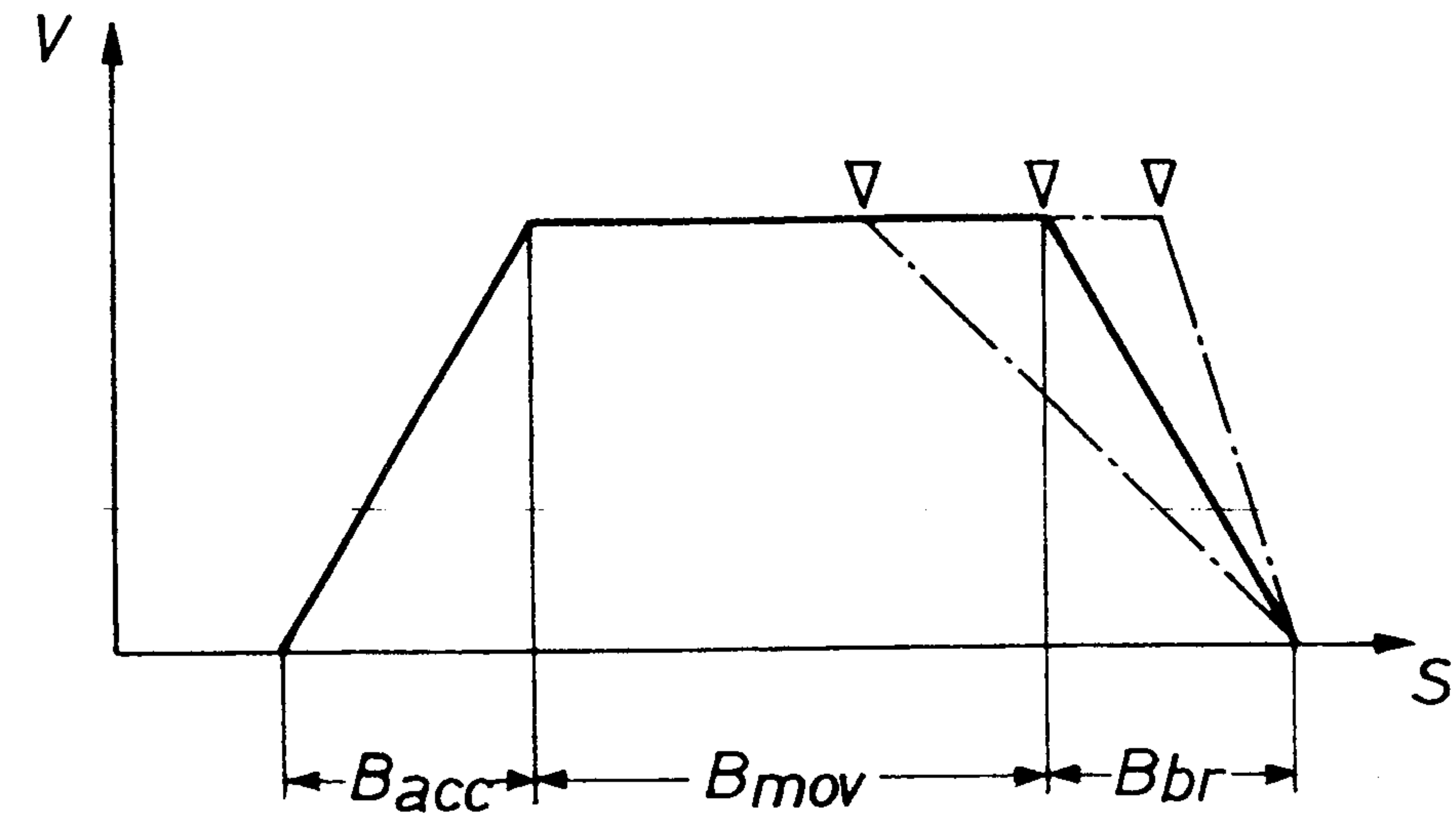

Fig. 3

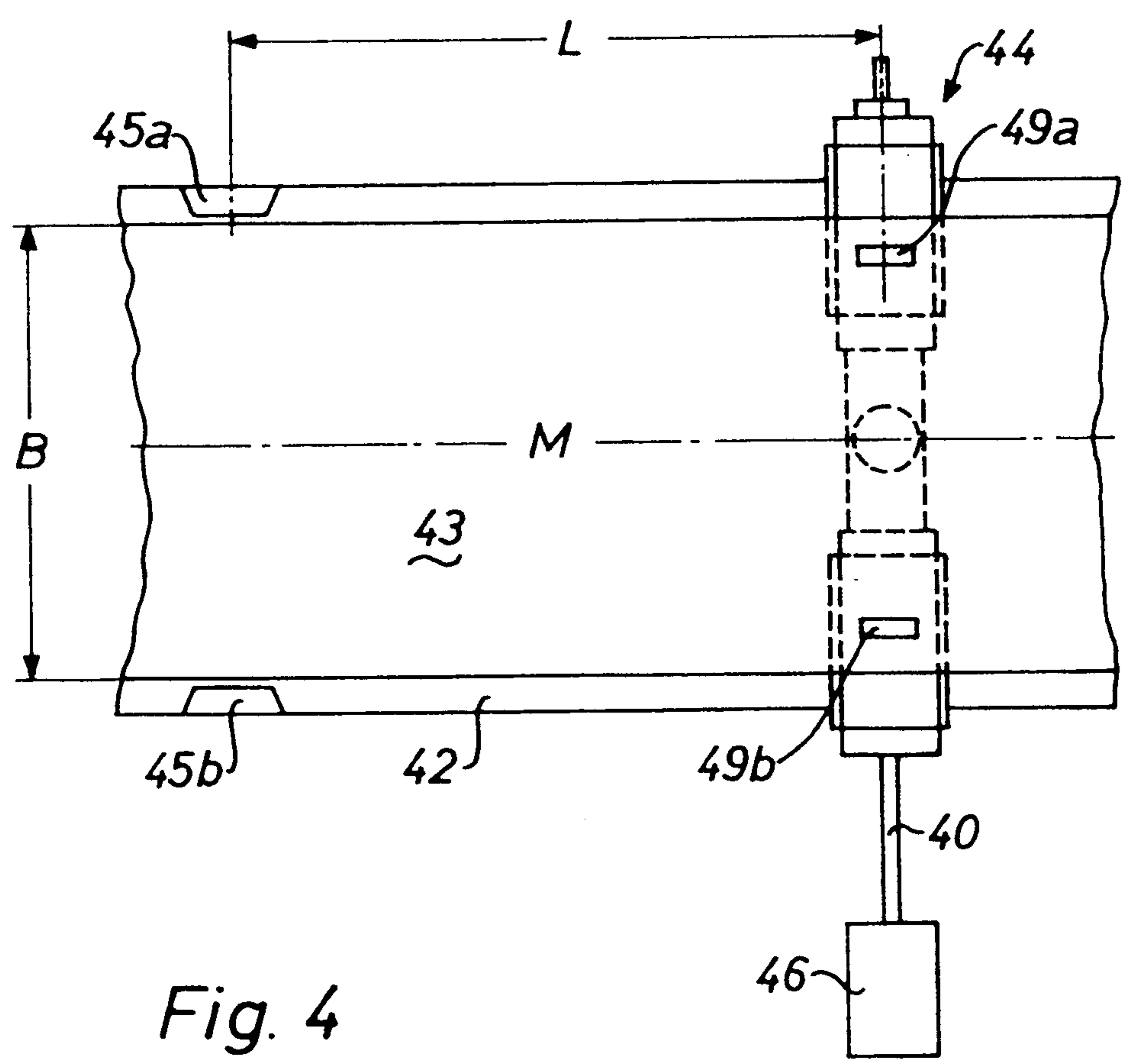

Fig. 4


1
192
15
12
B^1
11
182
162
194
17
B^2
13
164
14
184