United States Patent [19]

Jacobs

[11] **3,740,050**

[45] **June 19, 1973**

[54] **APPARATUS FOR ASSEMBLING A STACK OF SHEETS**

[75] Inventor: **Josef Egied Jacobs,** Vivegnis, Belgium

[73] Assignee: **Ordibel S.P.R.L.,** Herstal, Belgium

[22] Filed: **Aug. 6, 1970**

[21] Appl. No.: **61,628**

[30] **Foreign Application Priority Data**

Aug. 8, 1969 Luxembourg 59,256

[52] **U.S. Cl.** **270/58,** 271/64, 271/65

[51] **Int. Cl.** **B65h 39/02**

[58] **Field of Search** ..... 270/58; 271/64, 65, 271/66, DIG. 9

[56] **References Cited**

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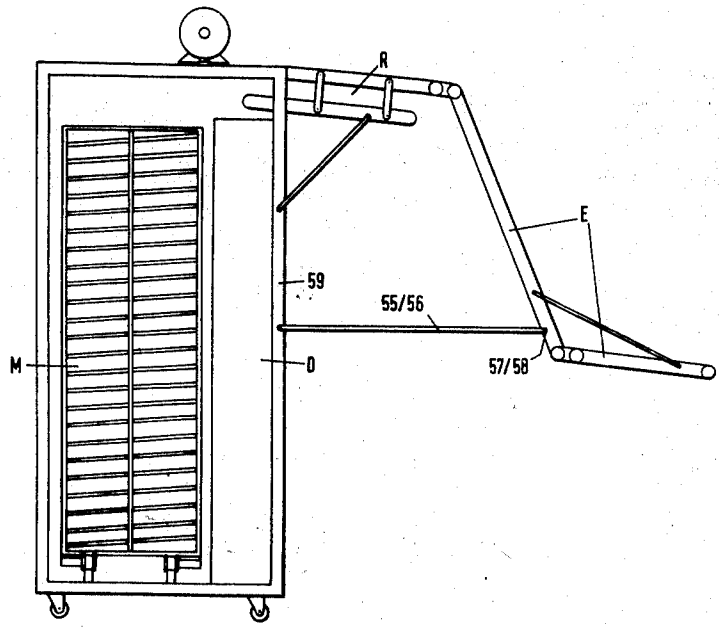
Primary Examiner—Wm. H. Grieb
Assistant Examiner—L. R. Oremland
Attorney—Holman and Stern

[57] **ABSTRACT**

Apparatus for conveying single sheets received from a printing press or the like, conveying them by means of relatively narrow endless belts to an inversion section where the sheets are received in a supplemental conveyor in one direction and serve to activate belt conveyors removing the individual sheets in the direction opposite that which they were received; the individual sheets, while inverted for proper pagination, being received in a distribution conveyor successively distributing the individual sheets to receiving sections controlled by deflecting gates and in which the deflecting gates of the respective receiving sections are automatically oriented to a non-deflecting position by control means operatively associated with the receiving section and activated by a sheet received in the section; and distributing conveyors functioning to sort or collate individual sheets in both descending and ascending relation relative to vertically spaced receiving sections controlled by the sheet-operated gates.

22 Claims, 41 Drawing Figures



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SHEET 01 OF 24

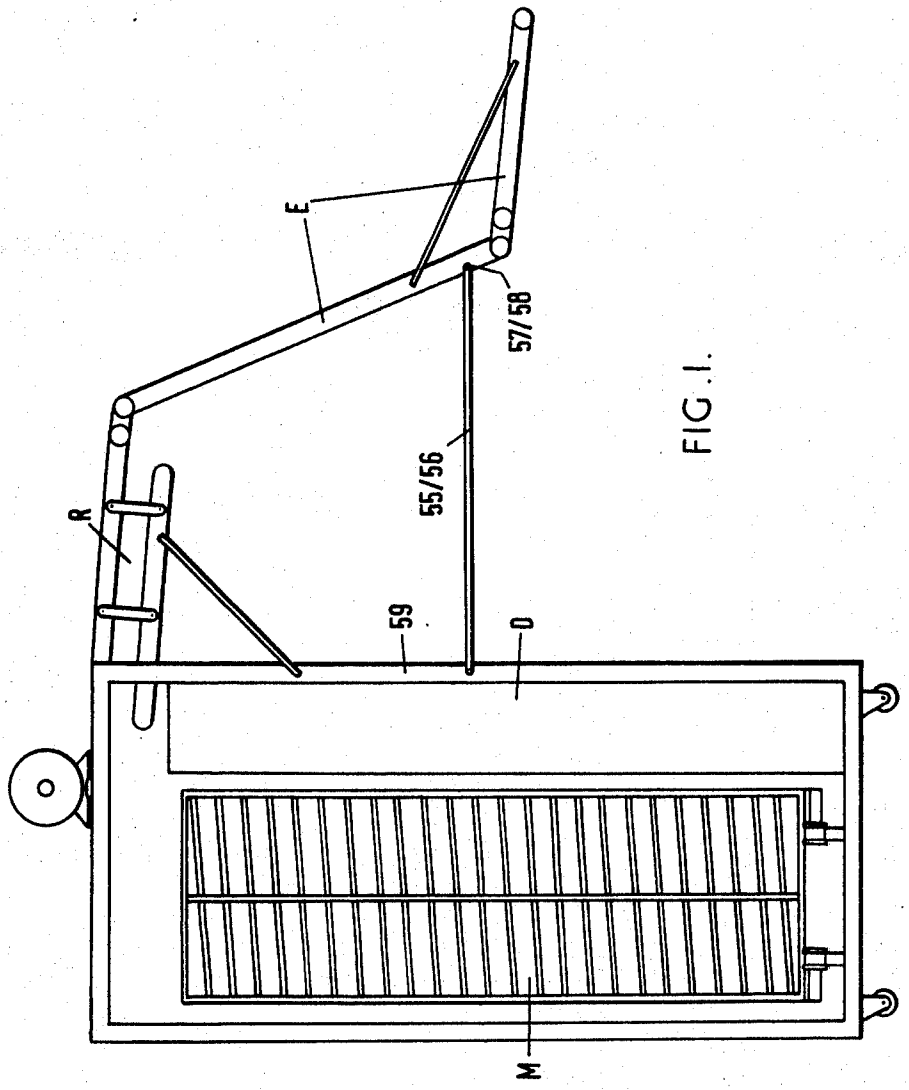

FIG. 1.

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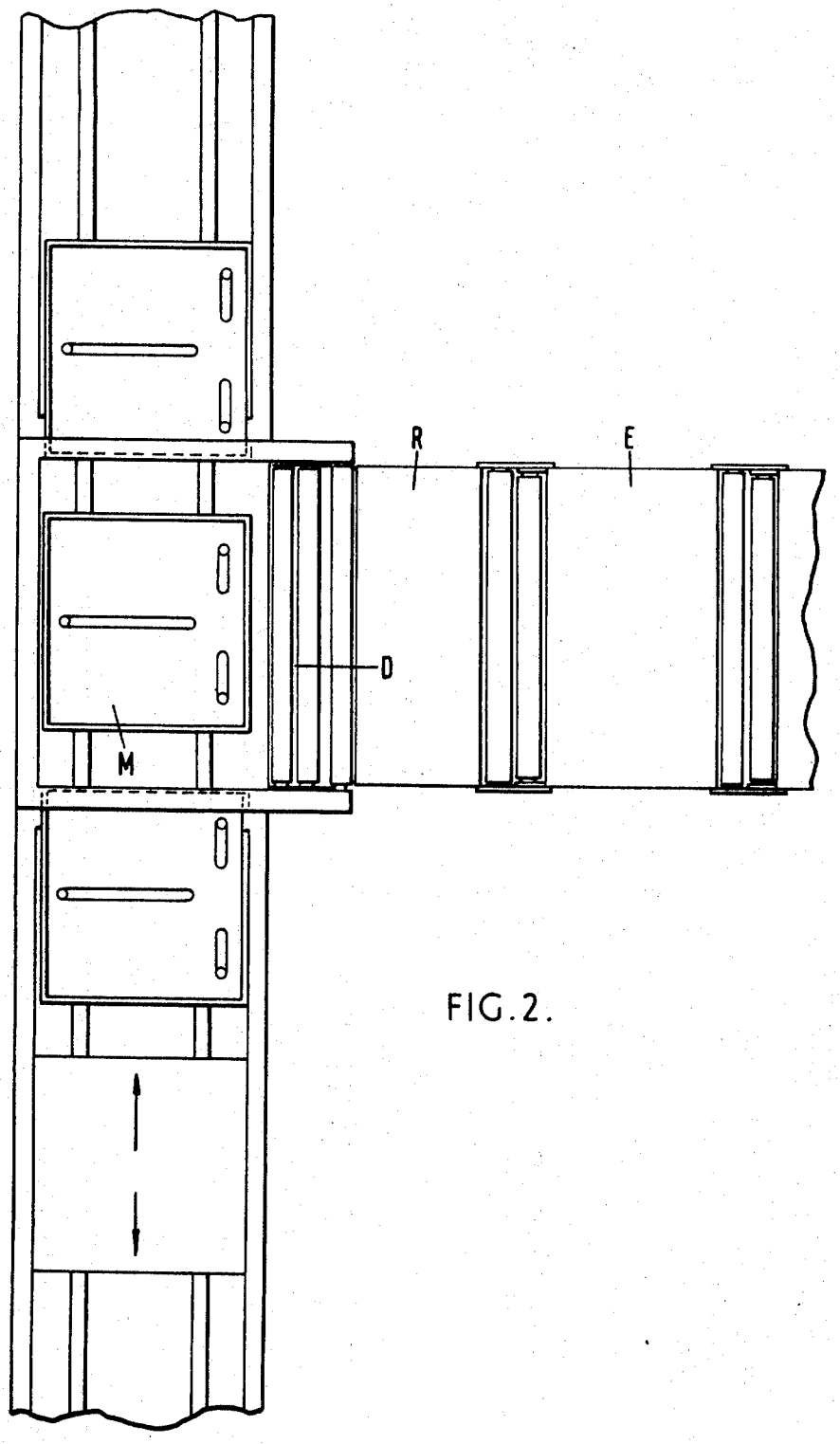

FIG. 2.

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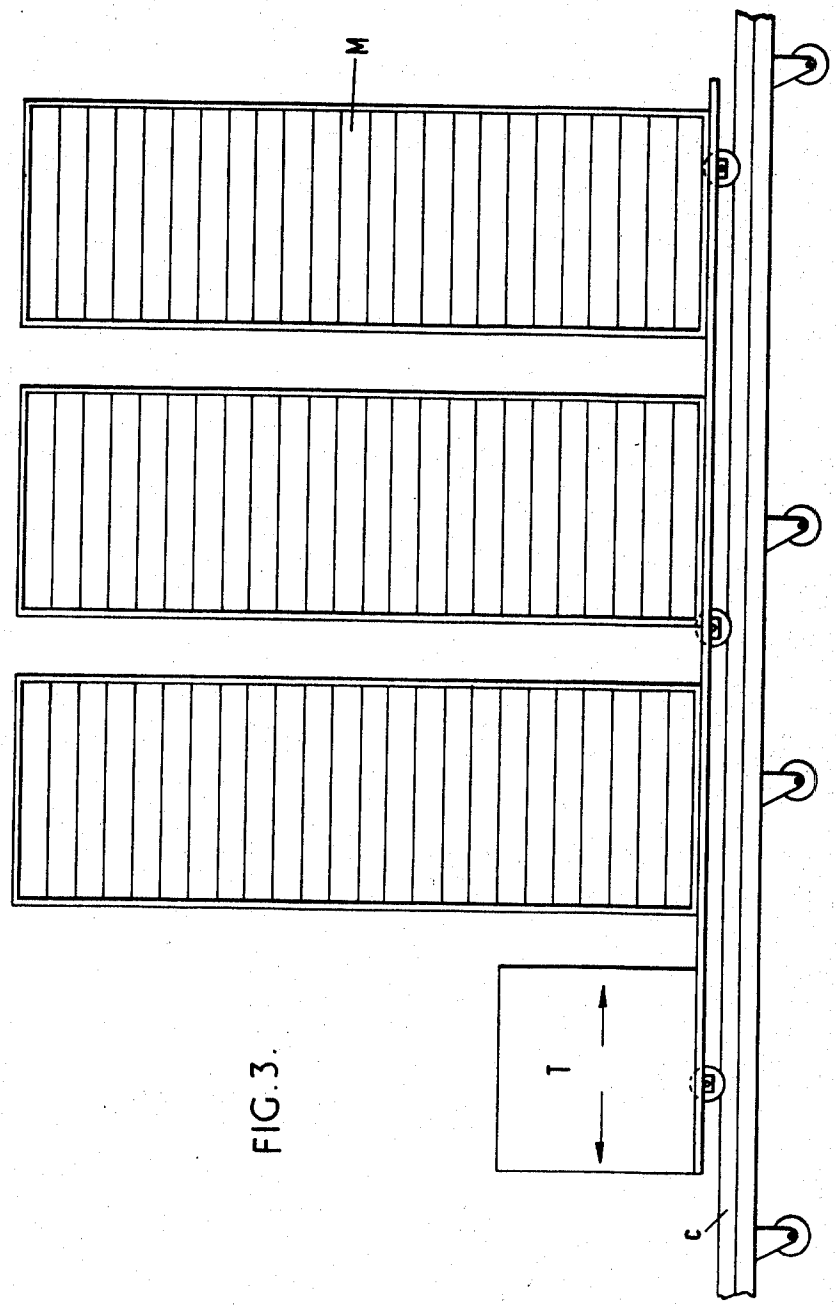

FIG. 3.

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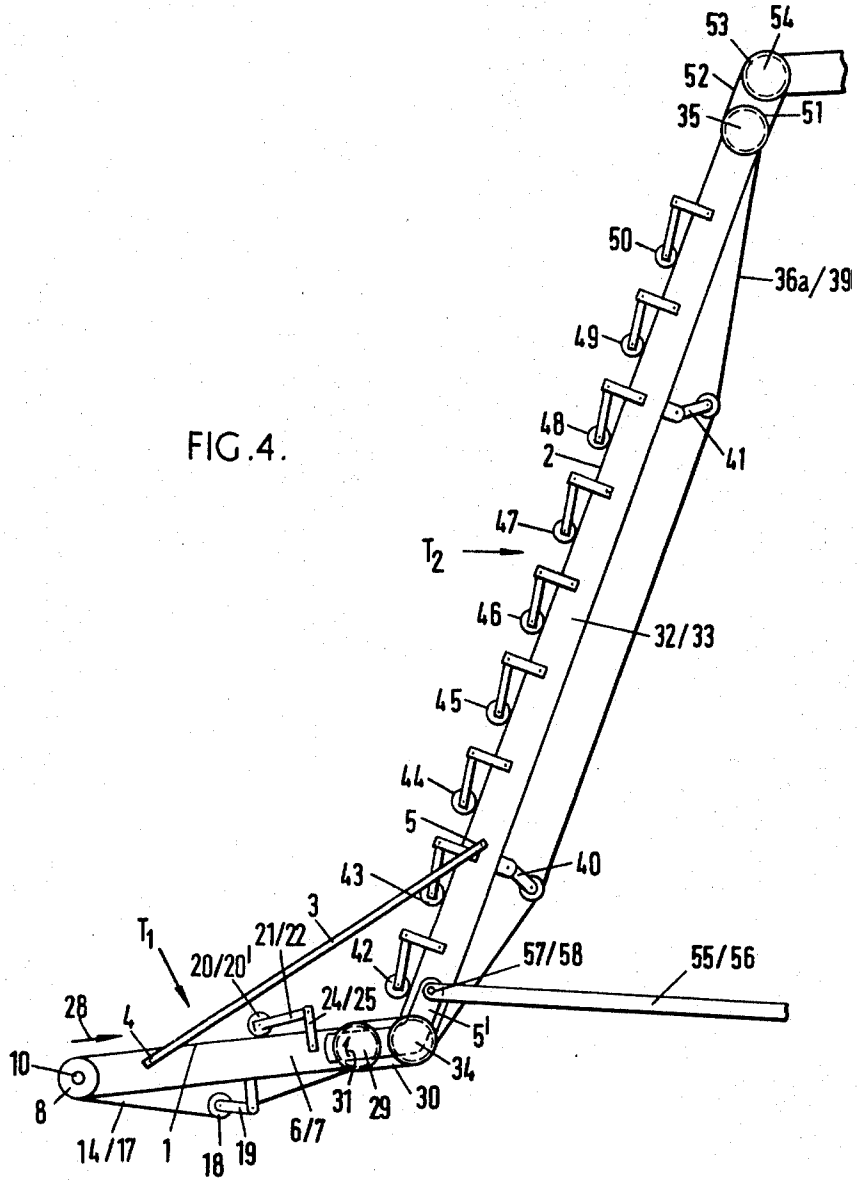
FIG. 4.



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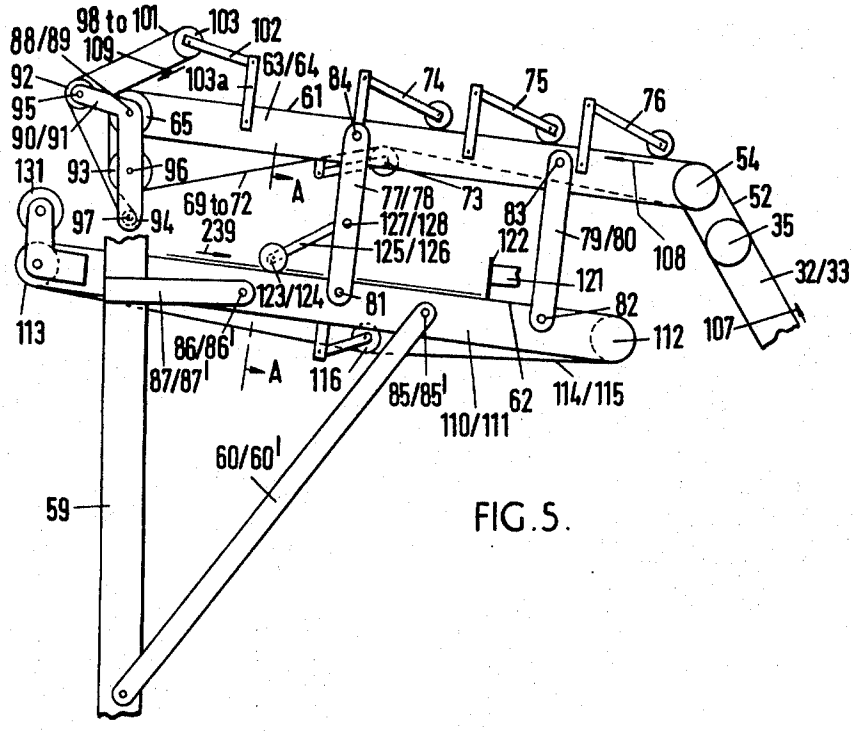
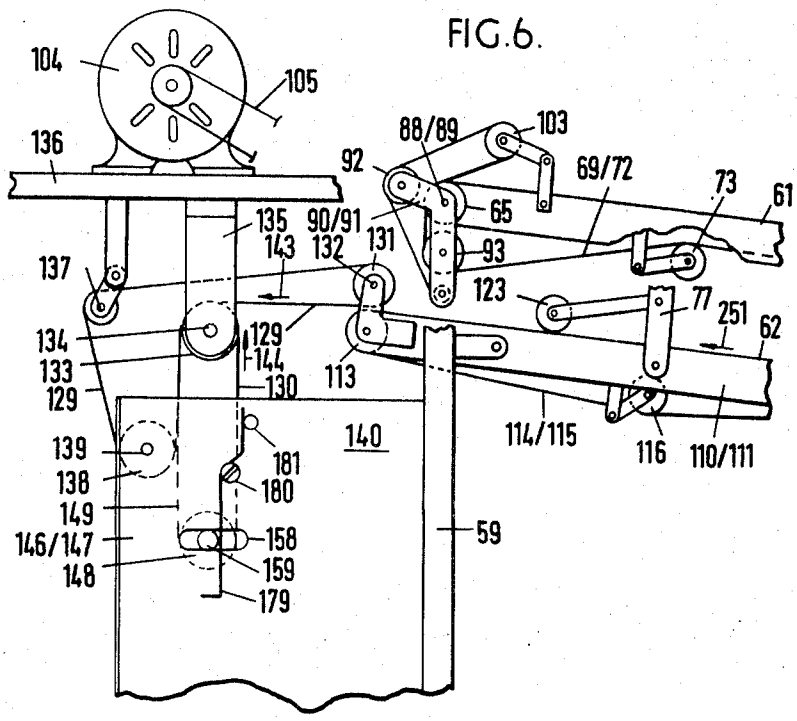


FIG.5.

FIG.6.



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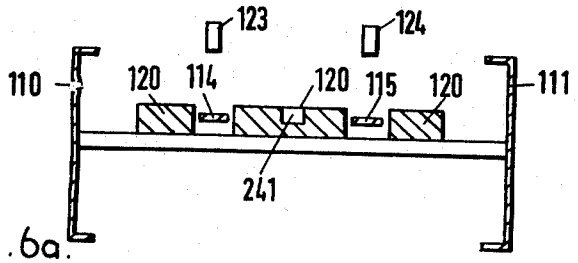

FIG. 6a.

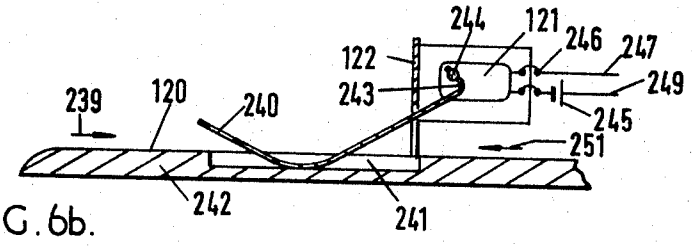

FIG. 6b.

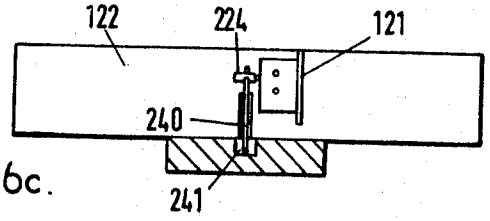

FIG. 6c.

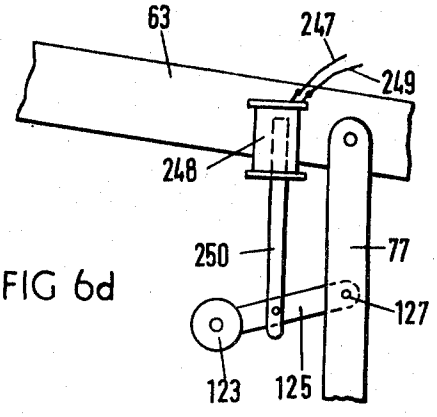

FIG 6d

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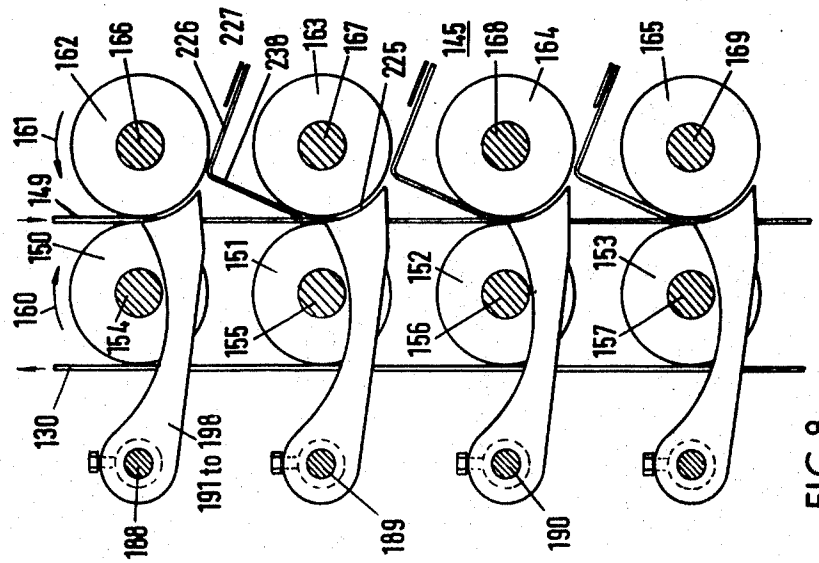

FIG. 8.

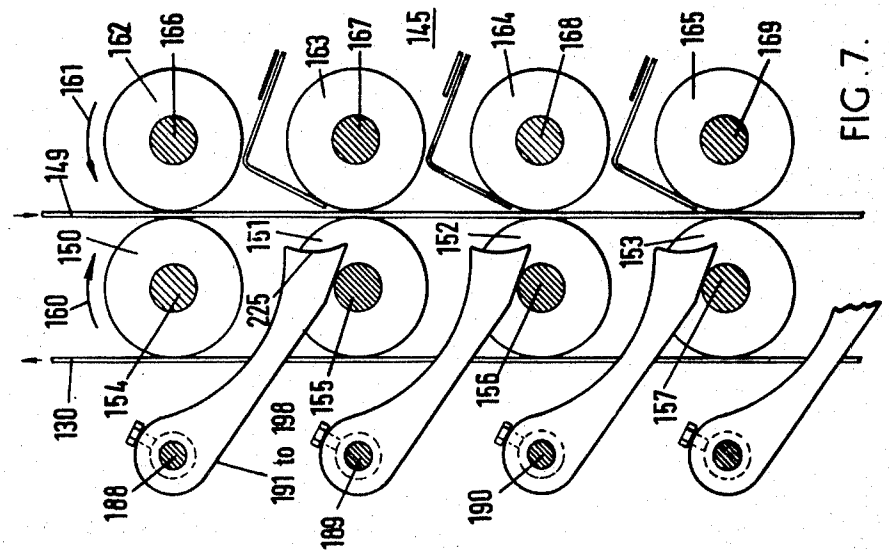

FIG. 7.

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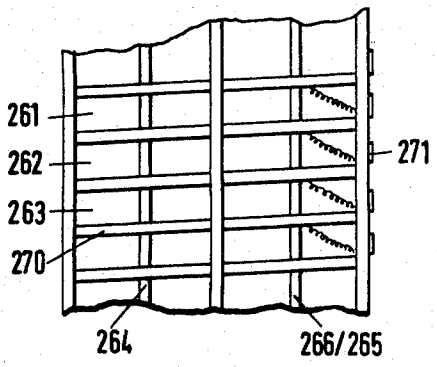


FIG. 9a.

FIG. 9b.

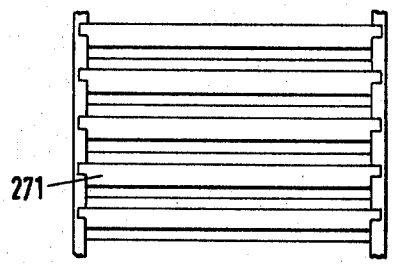
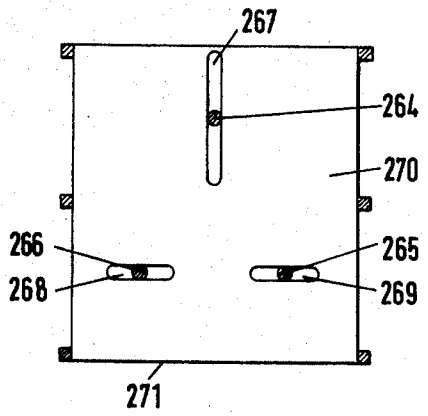


FIG 9c



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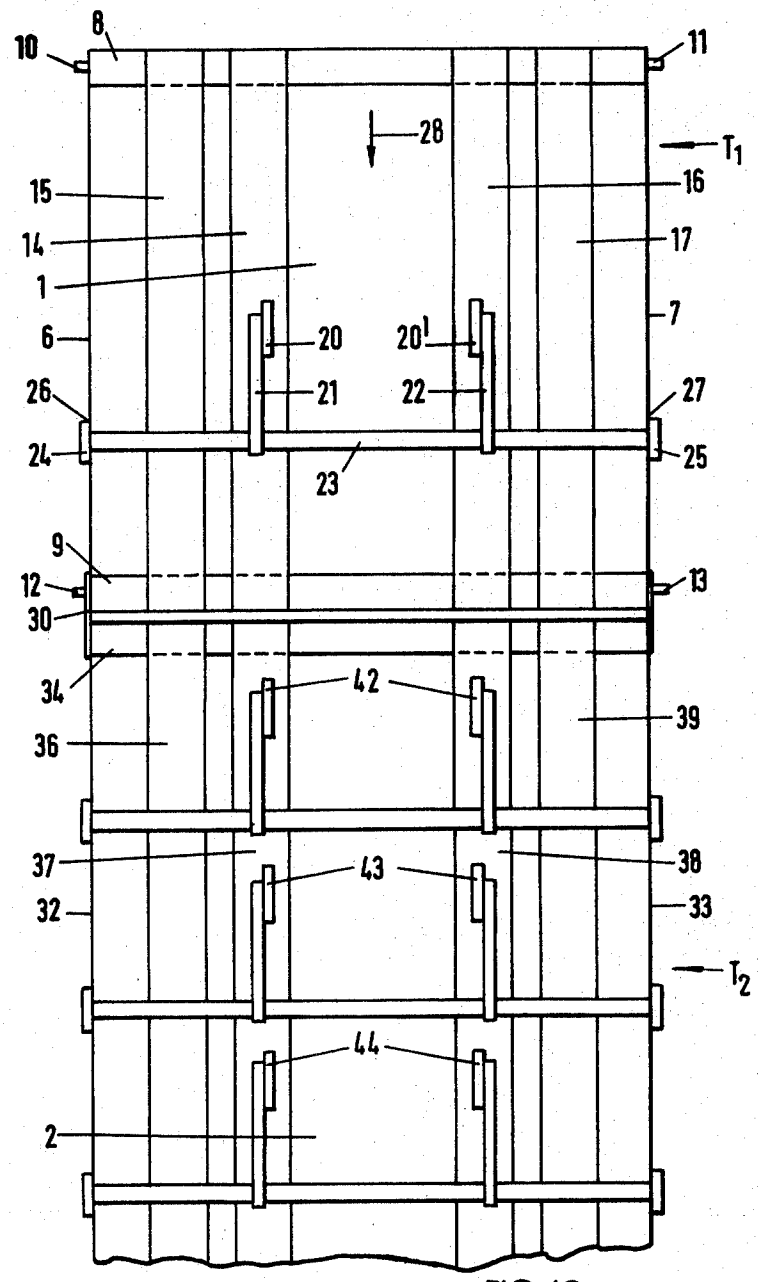

FIG. 10.

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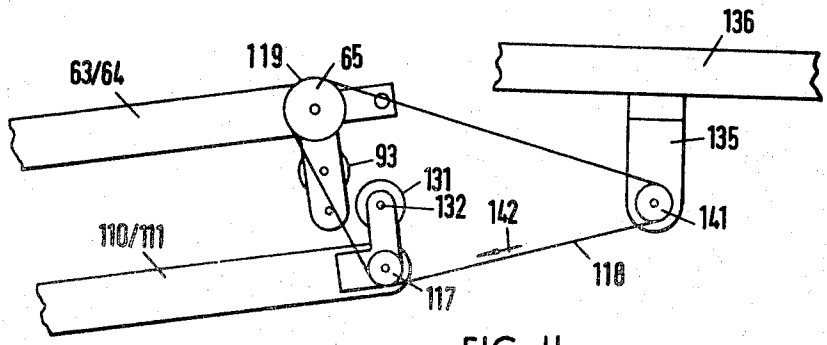

FIG 11

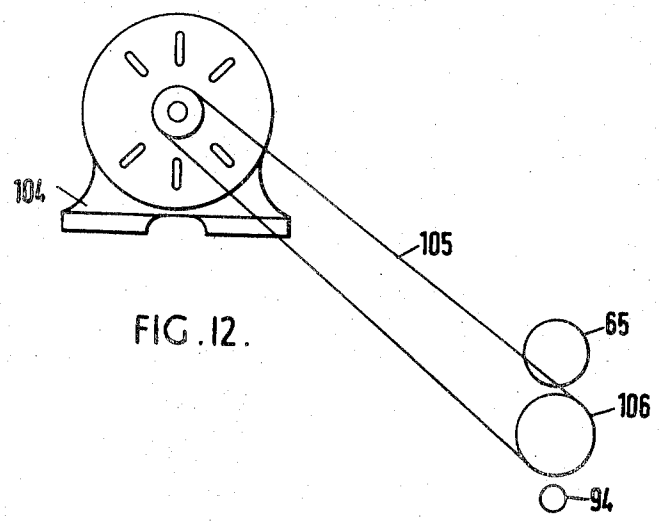

FIG. 12.

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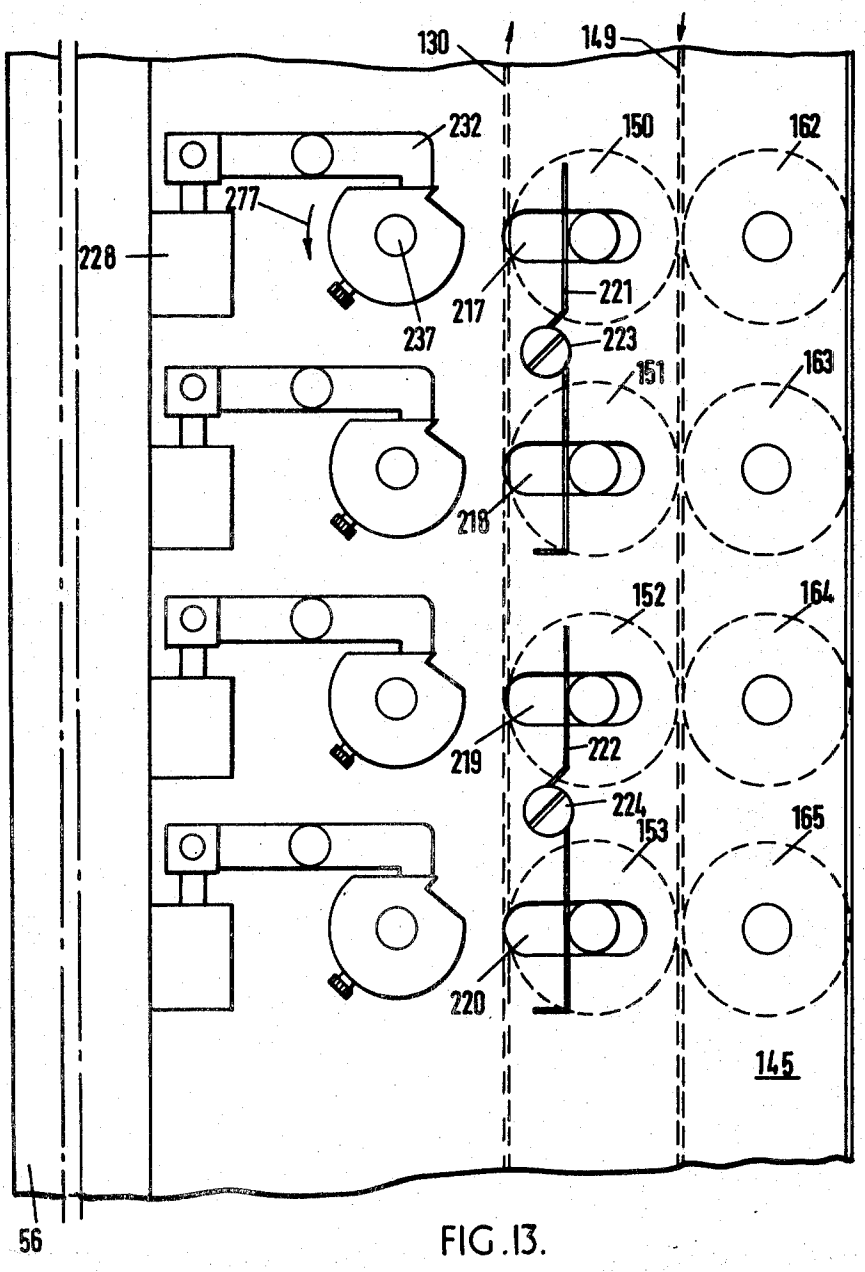

FIG. 13.

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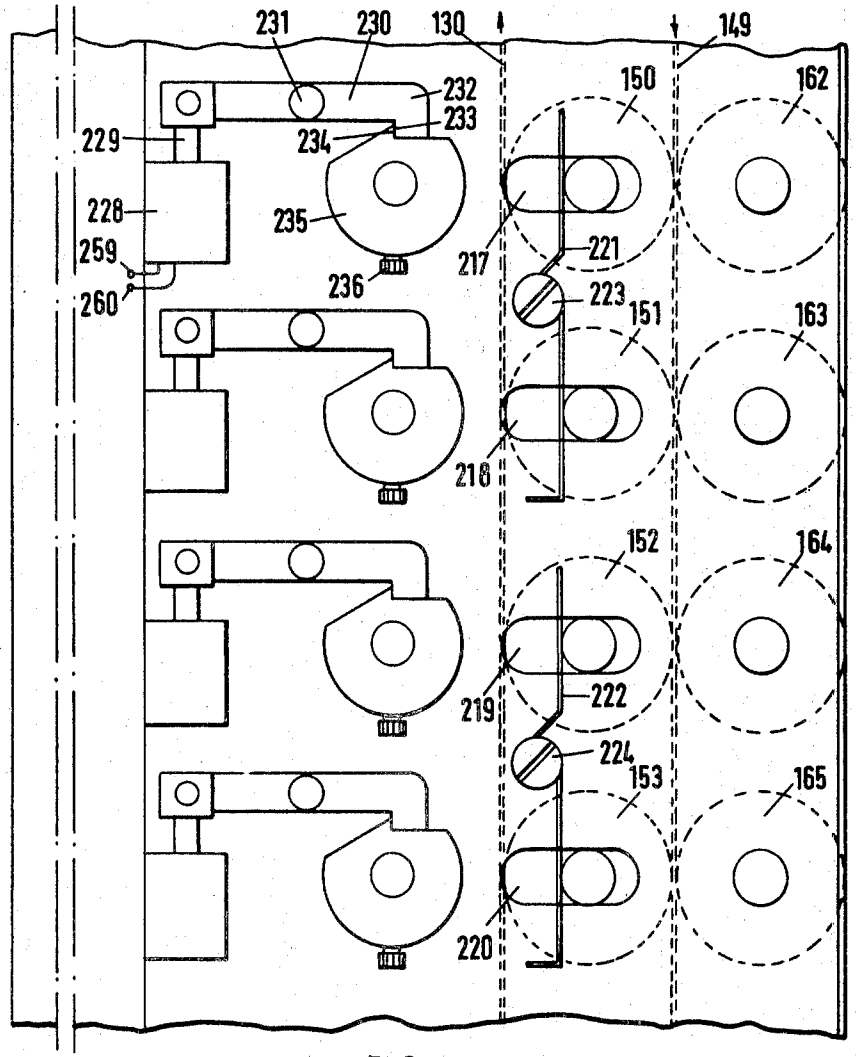

FIG. 14.

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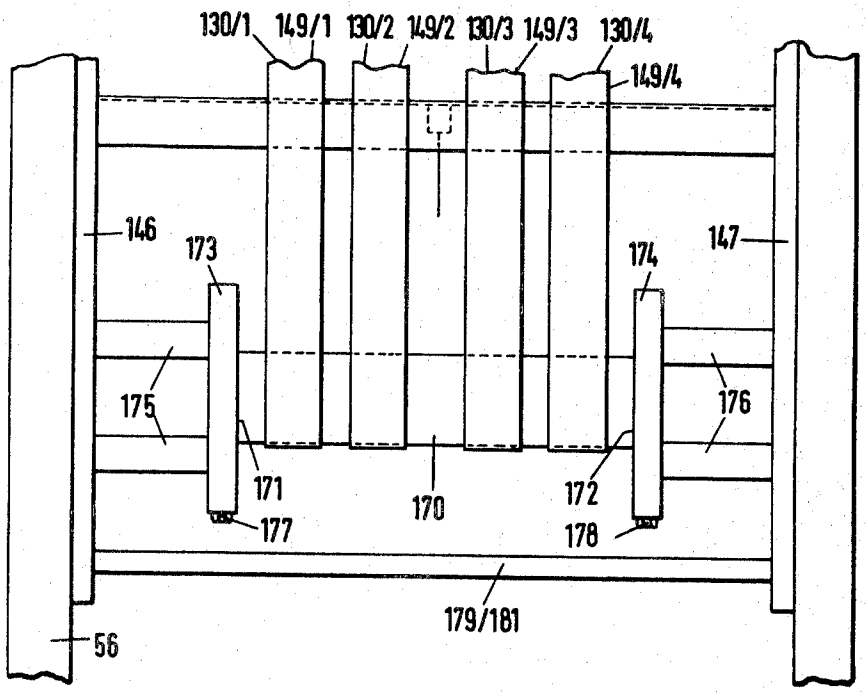

FIG. 15.

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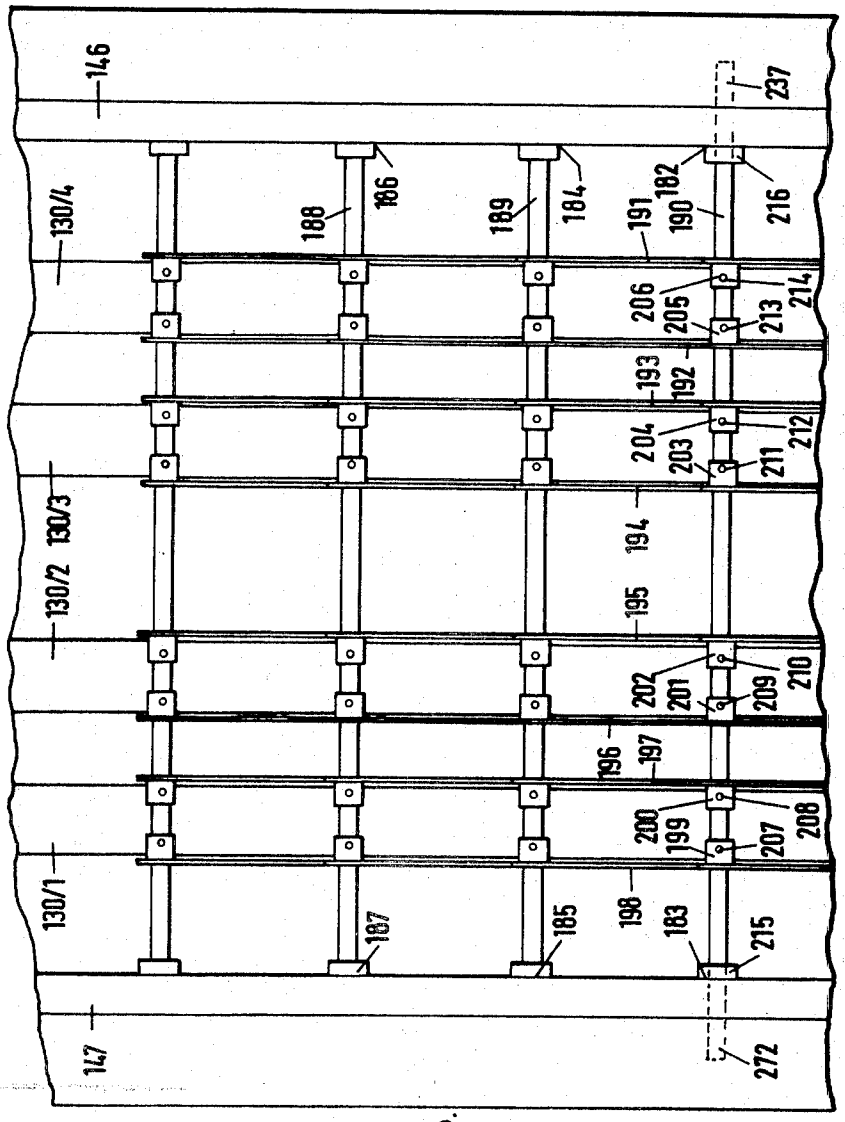

FIG. 16.

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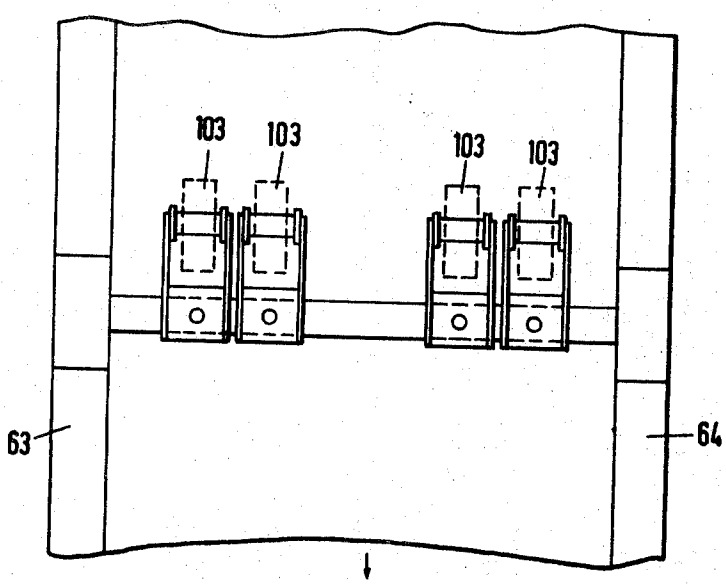
FIG. 17.



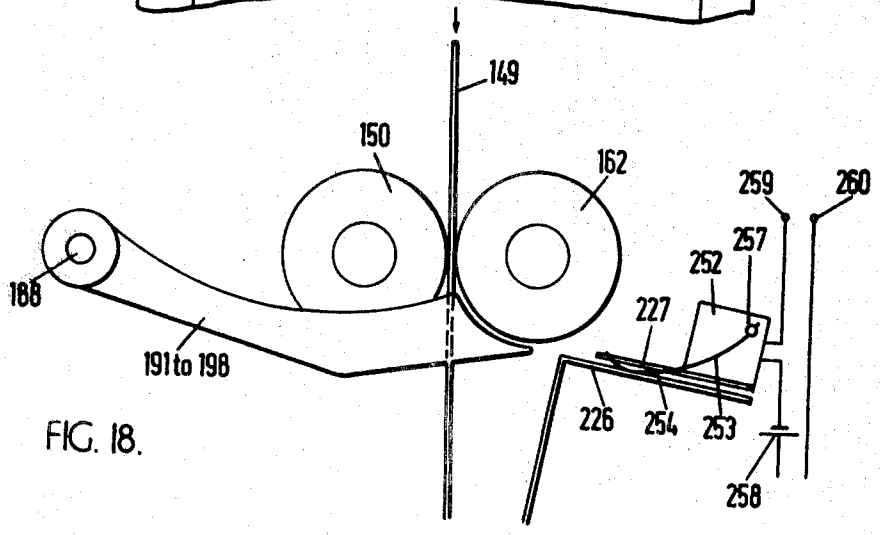
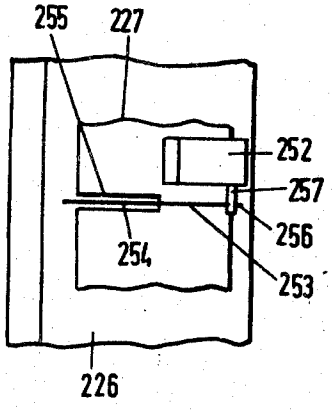


FIG. 18.

FIG 18a



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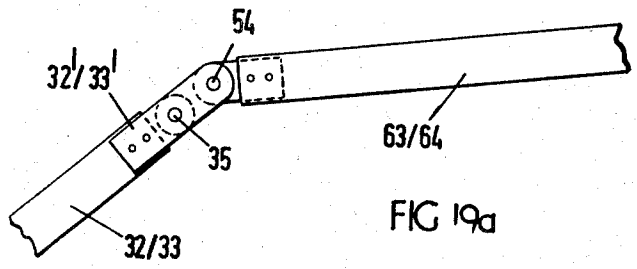

FIG 19a

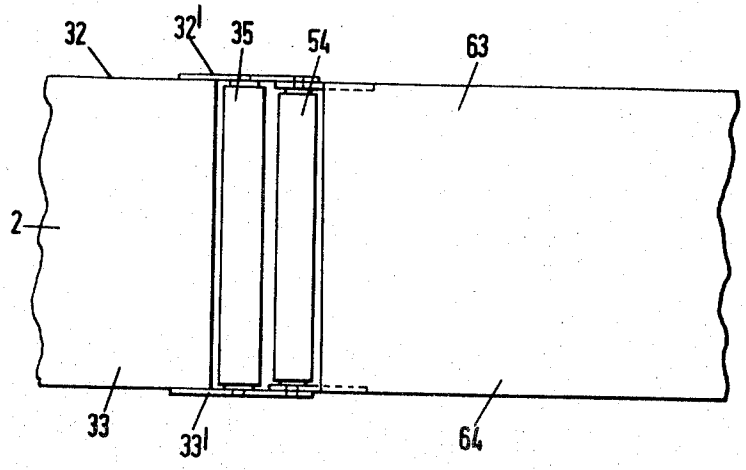

FIG 19b

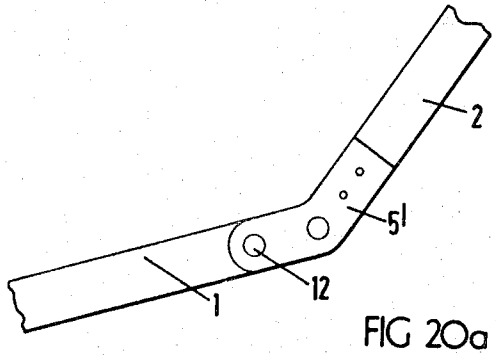

FIG 20a

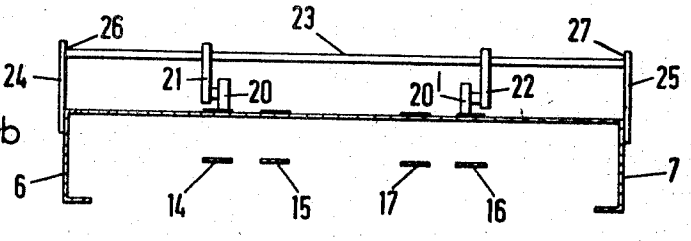

FIG 20b

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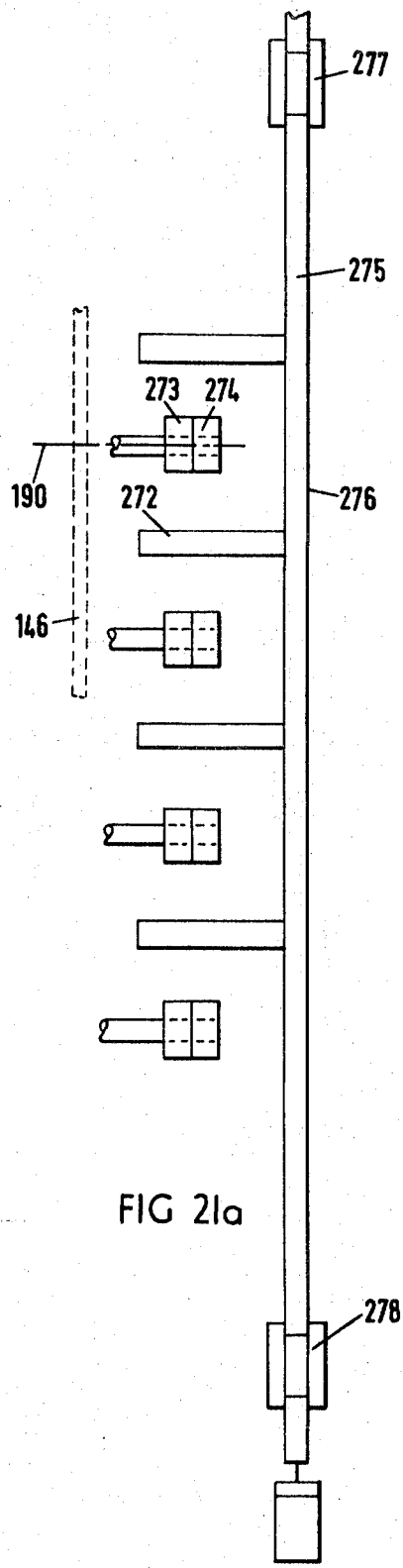

FIG 21a

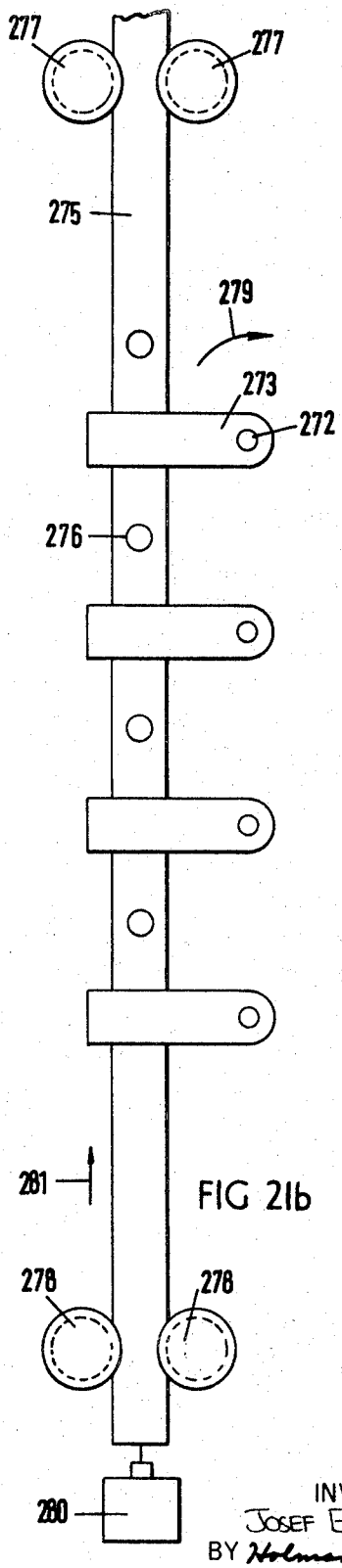

FIG 21b

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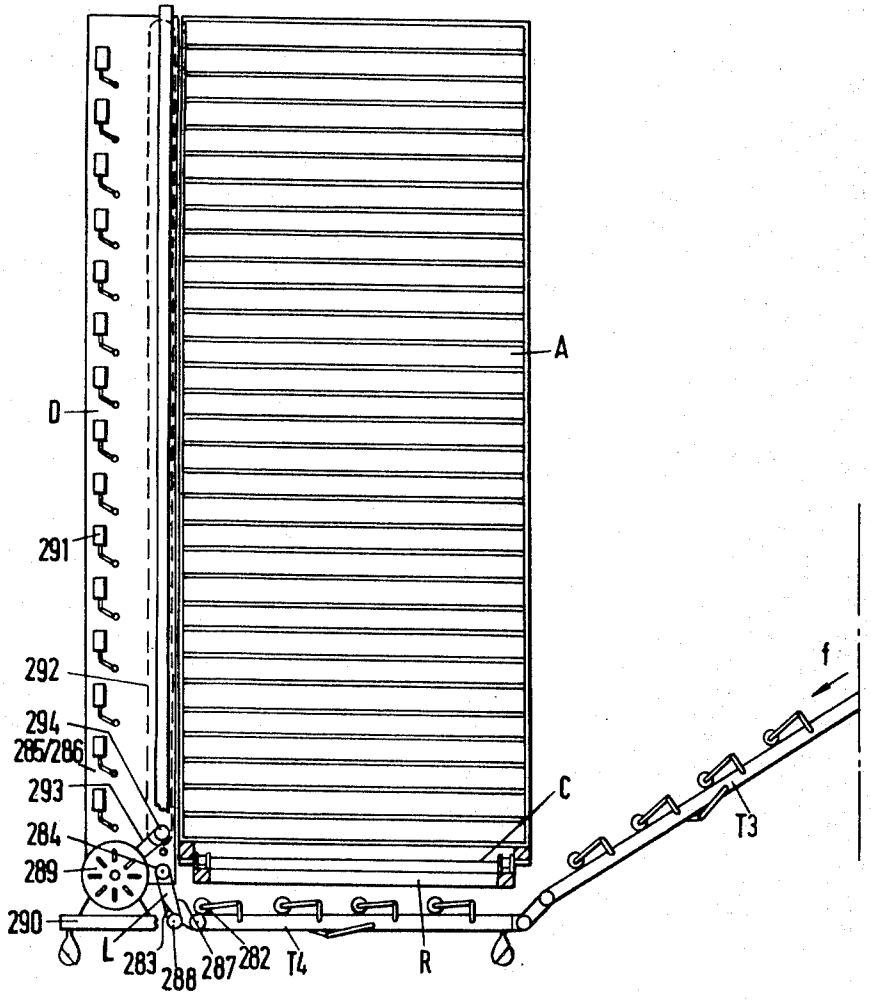

FIG. 22.

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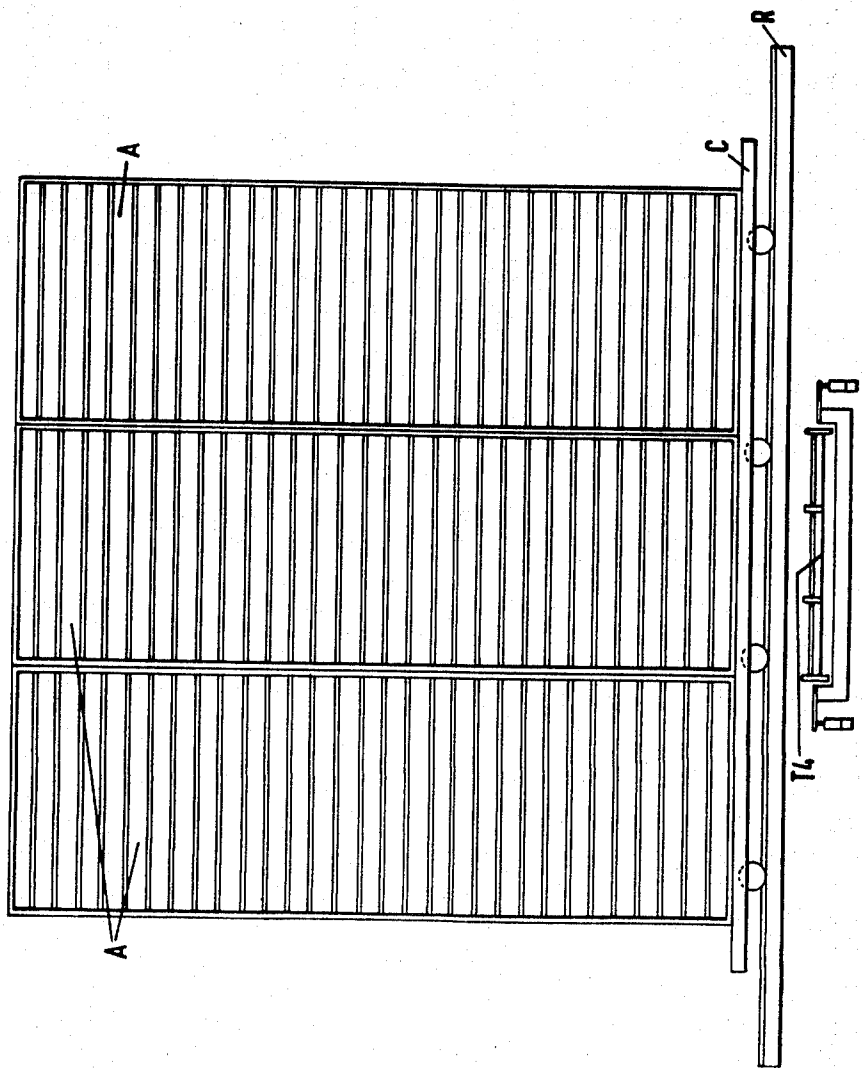

FIG 23

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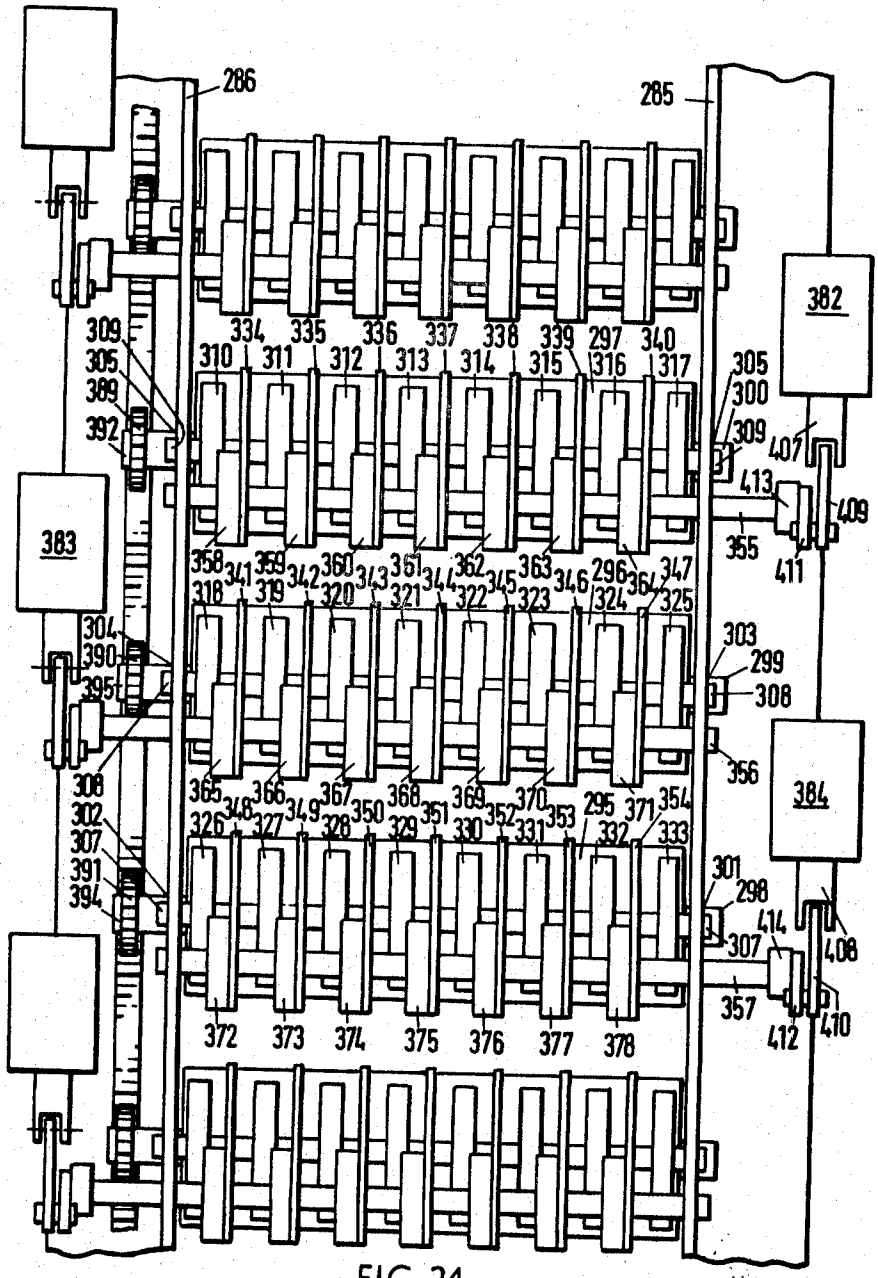

FIG. 24.

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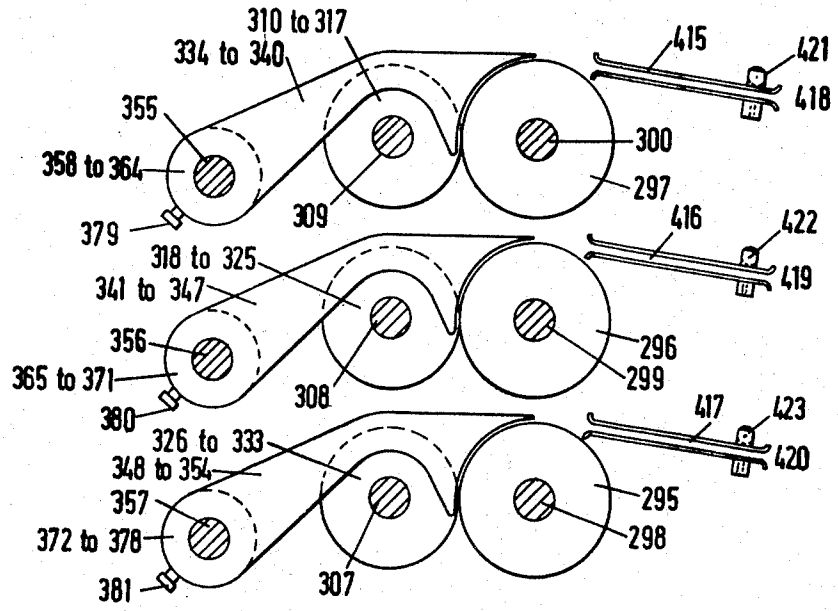

FIG 25

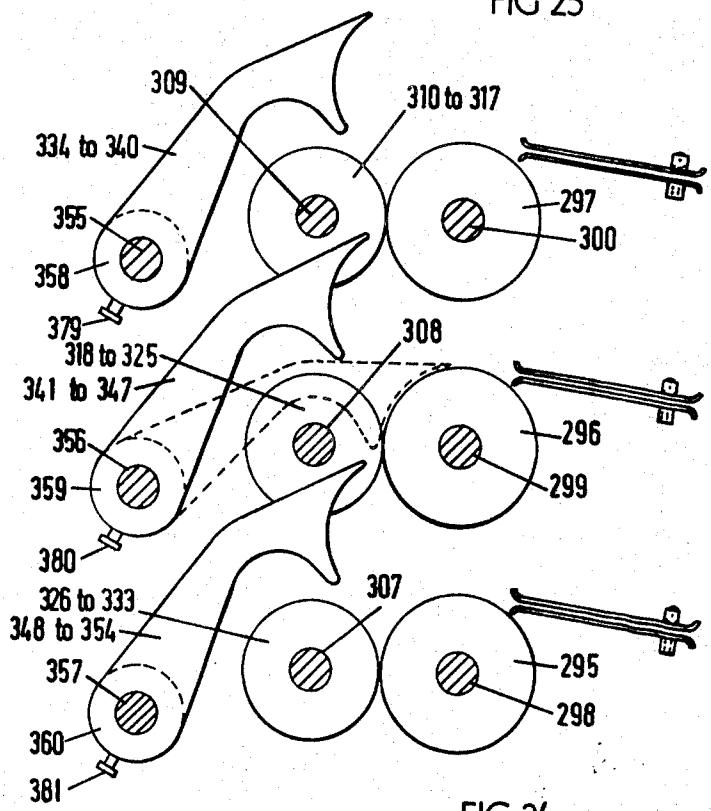

FIG 26

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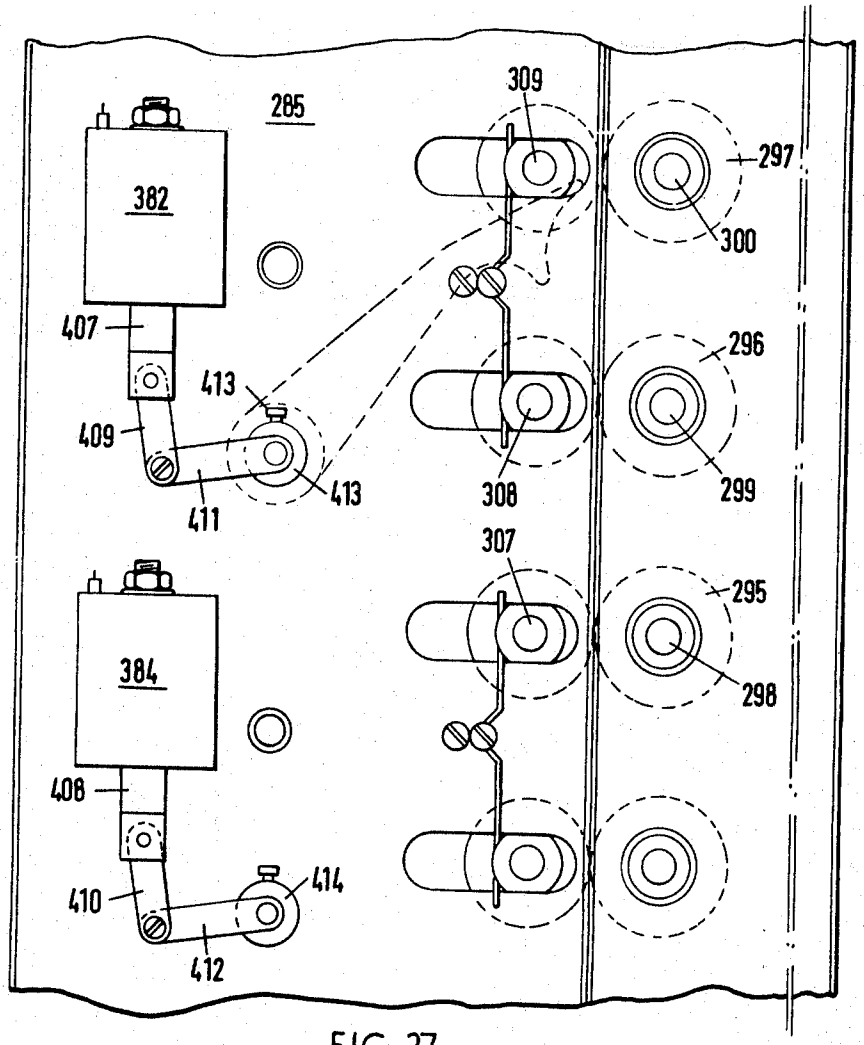

FIG. 27.

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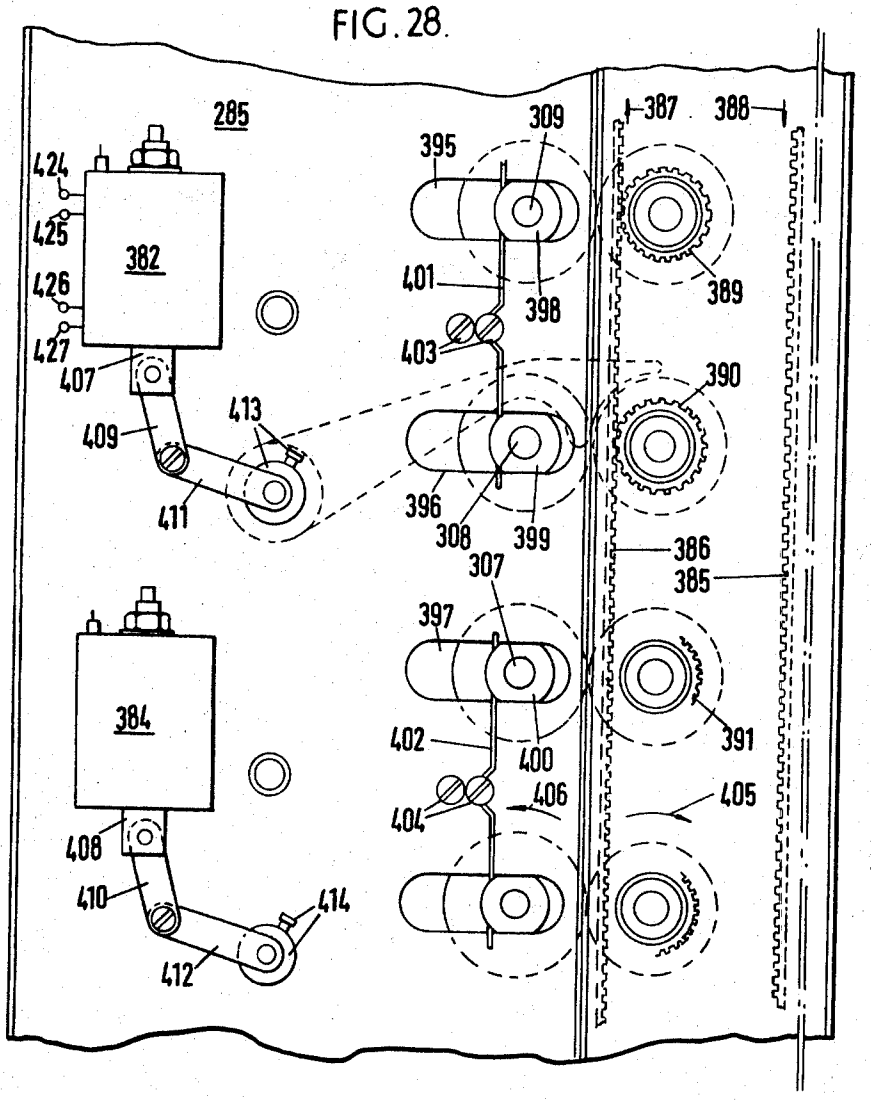
FIG. 28.



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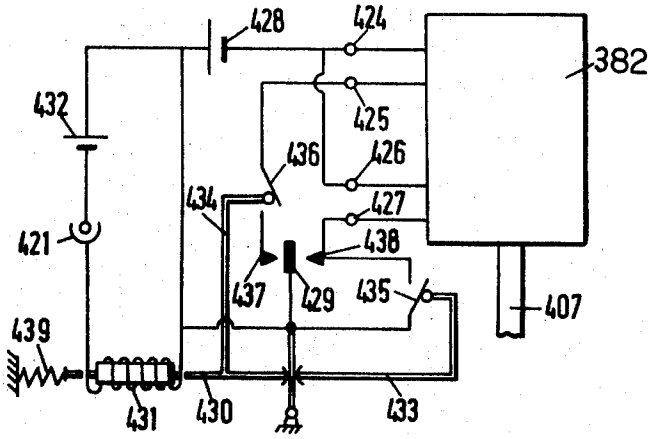

FIG 29

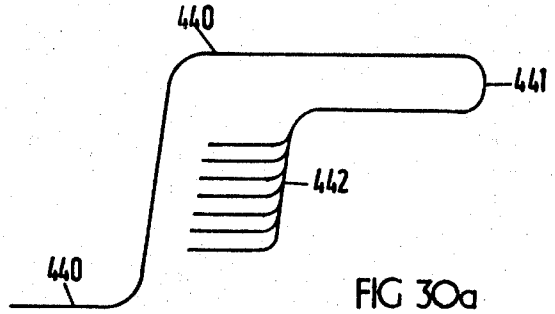

FIG 30a

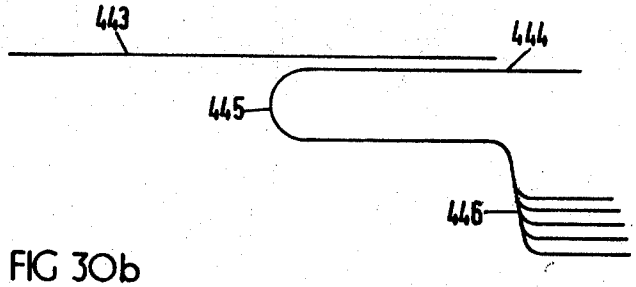

FIG 30b

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APPARATUS FOR ASSEMBLING A STACK OF SHEETS

The present invention relates to apparatus for automatically stacking or assembling sheets of paper into sections, and is especially suitable for printed sheets, having the advantage of operating quickly and reliably.

In the present state of technical development of the printing industry the assembly of paper sheets into sections containing some specified number of sheets, or arranged in some prescribed order paginated in a particular sequence, is effected in a number of different ways, already well known, each being adapted to the method by which the sheets are made available, by printing or otherwise, as well as the manner in which they are to be subsequently employed.

In most of the machines in present use for making up sections, the sheets are arranged in reverse order, i.e., the pagination does not follow the order required, the obverse of the first sheet being in contact with the reverse of the next following sheet.

In the actual case, the sheets are assembled almost always in the way in which they issue from the printing device, usually called the "press," which delivers them with the printed face lying upwards (for easier visual scanning during printing).

These printed pages are then separately carried forward and then delivered to a reception rack in which each sheet is successively covered by the following sheets of the section or brochure, all the sheets being placed in the same direction as the first, i.e., with the first or last printed side facing upwards. As a result, if the press delivers either sheets printed on one side (facing upwards) or sheets (obverse on top and reverse underneath) with a pagination reading one-half, three-fourths etc., starting with first sheets paginated one-half, followed by second sheets paginated three-fourths etc., the page sequence reading from the top sheet (which it is at the bottom of the stack forming the first section) will inevitably be in the order of 2-1-4-3-6-5 etc.; or "reverse 1, obverse 1, reverse 2, obverse 2, etc." which well illustrates the upside-down make up of the section.

To be able to reduce this to a pagination in the correct order, it will thus be necessary to turn over each sheet separately, starting the impression from the last sheet. This latter solution, however logical, is not always possible since in many cases, the final number of sheets composing a section is not yet known when starting to print the first pages thereof, or the number of sheets can be modified during the course of printing for any, purely fortuitous and unforeseen reason.

It should further be remarked, that these conditions can only be fulfilled in practice, for sheets printed on one side only.

To eliminate the aforesaid disadvantages, it has often become necessary to start printing the sections from their first page, and be prepared to have to turn over each sheet leaving the press, in such manner as to cause the sheet to lie with the face just printed, downwards, which avoids the necessity of turning over each sheet of a stack or section individually, as soon as each section is complete.

A number of arrangements have already been conceived for effecting this turning-over as the sheets leave the press. Among these may be instanced pneumatic devices operating by suction. However, these are inconvenient in that they work slowly and too often become out of order, in particular on account of loss of pressure or leakage of air; in addition they require perfect synchronization, which is often difficult to maintain, between the action of the printing machine and the pneumatic device.

It has similarly already been conceived to effect this turning-over by other means, pneumatic or otherwise: e.g., devices using air-blowing: these too have the drawback of being slow and subject to unexpected leakages as well as being difficult to regulate and maintain.

The present invention has precisely the object of producing an automatic machine which, while avoiding all the disadvantages mentioned above, presents in all its possible, variant embodiments, manifold advantages of its own, such as rapid and reliable functioning, whatever the rate of printing of the sheets, the number of sheets per section, and the total number of intended sections.

It is of course possible to envisage such a machine for handling sheets of some material other than paper: e.g., plastics, metal, compound materials, etc., without exceeding the intended scope of the invention.

The apparatus which is the subject of the present invention substantially comprises, at the intake, a device receiving the sheets, a device for inverting such sheets, a deflection device for distributing and deflecting the sheets, and, finally, on the output side, a device for receiving the inverted and sorted sheets.

The invention provides apparatus for assembling a stack of sheets to be arranged in a particular order, the apparatus comprising a cabinet including shelves for receiving the sheets, an intake conveyor for receiving sheet delivered singly and in sequence to the apparatus, and a distributing conveyor between the intake conveyor and the cabinet, the path of a sheet through the distributing conveyor being such that it is inverted during its passage from the intake conveyor to the cabinet, the sheets being distributed to different shelves of the cabinet.

A preferred embodiment of the apparatus comprises four principal sub-assemblies, suitably assembled in a single framework and which are in order of their action on the sheets to be assembled or collated, as follows:

a. a receiving table intended to receive sheets supplied for instance singly by a printing machine or press, such as an offset printing machine, the said table being equipped with a device causing the said sheets to move along the upper surface of the table from the entry side to the exit side;

b. a device for gripping and turning over (upside down) the sheets fed to the table by the receiving device according to (*a*) and delivering them to the discharge from the table;

c. a distributing device singly picking up the sheets thus turned over and causing them successively to pass along a path at least partially differing between one sheet and the next in such manner that at the end of such path they are separated from each other and are individually presented in front of a separate receiver such as one of the shelves or racks of the stacks or cabinets referred to below at (*d*); and

d. one or more receivers in the form of cabinets or stacks of shelves arranged side by side and suitably superposed, the said shelves being intended to receive in succession in upward sequence, all the

sheets appertaining to the same section or stack and having for this purpose their entrances arranged facing the discharge end of the arrangement forming the end of the several paths by which the sheets of such section or stack reach such distributor.

Thus, for instance, it will be sufficient to feed the receiving table with successive sheets the reverse side whereof is uppermost, or conversely, for the shelves or the like each to receive one of these sheets in succession with their obverse sides uppermost, or conversely. Having delivered to the machine according to the invention, the required number of sheets No. 1, it is sufficient to restore the assembly (*c*) to the initial state, for the machine to be ready to receive and distribute the sheets No. 2, and so forth for all the sheets required to make up the section or stack in question.

In accordance with an advantageous, alternative form of embodiment of the machine according to the invention, the latter further comprises a device for reversing the direction of motion of the sheets, and gripping them after reversal and before distribution. This variant form of embodiment presents the advantage of enabling the assembly of the sections or stacks to be effected on the side opposite to that on which the sheets arrive for assembling, thus facilitating the manipulation and operation of the machine if the space on the press side should be insufficient.

In accordance with a further, advantageous alternative form of embodiment of the machine according to the invention, the turnover device consists of two parts, each of which preferentially performs one half of the operation in question:

the first part being arranged between the assembly (*a*) and the assembly (*c*); and the second half being, for each individual sheet, constituted by a deflecting element determining the particular path which is to be assigned to each, separate sheet. In this variant, consequently, any deflecting element can simultaneously control two distinct operations treated as one: deflection, and turning over.

This particular alternative form of embodiment presents the advantage of greater simplicity of the different elements of the machine, as well as a smaller, overall bulk thereof; and is especially interesting if the space between the press and the distributor is free. It is also suitable for small-capacity machines, e.g., for office use.

The table receiving the sheets may comprise a number of successive sections, hinge-connected or otherwise, and sloped more or less according to the available space, each such section consisting in particular of a rigid frame with a substantially flat, sliding surface, e.g., the surface of a smooth web or sheet, at least two guide rollers parallel with each other, at least one of which is arranged at either end of the said frame and can rotate freely on its spindle on end trunnions housed in suitable sockets, provided in the said frame; a set of parallel, endless belts or tapes, connecting the two rollers, and the whole arranged in such manner that the "forward-moving" parts of the belts can slide on the above surface to the roller at the delivery end of the table, run round that roller, and thus become the "return parts" of the endless belt(s), located in the other side of the aforesaid carrying surface with reference to the "forward-moving" parts, travelling towards the end roller at the entry to the table and there becoming again, forward-moving; an element controlling the rotation of the one of the aforesaid rollers, a series of "driving rollers" comprising at least one such small roller for each belt or tape, the said small rollers being fitted at least circumferentially with a rough surface material, and running on spindles parallel to the shaft of the large rollers, which are held in contact with the "advancing" part of the belt either by their own weight or that of their supports or by suitable spring means, the said belts being made of a sufficiently rough material to carry the sheets of paper or the like with them under the small rollers the whole being arranged in such manner that each sheet fed to the receiving table is in the first instance moved by the roughness of the said belts and subsequently by its own weight and the rollers holding against such belts, thus being obliged to follow the motion of the latter and of the succeeding belts on any further section of the table, the motion of the sheets being thus relayed from one section of the table to the next by successive belts without a break.

The arrangement for turning over the sheets can be conceived FIGS. a number of different ways as for instance a pneumatic device of already known kind (which is, however, slot-acting and bulky, and somewhat fragile) but it has been found especially advantageous to arrange such means in combination with the discharge end of the receiving table or its last extension, working in a plane normal to the direction of motion of the sheets and thus readily detachable from the discharge end of the table at any time.

In accordance with this advantageous form of embodiment the turnover device comprises the following elements: sheet-accessability

a. a conveyor element of the endless type such as a set of belts, preferably all of the same length (henceforth referred to as "tapes") in equal or nearly equal number with the belts on the last section of the receiving table,

b. not less than two parallel rollers, whereof one is located slightly above the last section of the table and the other slightly below the same, set somewhat "upstream" of the end roller of such table section, the word "upstream" referring to the direction of the advancing part of the belt on that section,

c. tensioning means for the aforesaid element,

d. a suitable carrying frame comprising two cheeks or flanges or side walls rigidly interconnected and carrying the aforesaid not less than two rollers; and

e. a device enabling control of the rotation of at least one of the said rollers for driving the belts, the whole so arranged that

the rollers can run freely on their spindle by means of end trunnions with which they are fitted for this purpose and housing in suitable sockets made in the cheeks or side walls of the frame;

the said two rollers pass across the imaginary plane bounded by the closed contour of the said endless tapes;

the said tapes remain in contact with the said two rollers and with the tensioning means (e.g., by means of an auxiliary roller); and

the tapes pass around part of the end roller on the discharge end of the last section of the receiving table while remaining in contact therewith, preferably by the intermediary of the belts of the said table section the end roller being, however, external to the said tapes which allows the driving of

such tapes in accordance with (*a*), by the belts of the receiving table, the sheets being turned over by being drawn between the said tapes and the belts of the last section of the receiving table.

The device for reversing the direction of motion of the sheets on leaving the turnover mechanism suitably comprises:

- a suitable underframe, substantially flat, carrying a driving element of the continuous type (e.g., a number of parallel belts such as used in the receiving table), the direction of motion whereof is substantially opposite to that of the sheets coming from the turnover device and entering the reversing device, placed in the path of the sheets issuing from the turnover device;
- receiving means for the said sheets;
- an arrangement for temporarily forcing each sheet into contact with the aforesaid driving means, thus producing practically instantaneous raising of the sheets in a new direction of motion; and
- control means for such driving means.

In accordance with an advantageous alternative form of embodiment, the means for raising the sheets comprise:

- a flat sliding surface formed for instance of a smooth plate or sheet the upper surface whereof is located slightly above the upper level of the driving means, the said surface being arranged in such fashion that the sheets, e.g., on issuing from the turnover device, meet this surface and slide thereon before making contact with the driving means, the direction of sliding being opposite to the direction of motion of the said driving means; and
- a fixed end stop, suitably adjustable, for arresting the sliding sheets and at the same time adjusting them correctly before lifting-off, with a surface practically perpendicular to the direction of sliding. To facilitate the motion of the sheets along the sliding surface, this is slightly inclined in the direction of motion of the arriving sheets, e.g., on issuing from the turnover device, and practically parallel with the driving means.

This alternative form of embodiment presents the advantage that is does not require any motive power for the sheets during this section of their path.

The device for placing each sheet arriving on the smooth sliding surface in contact with the driving means comprises a suitable element such as a lever arm or bar holding the sheets in contact with the aforesaid driving means and working in suitable groove or slots made in the component forming the smooth sliding surface, in the direction of motion of the driving means, which immediately causes reversal of the direction of motion of the sheets by placing them in contact with the driving means, the sheets then being moved by the driving means. This smooth sliding surface may thus be provided with straight slots for the passage of the driving belts, the depth whereof being greater than the thickness of the said belts. The flat sliding surface or more correctly the element forming the same may also in accordance with the invention consist of a number of separate sections arranged so as to leave between them substantially rectilinear gaps or slots, suitable for the passage of the driving belts.

In accordance with another interesting modification of the deflector device an, element (e.g., a lever or bar) by which each successive sheet is pressed against the driving means, is associated with a device for controlling its own action, which is operated by each succeeding sheet when making contact with the aforesaid end stop element, suitably actuating a microswitch the closing (or, possibly, the opening) whereof releases the action of the aforesaid device by any suitable, known means. This modification is particularly applicable on account of its simplicity, rapidity, and reliable action.

Further advantageously, the said pressing element or bar is equipped with control means allowing the sheet to be held in contact with the driving means during the period of time necessary and sufficient for the major part of the sheet to pass under the said bar and for the front or leading edge of the sheet to be gripped by a following device directly or indirectly guiding the sheet to the distributor. After this period, a returning element incorporated in the device (e.g., controlled by the microswitch), acting by elastic, electromagnetic or gravity means, returns the said bar or lever into its initial position, away from the driving means. This driving or conveying element may be conceived in several ways, but most suitably consists of endless belts, with a rougher surface than the sliding table and arranged in a separate frame in a manner similar to the belts of the receiving table.

It must be recalled here that in the machine according to the invention it is possible to interchange the order of functioning of the deflecting device and the turnover device, in regard to their successive action on the sheet(s).

On leaving the deflector device, the sheets are gripped by the distributing device which imparts to each sheet a motion into a separate path each ending exactly in face of one rack or shelf of the receiving cabinet or stack.

It will not be outside the scope of the invention, however, if the distributor or the distributor-deflector are directly combined with the receiver or magazine, the distributor or the deflector for instance feeding the sheets always to the same spot (e.g., at the same level) and the position of the magazine being altered by moving it up or down after receiving each sheet, or any particular number of sheets. In such case, the special path as envisaged for instance at (*c*), may be provided in the magazine itself, by a combination of the two functions (*c*) and (*d*); in such case, each sheet entering the bottom of a shelf or rack can for instance be made to operate a microswitch or pass in front of a photoelectric cell, which will release the operation of a circuit controlling the motion of the entire magazine in such manner that a different shelf or rack is moved in front of the fixed exit point of the sheets.

The distributing device comprises:

- an element conveying the sheets received for instance from the reversing device (or the connecting link if the turning-over and distribution are combined);
- a series of deflector elements set in the path of the sheets conveyed by the preceding element, each sheet being deflected in turn by a single element of the above series which is automatically inactivated after performing its function, i.e., having deflected a predetermined number of sheets or acted a predetermined number of times;
- a frame carrying the deflector elements and preferably also the conveying means; and

control means for the different components of the distributor assembly, or the turning-over/distributing element.

The conveying element suitably comprises:

a series of reciprocally-parallel rollers preferably arranged in the same plane and substantially equally spaced; and

a series of endless belts with a suitably rough surface maintained continually, e.g., by small rollers and springs, in contact with the aforesaid rollers and which, caused to move in parallel with the plane of the rollers can likewise convey the sheets between themselves and the (small) rollers. To save space and aid operation, the sets of rollers, belts, etc., are most suitably superposed vertically.

This arrangement is particularly advantageous if the distributor used has the sheets moving from above downwards for convenience in applying the drive or synchronizing the speed of the moving sheets, if the entire machine is belt-driven.

If the sheets to be distributed have been printed or are covered with a relatively greasy ink or any analogous, slow-drying substance, the conveying element should preferably consist of two sets of parallel rollers, one smooth and one rough-surfaced, the rollers of each set being preferably arranged in the same plane and evenly spaced; one at least of the sets of rollers (that on the inked side of the sheets) having a knurled cylindrical surface (or roughened or more or less uniformly recessed on its circumference in such manner as to prevent contact with the sheet except over a very small part of its periphery) which will nearly completely eliminate any risk that a sheet might become soiled by contact with a roller; soiled for instance by ink from an insufficiently-dried previous sheet making contact with the same roller. In this alternative embodiment each sheet is drawn between a series of rollers with a relatively smooth surface, although with sufficient drawing power (e.g., rubber), and a matching set of roughened, knurled, or like rollers. Each smooth roller is held in permanent contact with its matching knurled roller by appropriate spring means.

In accordance with an especially advantageous modification of the above, the major part at least of each smooth roller, and the majority of the smooth roller, are formed of an assembly of small rollers which may themselves be knurled, all of the same diameter and coaxially placed, so as to leave between them in a particularly ingenious manner the space necessary for the passage of the deflecting elements towards the sheets to be deflected. Each deflecting element suitably consists of a specified number of blades of suitable end profile and arranged in such fashion as to be able to slip between the rollers of any one assembly, so that their suitably profiled ends or tips can move into and out of the path of the sheets to be deflected. This arrangement further enables the sheets to be easily conveyed between the knurled (driving) rollers and the smooth (driven) rollers, thus reducing to a minimum any risk of soiling of the sheets. In such case the control means of the driving rollers is arranged near one of the side walls of the machine frame and preferably outside the same.

The elements for deflecting the sheets are advantageously each mounted on a pivot, all practically parallel with each other and carried on trunnions lodging in sockets provided in the frame, each such element having two, distinctive positions, the first termed the "sunk" position in which it is outside the path of the sheets, the other "deflecting" when, e.g., by rotation (since means other than rotation can be envisaged for moving these elements between their two positions e.g., by a translatory movement, or a composite movement about the axis), it can present its suitably profiled end or tip in the path of the sheets constraining the latter to curve e.g., inwardly in a different direction from that which they would have if continuing to move between the several pairs of successive rollers, the said sheets thus gradually leaving the conveyor element.

The control of the motion whereby the deflector elements are displaced into either distinctive position, is preferably effected in the case of rotatory motion (which is likewise preferably for each of control and reduced bulk), by the following elements:

In the "deflecting/sunk" direction individually by a separate element e.g., the core of an electromagnet or an element (such as a bar or disc) controlled thereby, started by the sheet itself upon leaving the distributor, e.g., through a microswitch or a photocell.

In the "sunk/deflecting" direction by a combined movement of all these elements, each individual element being for this purpose fitted with an appropriate lever and all these levers being turned together by a single actuating rod.

It is similarly advantageous to control the two movements of the deflecting elements electromagnetically: each such element being for this purpose associated with a two-position electromagnet controlling the rotation thereof, each of the cores of this electromagnet being controlled by a common switch, whether electric, magnetic, mechanical or other.

Further advantageously, the said individual element allows the deflecting elements to be held in the deflecting position by an automatic clutch device (e.g., electromagnetic or mechanical, with pawl and ratchet); moreover, the microswitch or photocell allows the automatic device to be uncoupled by which means the deflectors can resume their "sunk" positions e.g., by means of a special restoring element, spring action, by gravity, or electromagnetically.

The receiving element can itself and in the same manner be of the nature of a stack of shelves or racks, possibly set at an inclination, carried by two cheeks on a frame capable of moving on rollers or the like in such manner that after the stack formed by the shelf assembly has been moved into position, each such rack or shelf is located directly in front of a separate exit from the distributor.

It has been found suitable to provide each stack or cabinet with a pushrod located at a point where when the cabinet has been set facing the distributor, the pushrod can operate a rod or an appropriate contact controlling the return to the "deflecting" position of all the deflector elements.

The total capacity of such a machine is restricted by the number of sheets which can be held on each shelf or rack, the number of stacks or cabinets available, and the rate at which the sheets can be fed one by one to the machine without possibility of contact between them.

The invention will be described further with reference to the accompanying drawings, by way of example only.

In detail, the drawings are as follows:

FIG. 1 is a diagrammatic side elevation of one embodiment of apparatus according to the invention;

FIG. 2 is a partial plan view of the apparatus;

FIG. 3 is a rear elevation of the apparatus;

FIG. 4 is an enlarged, fragmentary side elevation (opposite to that of FIG. 1) showing the intake conveyor of the apparatus;

FIG. 5 is a fragmentary side elevation showing the upper end of the intake conveyor, and devices for inverting the sheets and reversing their direction of motion (see also FIGS. 19*a*, 19*b*, 20*a* and 20*b*);

FIG. 6 is a fragmentary side elevation showing the connection between the inverting and reversing devices and the distributing conveyor (see also FIG. 11);

FIG. 6*a* is a section on line A—A of FIG. 5, on an enlarged scale;

FIG. 6*b* is a fragmentary longitudinal section through the end-stop shown in FIG. 5, on an enlarged scale;

FIG. 6*c* is a vertical section taken along the rear surface of the end-stop;

FIG. 6*d* is a detail of FIG. 5;

FIG. 7 is a fragmentary longitudinal section through the distributing conveyor (seen from the side opposite to that shown in FIG. 1);

FIG. 8 is a similar view to that of FIG. 7, with the deflecting blades in the deflecting position;

FIG. 9*a* is a partial side elevation of the cabinet which receives sheets from the distributing conveyor;

FIG. 9*b* is a partial front elevation of the cabinet;

FIG. 9*c* is a horizontal section through the cabinet;

FIG. 10 is a plan view of part of the intake conveyor;

FIG. 11 is a fragmentary side elevation (opposite to that of FIG. 6 and on an enlarged scale) showing the connection between the inverting and reversing devices and the distributing conveyor;

FIG. 12 schematically shows the drive of the inverting device;

FIG. 13 is a side elevation of part of the distributing conveyor, showing the control of the deflecting blades (corresponding to FIG. 7);

FIG. 14 is a similar view (corresponding to FIG. 8);

FIG. 15 is a fragmentary front elevation of the lower end of the distributing conveyor;

FIG. 16 is a fragmentary rear elevation of the distributing conveyor;

FIG. 17 is a plan view of part of the inverting device, showing the belt tensioners;

FIG. 18 is a schematic side elevation of part of the distributing conveyor (cf. FIG. 8);

FIG. 18*a* is a fragmentary plan of part of the deflecting unit shown in FIG. 18;

FIG. 19*a* is a fragmentary side elevation showing the connection between the intake conveyor and the inverting device (cf. FIG. 4);

FIG. 19*b* is a fragmentary plan of the same;

FIG. 20*a* is a detail of the intake conveyor, in side elevation (cf. FIG. 4);

FIG. 20*b* is a transverse section through the first section of the intake conveyor, on an enlarged scale;

FIG. 21*a* is a fragmentary front elevation of one side of the distributing conveyor (cf. FIG. 16);

FIG. 21*b* is an elevation of this side;

FIG. 22 is a general view, in side elevation, of a second embodiment of apparatus according to the invention;

FIG. 23 is a front elevation of the apparatus, with certain parts omitted for clarity;

FIG. 24 is a rear view of part of the apparatus, showing the distributing conveyor;

FIG. 25 is a vertical section through part of the distributing conveyor;

FIG. 26 is a similar view to FIG. 25, with the deflecting blades removed from the conveying path;

FIG. 27 is a side elevation of part of the distributing conveyor, showing the deflecting-blade control (corresponding to FIG. 25);

FIG. 28 is a similar view to FIG. 27 (corresponding to FIG. 26), also showing the drive of the conveying rollers;

FIG. 29 shows the deflecting-blade control circuit;

FIG. 30*a* diagrammatically illustrates a possible modification of the apparatus; and

FIG. 30*b* similarly illustrates another possible modification.

The apparatus illustrated in FIGS. 1 to 21*b* comprises (cf. FIGS. 1 to 3) a receiver and elevator for the sheets E, a turnover device R for the sheets, a distributor device D, and a storage (stacking) device M equipped with a motor T by which it can be moved along suitable guide rail c (e.g., in the direction of the arrows).

This form of embodiment is of particular interest when the number of sheets to be assembled in each shelf compartment, and the number of shelves is used, are great; the machine being an industrial, high-duty unit.

The elevator E shown in FIG. 4 consists of two conveyor racks T_1 and T_2 in belt form, intended to receive the printed sheets (assumed to be delivered from the printing press in the direction of the arrow 28, on the left of the drawing), and guiding them to the intake of the rack T_2 which lifts them to a level above the turnover device.

The rack T_1 is carried partly on two link rods 3 connected to it and the rack T_2 by suitable bolts 4, 5 and nuts, and partly by a crank 5' (better seen in FIG. 20*a*), comprising a smooth platen reinforced on its two edges by a frame consisting of two stretcher bars 6 and 7 connected at their ends by two round bars 8 and 9 (cf. FIG. 10) rotating on end pivots 10, 11, 12, 13 in sockets made in the ends of the two stretchers, the said sockets acting as mountings for needle bearings (not shown) carrying the said pivots.

The two round bars 8 and 9 act as supports for four parallel (conveyor) belts or straps 14, 15, 16, 17 maintained stretched by a tensioning roller 18 (FIG. 4) connected to the aforesaid frame by two adjustable arms 19. Two rollers 20 and 20' (see FIG. 20*b*) are held against two of the belts (straps) 14 and 16 on two arms 21, 22 attached to a bar 23 rotatably mounted at its ends 26, 27 in sockets provided in two links 24, 25 attached to the stretchers 6, 7.

The pressure of the rollers 20, 20' on the belts 14 and 16 is adjusted so as to ensure correct conveying of the sheets between the belt or strap and the rollers (in the direction of the arrow 28), the motion of the belts being controlled by a wheel 29 on the end of the pivot pin 12 on the round bar 9 and actuated by a chain 30. The wheel 29 rotates in the direction of the arrow 31.

The rack T_2 is constructed substantially in the same manner as the rack T_1 but is slightly longer and has two belt (strap) tensioning devices instead of only one. It comprises a smooth platen 2 connected laterally with two stretchers 32 and 33, two end bars 34 and 35 carrying four belts 36, 37, 38, 39, two belt-tensioners 40, 41,

nine pairs of pressure-rollers (42–50) for the sheets, each with a connecting link and supporting arms (not referenced), forming a similar assembly to that of the arms 21, 22 and links 24, 25. The upper part of the rack T_2 has, at the end of the bar 35, a gear wheel 53 fixed on an end bar 54 which forms part (cf. FIG. 4) of the top platen of the turnover device.

The rack T_2 is held at a suitable inclination, on the one hand, by the front end of the turnover device (the stretchers 32, 33 are suspended by their ends 32′ and 33′ from the pivot pins of the bar 54 (cf. FIG. 19)) and, on the other hand, by two links 55, 56 hinged at 57, 58 to the stretchers 32, 33 and themselves resting on the vertical strut 59 (FIG. 1) of the frame carrying this assembly.

Following the rack T_2, as shown diagrammatically in FIG. 5 and 6, the turnover device proper for the sheets is shown diagrammatically in FIGS. 6*a–d* with the control device for reversing the direction of motion of the sheets.

This device comprises, carried on the strut 59 and links 60, 60′, two platens: upper 61, and lower 62.

The upper platen 61 is of the same kind as that in the rack T_2 and comprises two stretchers 63, 64, two rotating end bars 54, 65, four belts 69, 70, 71, 72, a tensioning roller 73, and three sheet grips 74, 75, 76. This upper platen is connected to the lower platen by means of two connecting links 77 and 79, screwed at 81, 82, 83, 84 to two of the stretchers 63 and 110 of the two platens, and two similar links 78 and 80 screwed to the other two stretcher bars 64 and 111. Each stretcher 110, 111 of the lower platen is attached at 85, 85′ to one of the links 60, 60′ and at 86, 86′ to a strap or hanger 87, 87′ fixed on the strut 59.

The spindle 65 at the end of the platen 61 has, at its ends, pivot pins 88, 89 carrying two rotatable cranked levers 90, 91 which in turn carry three cylindrical rotating rollers 92, 93, 94, respectively working in three pairs of corresponding holes 95, 96, 97 in the two cranked levers 90, 91.

A set of four belts or straps 98, 99, 100, 101, stretched by the tensioner 102 (roller 103 and arm 103*a*) mounted on the stretchers 63, 64, drives the three rollers 103, 92, 94. These belts (straps) are themselves driven by the belts 69 to 72 passing over the spindle 65 and roller 93. The belt assembly is driven by the motor 104 (FIG. 6) through a chain 105 and a sprocket 106 (FIG. 12) keyed on the spindle of the roller 93. The direction of motion of the sheets and the belts (straps) is indicated by the arrow 107 on the rack T_2, the arrow 108 on the upper platen 61, and the arrow 109 towards the belt assembly 98 to 101. The sheets coming off the rack T_2 are thus carried between the two sets of belts 69 to 72 and 98 to 101 until they arrive above the lower platen 62, after passing between the rollers 93 and 94.

This lower platen comprises (FIGS. 5 and 6) two stretchers 110, 111, two end spindles 112, 113, one pair of belts or straps 114, 115, and a tensioning roller 116. The spindle 118 is driven in rotation in the same sense as the spindle 65, through the intermediary of a pulley 117 (FIG. 11) on the end of the spindle 113 and a chain 118 driven by a sprocket 119 keyed on the end of the spindle 65.

A cross-section (FIG. 6*a*) along the line A—A in FIG. 5 shows the stretchers 110 and 111, and the upper parts of the two belts 114 and 115 the upper surface whereof is slightly below (about 1 mm) the surfaces of a polished slide 120, flush with the platen 62 and parallel to the upper parts of the two belts. The sheets leaving the two sets of gripping rollers, drop on this polished surface and slide in the direction opposite to their original motion on the upper platen 61.

In order to facilitate the sliding of the sheets, the surface 120 is inclined in the direction of motion of the said sheets. The sheets are presented singly and in turn and actuate a microswitch 121 (FIGS. 6*b*, 6*c*) striking against an end stop 122 fitted across the stretchers 110, 111. The sheets are aligned by the flat face of this end stop, and the actuated microswitch closes an electric circuit which causes two rollers 123, 124, carried on two arms 125, 126 pivoting at 127, 128 on struts 77, 78, to drop.

This change of direction of motion is controlled as follows:

The turned-over sheets, arriving singly from between the rollers 93 and 94, slide along the surface 120 in the direction of the arrow 239 (FIGS. 5 and 6*b*). They lift a spring filament 240 held in a groove 241 extending longitudinally in the central part of the plate 242 providing the smooth upper face 120. This spring has at one end a bent part 243 which enters a small hole in a peg 244 which by the pressure of an internal spring in the microswitch is biased to close a contact in the microswitch 121. In the absence of a sheet, the contact is closed and an electric current from an electric generator 245 passes along a circuit formed by the output terminal 246, conductor wire 247, coil 248, and conductor wire 249; the coil 248 fitted on the stretcher 63 maintains the arm 125 and the roller 123 in the raised position by means of its core 250 which is attracted upwards. The passage of a sheet displaces the spring 240, forces the peg 244 to rotate, and interrupts the excitation current of the coil 248, which causes the rollers 123 and 124 to drop.

These two rollers 123 and 124 are located just above the belts 114, 115 and, when dropped, grip the sheet between themselves and the said belts which, being sufficiently rough, propel the sheet in their own direction of motion, i.e., of the arrow 251. As soon as this sheet, travelling in the direction of the arrow 251 has allowed the spring 240 to resume its position on the groove 241, the electric current is restored and the coil 248 raises the arm 125. The device is now ready to receive the next sheet. The sheet carried by the belts 114, 115 reaches the end of the lower platen 62 and is gripped between two other belts 129 and 130 (rising part). The belt 130 is driven on a spindle 133, by the friction of the belt 129; its purpose will be explained presently. The circuit of the belt 129 includes a roller 131 running on a spindle 132 parallel to the spindle 113 and acting as a guide for the issuing sheets; a roller 133 on a spindle 134 practically at the level of the roller 113 and suspended from a bracket 135 attached to the supporting frame 136; a tensioning roller 137 similarly attached to the frame 136; and a return roller 138 whose ends 139, 139′ are journalled in the walls 146, 147 of the distributor 140. The position of this roller 138 is such that it acts to increase the arc of contact between the belt 129 and the roller 133. This roller 133 is driven at one end by a toothed trunnion pin rotated by the chain 118 (FIG. 11). The driving direction is shown by the arrows 142 (chain 118), 143 (belt 129), and 144 (belt 130). It should be noted that in FIG. 6 the distance between

the roller **113** and the roller **133** has been disproportionately increased for clarity in representation: in fact, this distance is sufficiently small for the edge of a sheet leaving the lower platen **62** to be immediately nipped by the belt **130** without having sufficient space to curl by its weight and thus not having been able to touch the said belt (rising part).

The purpose of the distributor **140** is to receive the sheets in its top part, and distribute them one by one into the casing, on to a series of sloping shelves arranged one above the other in a movable cabinet moved at the proper instant in front of and facing the discharge side **145** (FIG. 7) of the said distributor.

This distributor is in the form of a vertical cabinet with two side walls **146** and **147** attached on the strut **59.** Between these two side walls **146, 147** are mounted two sets of spindles such as **154** to **157** and **166** to **169** (FIG. 7) supporting two rows of parallel, horizontal rollers. Each row or set of rollers comprises, in the same vertical plane and spaced at a convenient distance from each other, the same number of rollers as there are shelves or racks in the collector cabinet; in addition, in the horizontal plane each roller is set opposite to and nearly against a roller of the other set, the space between the pair of rollers being just sufficient to allow the passage of the descending part **149** (with a slight nip) of a belt the ascending part of which is shown at **130.**

FIGS. 7 and 8 show a partial longitudinal section of this distributor; in particular a part of the two sets of rollers. One of these sets, the top roller of which is referenced **148** (FIG. 6), is guided at back and front by the belt **130, 149** (rising and descending parts respectively). These rollers are shown diagrammatically in FIGS. 7 and 8, as the four rollers **150, 151, 152, 153,** identical with the roller **148;** the ends of the spindles **154, 155, 156, 157** are carried in the walls **146, 147** in horizontal grooves or slots similar to that referenced **158** in FIG. 6 (corresponding to the spindle **159** of the roller **148**). All the rollers of this set rotate in the same direction, indicated by the arrow **160.** Each roller, say **150,** of the set consists in fact of four longitudinal roller sections of the same diameter, freely rotating on the same spindle, each driven in rotation by one of the belts **130, 149.** The width of each roller section is practically the same as the width of the belt by which it is driven.

The second set of rollers is arranged between the first set and the side wall of the distributor, on the discharge side **145;** FIGS. 7 and 8 similarly show four of these rollers **162, 163, 164, 165** diagrammatically; all these rotate in the same direction, indicated by the arrow **161** and their spindles **166, 167, 168, 169** are similarly held in the side walls **146, 147.** The distance between rollers on the same level, e.g., **150** and **162,** is such that the descending part of the belt **149** can just pass through, rotating the roller **162** in the direction of the arrow **161.** Moreover, each roller of the type **150** is pressed against its matching roller **162** by means of a spring **179** (FIG. 6) attached by a screw **180** and end stop **181** to the wall of the distributor.

FIGS. **13** and **14** show the pairs of grooves (one in each side wall) **217, 218, 219, 220,** the pairs of springs **221, 222** and the fixing screws **223, 224.**

The lower loop of the belt, joining the parts **130** and **149,** is shown diagrammatically in FIG. **15.** As this Figure shows, this belt is in fact constituted by four belt sections or straps, **130/1,** 130/2, 130/3, 130/4 (and respectively, **149/1,** 149/2, 149/3, 149/4) passing around a roller **170.** In the lower part of the distributor the ends **171, 172** of the roller **170** are journalled in two supports **173** and **174** attached by arms **175** and **176** to the walls **146, 147** and each having a belt-tensioning slide the position of which is controlled by a screw **177, 178.**

The two side walls **146** and **147** of the distributor are further held at the correct spacing by means of three cross-bars **179, 180, 181,** equally spaced along the height of the distributor. They have further (FIG. **16**) a series of holes arranged in a vertical row and matching in pairs at the same level: **182** and **183, 184** and **185, 186** and **187,** etc., between which spindles **190, 189, 188,** etc., are mounted. The spindle **190,** similarly to the others, rotates freely in two ball bearings **215, 216** fitting in the holes **182, 183.** Each of these spindles carries four pairs of deflecting fingers of thin sheet metal, set at each level on either side of the four belts **130/1,** 130/2, 130/3, 130/4. The eight fingers corresponding to the spindle **189** are referenced **191** to **198.** Each is attached on the spindle **189** by means of a collar (shown at **199** to **206**) rigid therewith, and a locking screw (shown at **204** to **214**). All the fingers carried on the same spindle move synchronously. They can occupy two distinct positions: the first is the neutral position (cf. FIG. 7) which they assume automatically when only under the influence of gravity; the second is the working position (cf. FIG. **8**), when they are practically in contact with the rollers **162** to **165,** their corresponding spindles having been rotated in the appropriate direction by the action of a lever as will presently be explained. In this working position, with the fingers displaced by their rotation to a position between the belts **130** and **149** and the several roller sections making up a roller such as **150,** their tips e.g., **225** will be practically in contact with the rollers e.g., **163.**

The sheets descend one by one between the four descending straps **149** and the rollers **162, 163, 164** etc. until a set of eight fingers, projecting into the path of the descending sheets (FIG. **8**), causes one such sheet to turn around a roller such as **162** in such manner that the said sheet loses contact with the belt **149** and slides down an inclined plane the longitudinal section whereof is shown at **226;** after which it proceeds between this plane and a flat guide **227** as far as the receiver (collector). The inclined plane **226** and the guide are made of a thin, folded metal sheet the ends of which are attached (e.g., by bolts) to the two side walls **146, 147.** While passing between the inclined plane **226** and the guide **227,** this sheet actuates a microswitch **252** (FIGS. **18** and **18***a*) by raising a wire **253** one end **254** of which rests on the plane **226** and passes through a slot **255** in the guide **227** and the other end **256** of which is inserted in a pin forming part of the microswitch **252** and breaking contact in the microswitch under the biasing action of a spring. Any sheet passing between **226** and **227** raises this wire **253,** which causes the pin **257** to turn (in a clockwise direction in FIG. **18**) and close an electric circuit supplied by a current source (represented by a battery or cell **258**). This source supplies to two terminals **259** and **260** (FIGS. **14** and **18**) a voltage energizing an electromagnet **228** mounted on the frame **56.** This electromagnet **228** cooperates with a plunger **229** pivoted to a rockable lever **230** which maintains the deflecting fingers in the working position. The tip **232** of the lever **230** has a shoulder

233 abutting a tooth 234 cut in a solid disc 235 attached by a screw 236 to the extension 237 of the shaft 188. The passage of the current causes the electromagnet to retract the plunger 229, which thereby rotates the lever 230 about a spindle 231. The engaged position (FIG. 14) of the disc 235 corresponds to the working position of the fingers (FIG. 8). As soon as the electromagnet has been energized by the passage of a sheet between the plane 226 and guide 227, the tooth 234 is freed by the rocking of the lever 230, and the weight of the eight fingers 191 to 198 causes them to fall into the position shown in FIG. 7, corresponding to the released position of the discs 235 (FIG. 13). The sheet having slid through the space between the plane 226 and guide 227, the microswitch again de-energizes the electromagnets 228 and the end 232 of the lever 230 rests on the disc 235 by its own weight.

At the start of the operations the electromagnets are all in the position shown in FIG. 14 and the sets of fingers are in the position shown in FIG. 8. Any sheet deflected by a set of fingers releases this set by the action of the microswitch which it actuates in passing under the wire. The next sheet is only deflected by the following set of cams, and this is repeated until all the sets of cams have been released. At this time, all the shelves or racks are occupied by the appropriate sheets.

It should be noted that each inclined plane 226 has an inclined flange 238 intended to guide the next following sheet towards the free gap between the following roller e.g., 163, the set of fingers co-operating with the roller 162 having removed from the path of this sheet by the action of the microswitch 252.

The distributing mechanism D thus delivers a "turned" sheet successively to all the shelves or racks such as 261, 262, 263 (FIG. 9*a*) of the magazine (store) M (FIG. 1). Each shelf or rack is inclined in the direction of the entering sheet, and each such store or magazine has three vertical rods 264, 265, 266 moving in horizontal slots 267, 268, 269 in the bottom of a compartment 270, to adjust the size of the receiving rack to the dimensions of the sheet to be received. While each magazine is being moved away when filled, each compartment or shelf is held closed by a spring flap 271.

When all the compartments of a magazine have been filled with the appropriate sheets it will be possible, either to continue the distribution of appropriate sheets into another magazine, or to proceed to distribute further sheets into the same magazine. Therefore, all the sets of fingers will have to be moved back into their deflecting positions. This operation is conducted as follows (FIG. 21*a*).

Each roller e.g., 190 (represented here by its spindle) or equivalent (FIG. 16) has on its right-hand side (FIG. 21*a*) an extension 272 projecting beyond the side wall 147. A lever 273 (FIG. 21*b*) fixed on the extension 272 by a collar 274, rotates with the roller 190 and, when desired, controls this rotation. A vertical rod 275, fitted with as many pins 276 as there are levers 273, is arranged to move vertically (arrow 281) between two pairs of rollers 277, 278 whose spindles are mounted in the frame 56. While moving upwards each pin 276 causes the lever 273 to rotate the extension 272 (arrow 279) and thereby the roller 190, so that its other extension 237 (cf. FIGS. 13 and 16) is rotated in the direction of the arrow 279 until the tooth 234 (FIGS. 13 and 14) is again in contact with the shoulder 233 and the fingers are thus in the working position. The action of the rod 275 can be effected either by hand (and thus, at any desired instant); or under control of an electromagnet; or mechanically at the instant of substitution of the magazine by another, by means of a pushrod attached on the base of the frame of the said magazine and raising the lower end 280 of the rod 275 at the instant of changing the said magazine; the said end 280 at the said instant of such replacement, being moved upwards by, for example, a bevelled block attached to the main frame of the machine.

In accordance with a second embodiment, FIG. 22 diagrammatically shows an end elevation of the apparatus; FIG. 23 is a front view of the arrangement of cabinets or racks A; FIG. 24 shows a front view of part of the sheet-elevator D; FIGS. 25 and 26 show the two characteristic positions of the sheet-deflecting system; FIGS. 27 and 28 show the two corresponding positions of the electromagnets controlling the sheet-deflecting system; FIG. 29 is an electric circuit diagram of the electromagnets; and FIGS. 30*a* and 30*b* show a diagrammatic, general sketch of two other possible arrangements of the constituent elements of the apparatus.

FIG. 22 shows the receiver for the sheets coming from a printing machine in the direction of the arrow *f*. This consists of a sloping conveyor table T_3 and a horizontal conveyor table T_4; an elevating and deflecting device D, through which the sheets travel from the bottom upwards, follows a connecting element L which maintains the continuity of motion of the sheets from the table T_4 to the device D; finally, a stack of shelves or racks A is arranged at the discharge from the deflecting device D, for receiving the inverted sheets. The inversion of the sheets is effected in part by the element L and in part by the deflecting device.

Stacks of shelves or racks A identical with the one already mentioned above, are set on a carriage travelling on rails 2 arranged above the table T_4 (cf. FIG. 23).

The tables T_3 and T_4 of the conveyor belt type are constructed in substantially the same manner as the tables T_1 and T_2 shown in FIG. 1.

The connecting element L consists actually of a smooth, curved sheet 283 placed at the end of the table T_4 so as to receive and guide the sheets conveyed by the last roller 282, and the belts or straps forming the conveyor table T_4. The sheets leave the table T_4, slide along the sheet 283, and curve upwardly until on leaving the sheet 283 they are gripped and conveyed between a roller 284 and a series of small rollers (not shown), all these rollers rotating freely on spindles the ends of which run in appropriate sockets made in the lower part of the two side walls 285, 286 carrying all the mechanism constituting the elevator deflector D.

The roller 284 is driven (in a counter-clockwise direction, FIG. 22), by a belt 287 passing round a spindle 288 which is rotated (through a coupling not shown) by a motor 289 carried on a frame 290 also carrying the table T_4.

The elevator-deflector D, comprising the two vertical side-walls 285, 286, is formed of a vertical series of elevating and deflecting elements, all identical and controlled on the one hand by electromagnets 291 fitted on the walls 285, 286, and on the other hand by an endless belt 292, which is driven by the motor 289 through a belt transmission 293 acting on a roller 294 forming

part of the first elevating and deflecting element, directly above the linkage L.

FIGS. 25 and 26 illustrate the construction of these elevating and deflecting elements. The description following refers to a set of three consecutive elements, but of course applies equally to the whole assembly forming the elevator-deflector D. The lowest element in this assembly D receives the sheets issuing singly from between the roller 284 and the set of small rollers. This roller 284 and its small rollers form, in fact, a first "elevator" stage, which is without a corresponding deflector element and merely serves to guide and raise the sheets to the intake of the first "elevator-deflector" element, the roller 294.

Each such elevator-deflector element comprises:

a. a driving roller (295, 296, 297) carried on a shaft (298, 299, 300) whose ends are mounted in the side walls 285, 286 in appropriate sockets (301 and 302, 303 and 304, 305 and 306);

b. an idler shaft (307, 308, 309) placed at the same level as the shaft (298, 299, 300); its ends similarly pass through the side-walls 285, 286 and are carried by slides as described below;

c. a series of small rollers (310 to 317, 318 to 325, 326 to 333) running freely on their corresponding shafts (309, 308, 307);

d. a series of shaped blades acting as deflectors (334 to 304, 341 to 347, 348 to 354) carried on spindles (355, 356, 357) with collars (358 to 364, 365 to 371, 372 to 378) having set screws (379, 380, 381) respectively; the ends of the shafts 355, 357, 357 similarly rotate in sockets provided in the walls 285, 286; and

e. a controlling electromagnet (382, 383, 384).

The action of this device is as follows:

The motor 289 through, the intermediary of the belt 293 and the roller 294, drives a toothed wheel (not shown) attached to the end of the spindle of the said roller 294 (on the side of the wall 286). This toothed wheel in turn actuates a beltrack 292 of the endless flexible type (FIG. 22). The beltrack 292, the two parts 385 and 386 of which are shown in FIG. 28, moves in the direction of the arrows 387 (ascending part) and 388 (descending part), and rotates, in a clockwise direction, the gear wheels 389, 390, 391 attached on the ends 392, 393, 394 of the shafts carrying the rollers 297, 296, 295.

By the action of this beltrack, all the rollers 297, 296, 295 rotate clockwise (FIG. 26). They in turn drive the series of small rollers 310 to 317, 318 to 325, 326 to 233 respectively, made of a sufficiently rough material, e.g. rubber, which are placed on the same level as the rollers 297, 296, 295. The small rollers are mounted in slots 395, 396, 397 in the side walls 285, 286 by means of guides 398, 399, 400 serving as bearings for the ends 309, 308, 307 of the spindles of the small rollers. The guides are continuously forced towards the large rollers by springs 401, 402 attached to the side walls 285, 286 by screws 403, 404.

The direction of rotation of the large rollers being that of the arrow 405, and that of the small rollers being in the direction of the arrow 406, it will be appreciated that a sheet gripped between a large roller (which is knurled to grip the sheets better) and its associated small rollers, ascends between each pair of rollers until it meets an obstruction. Such an obstruction is furnished by the deflector blades, e.g., 348 to 354, which may occupy two different positions, viz., a deflecting position (FIG. 25) and an idling position (FIG. 26).

These two positions are controlled by electromagnets such as 382, 384 whose cores 407, 408 force the blades into one or the other position by the action of links 409, 410, cranks 411, 412, and flanges 413, 414, allowing the rotation of the spindles 355, 357 on which the said blades are carried.

In the idle position the blades allow free passage of the ascending sheets; in the deflecting position they cause the sheets to curve to the right (FIG. 25) and to enter guides 415, 416, 417 each formed of substantially horizontal plates arranged one above the other and leaving a sliding gap between them. The outlets 418, 419, 420 of these guides are arranged respectively facing a shelf or rack of the magazine to be filled. Each guide 415 has near its outlet end a photocell 421, 422, 423. These cells are connected in an electric circuit controlling the raising or lowering of the corresponding (deflector) blades.

A simple electric circuit for this controlling action is as follows (FIG. 29). An electromagnet 382 is equipped with two pairs of terminals 424 and 425, 426 and 427. A current source (battery 428) can be connected across either pair of terminals in such manner that the core 407 can be slid axially within the electromagnet into one of two extreme positions. The connection with the current source 428 is effected through a changeover switch mechanically operated by an extension 430 of the core of an auxiliary electromagnet 431 energized by a battery 432. The photoelectric cell 421 is connected in this circuit (431, 432). The core extension 430 further has two auxiliary arms 433 and 434 the first of which can close a switch 435, without being able to open it, while the second arm can open a switch 436 without being able to close it. The circuit connections with the terminals 425 and 427 are closed by the contacts 437 and 438 respectively of a changeover switch 429. The core of the electromagnet 431 is held in position on the left (FIG. 29), by means of a tension spring 439.

This electrical control system operates in the following manner. Initially, when current is passing through the photoelectric cell 421, the battery 428 is connected to the terminals 424 and 425 through the intermediary of the changeover switch 429 whose contact 437, as well as the switch 436, is closed.

Breaking of the circuit at the cell 421 (for instance by the passage of a sheet) allows the core extension 430 to return to the right (to the position shown in FIG. 29) opening the switch 436 and contact 437 and closing the contact 438. The battery 428 is now connected to the terminals 426, 427 through the changeover switch 429. The core 407 moves down and raises the corresponding blades 334 to 340. When the sheet has passed through, current is restored through the cell 421; the core extension 430 moves to the left, closing the switch 435 and leaving the switch 436 open, so as to maintain the current supply to the terminals 426, 427 of the electromagnet 382.

When the required number of shelves or racks has been occupied by sheets (starting from the bottom of the distributor), an external agency, mechanical or electrical, closes the contacts 436 at each level, and opens the contacts 435, similarly at each level, which causes all the electromagnets to return their blades into

their initial deflecting position. The device is now ready to resume operation.

Obviously it can be envisaged to make the arrangement operate continuously and automatically, and even to automate it to respond to a predetermined program.

The two exemplary embodiments described above represent two preferred forms of apparatus. However, other ways and means of arranging these devices are equally conceivable, e.g., to modify the order in which the different operations of turning-over, reversal of direction, distribution, etc., are performed. For instance, it would be possible to conceive a different sequence of operations as follows:

a. (FIG. **30***a*) reception (**440**), turning over (**441**) the sheets; distribution (**442**); or

b. (FIG. **30***b*) reception (**443**), reversing the direction of motion (**444**), turning-over (**445**), distribution of the sheets.

I claim:

1. Apparatus for assembling stacks of sheets which are to be arranged in a particular order in the stack, the apparatus comprising in combination and in sequence:

a. intake conveyor means for continuously receiving sheets singly and in sequence;

b. means operatively connected to said intake conveyor means for inverting the sheets singly as they are received from said intake conveyor means;

c. distributing conveyor means operatively connected to said means for inverting said single sheets;

d. and receivor means including a plurality of receiving sections operatively associated with said distributing conveyor means for receiving single sheets in sequence from said distributing conveyor means;

said distributing conveyor means including means for conveying the sheets in succession along a given path, a series of deflectors arranged sequentially along said path and operatively associated with the respective receivor sections for deflecting a single sheet into a respective receivor section, a plurality of control means, one of each operatively connected to each respective deflector and a respective receiving section, said control means including a sheet-actuated control portion downstream of each respective deflector for de-activating a respective deflector controlling sheet-accessibility to the receivor section into which a sheet has been received, whereby, successive groups of inverted sheets, each group containing a predetermined number of sheets, are successively distributed to the receiving sections of said receivor means.

2. The apparatus as claimed in claim **1** wherein said means for inverting the sheets singly comprises means for receiving the single sheets in one direction, and means actuated by the single sheets for reversing the direction of movement of the single sheets toward a direction opposite that received in the means for inverting and directing them to said distributing conveyor means.

3. Apparatus as claimed in claim **2** which said distributing conveyor means and said means for inverting said single sheets comprise endless belts having overlying end portions so arranged that a sheet entrained on the endless belt of the means for inverting is received on the portion of the endless belt of said distributing conveyor means moving in a common direction, said deflectors being positionable transverse to the path of travel of the endless belt of said distributing conveyor means and including means for inverting the single sheets as they are directed into the receiver sections.

4. Apparatus as claimed in claim **2,** wherein said means for inverting and reversing the direction of motion of the sheets comprises a receiver for sheets, conveyor means including a control for actuation by a sheet upon arrival in the receiver, including means for temporarily bringing the sheet into contact with the conveyor means, whereby the sheet is removed from the receiver.

5. Apparatus as claimed in claim **4,** wherein the receiver comprises a flat support having a smooth upper surface slightly above the conveying surface of the conveyor means, and having a slot through which the conveyor means are exposed, the smooth surface sloping downwardly so that the sheet received from the inverting section strikes this surface and slides thereon before making contact with the conveyor means, the sliding direction being opposite to the conveying direction; and a stop arresting the motion of the sliding sheet and having a working face substantially perpendicular to the conveying direction, whereby the sheet is aligned.

6. Apparatus as claimed in claim **5,** wherein the means for bringing the sheet into contact with the conveyor means comprises means for pressing the sheet against the conveyor surface through the slot in the flat support.

7. Apparatus as claimed in claim **6,** wherein the means for bringing the sheet into contact with the conveyor means includes a control element for raising the said pressing means to press the sheet against the conveyor surface for a time sufficient for the major part of the sheet to pass between the said pressing means and the conveyor surface and for the leading edge of the sheet to be gripped by a deflecting section, the control element including means for releasing the said pressing means after the said time has elapsed.

8. Apparatus as claimed in claim **4,** wherein the means for bringing the sheet into contact with the conveyor means includes a control switch for actuation by the arrival of a sheet in the receiver.

9. Apparatus as claimed in claim **4,** wherein the conveyor means comprises at least one endless belt.

10. Apparatus as claimed in claim **1,** wherein the distributing conveyor means includes a series of parallel rollers, at least one endless belt having a rough surface maintained continuously in contact with the rollers for positively controlling individual sheets conveyed between the belt and the rollers.

11. Apparatus as claimed in claim **1,** wherein the distributing conveyor means includes two sets of parallel rollers, one set being smooth and the other rough, the rollers of at least one of the sets having knurled surfaces, and resilient means biasing each roller of one set towards the corresponding roller of the other set.

12. Apparatus as claimed in claim **1,** wherein the distributing conveyor means includes rollers, and each deflector includes a plurality of deflector members, each roller comprising a plurality of small coaxial rollers all of the same diameter, so arranged as to leave between them sufficient transverse space for the passage of the deflecting member.

13. Apparatus as claimed in claim 1, wherein each deflector is pivotally mounted for movement into and out of the said path of the sheets.

14. Apparatus as claimed in claim 1, wherein each control portion comprises means for detecting the passage of a deflected sheet, and means for removing the deflector from the said path, the removing means being operatively connected to and operable by the detecting means.

15. Apparatus as claimed in claim 14, wherein the removing means include a clutch for maintaining the deflector in the said path, means biasing the deflector towards a position removed from this path, the removing means including means operable by the detecting means to release the clutch.

16. Apparatus as claimed in claim 1, including means for simultaneously returning all the deflectors into the said path.

17. Apparatus as claimed in claim 16, wherein the receivor means comprises a cabinet having shelves for receiving the sheets, means mounting the cabinet so as to be movable relative to the distributing conveyor means, the cabinet carrying a member positioned so as to actuate the said deflector returning means as the cabinet is positioned at the discharge side of the distributing conveyor.

18. Apparatus as claimed in claim 1, wherein the control elements are of the electromagnetic type.

19. Apparatus as claimed in claim 1, wherein the, receiver means comprising one of a plurality of cabinets having shelves for receiving the sheets and means mounting the cabinets for movement relative to the distributing conveyor means.

20. Apparatus as claimed in claim 1, wherein the means for inverting comprises two parallel rollers located respectively above and below a discharge end of the intake conveyor means, each roller being upstream of the said end, an endless belt passing round the rollers, means for driving the belt around the rollers, and an intermediate conveyor positioned in a reverse direction below said endless belt to receive sheets from the endless belt, whereby a sheet discharged from the intake conveyor means is carried between the endless belt and the said end of the intake conveyor means while being inverted, and is passed to the intermediate conveyor.

21. Apparatus as claimed in claim 1, wherein the intake conveyor means comprises a rigid frame having a substantially flat upper surface for supporting the run of an endless belt, two parallel guide rollers respectively rotatably mounted at the ends of the frame, a set of parallel endless rough-surfaced belts entrained between the two guide rollers and having an upper run resting in said flat surface, means for driving one of the rollers in rotation, and a set of conveyor rollers each having a rough surface and being biased towards an advancing part of a belt, whereby each sheet received by the intake conveyor is held by the conveyor rolls against the advancing part of the belts and is constrained to follow the motion of the said advancing part.

22. Apparatus as claimed in claim 21, wherein the intake conveyor comprises a plurality of similar sections in angular relation to each other, the belts of each section being inter-related for conveying sheets without interruption to the belts of any succeeding section.

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