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(54) Sheet collating apparatus.

(57) Sheet collating apparatus comprises a plurality of bins (32), a belt conveyor system (22) and a distributor device (30) which co-acts with the belt conveyor to direct sheets from the conveyor into selected bins. Each bin includes a sheet guide (58) which extends towards the conveyor but only co-acts therewith at the diverted portion. These guides ensure positive guidance of the sheets into the bins.

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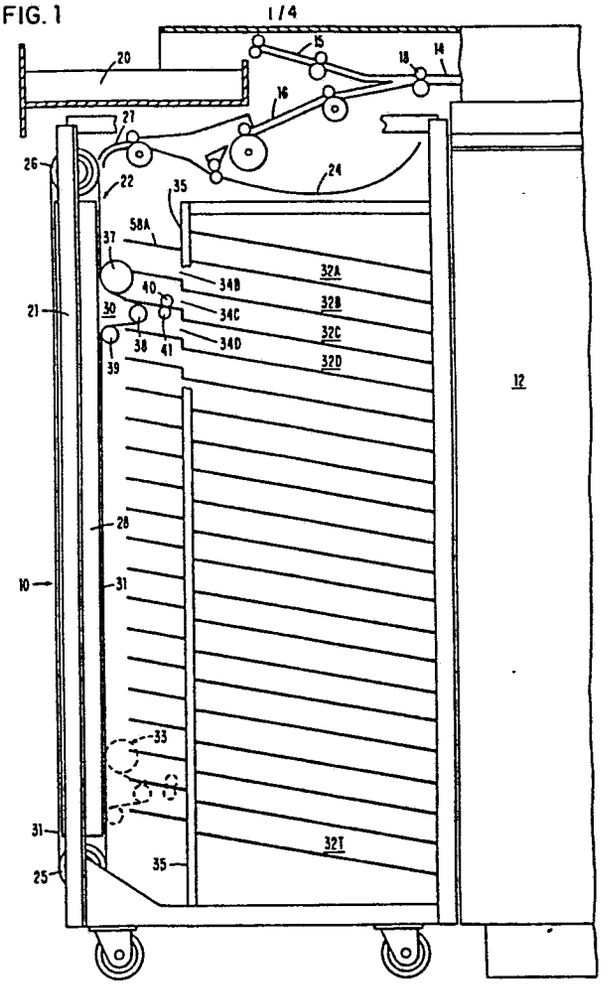
FIG. 1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SHEET COLLATING APPARATUS

The present invention relates to apparatus for collating sheets received from a source such as a copier, a duplicator or an offset press.

Prior art collators employing pivotable gates at each bin entrance have been well known in the past, as have collators which have a travelling distributor or a single moving deflector that is indexed from bin to bin. Each of the aforementioned types of collator has its own advantages and disadvantages. For instance, the multiple deflector type collators are useful for sequential collating of sets at a higher speed than single deflector type collators (depending upon the index mechanism selected) and can handle random sorting of documents for which the single deflector is poorly suited. However, the travelling distributor or deflector type of collator has the advantage of lesser moving parts and accordingly, less wear and noise problems. Furthermore, the relatively fixed position of the gates associated with each bin of a multiple deflector collator tend to stay in adjustment better than travelling distributor type collators.

U.S. Patent Specification 2,328,317 and 3,638,937 show travelling distributor type collators wherein the conveyor belts or cords associated with transport of the documents to be collated are diverted into alignment with the bin into which the document is to be placed. The belt diverting mechanism is moved under control of an index device from bin to bin. U.S. Patent Specification 3,414,254 shows a similarly indexable deflector including a separate plate which extends through the plane of the conveyor belts or cords so as to intercept the documents and direct them into the bin with which the deflector is aligned.

It is highly desirable to realize the positive document control benefits of both belt or conveyor cord diversion and the assured alignment of multiple deflector gates, while minimizing the amount that the belt or conveyor must be diverted in redirecting the movement of documents to be collated.

Accordingly, the present invention provides a sheet collating apparatus including a plurality of sheet collecting bins having sheet receiving openings positioned in a common plane, a sheet conveyor including a belt movable along a path parallel to said common plane, a distributor device arranged to co-act with the belt to divert it from said path towards said common plane, said distributor being movable to positions corresponding to said openings thereby to deflect sheets carried by the conveyor towards said openings, characterised in that each bin has associated therewith a sheet guide which extends from the bin opening towards said path to a position short of said path but into intersecting relationship with the belt when diverted.

The present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

FIG. 1 is a side view of a sheet collator embodying the present invention;

FIG. 2 is a more detailed view of the belt diverting distributor mechanism of FIG. 1;

FIG. 3 is a top, broken and partially sectioned view of the distributor and deflector mechanisms of FIG. 1; and

FIG. 4 is an isometric view of a section of the vacuum transport and distributor mechanism of the FIG. 1 collator.

A collator 10 is shown in FIG. 1 attached to a source 12 of a stream of documents, cards, sheets, or the like, the source being, for example, an office copier. A document stream output channel 14 is fed to collator 10, which includes conventional path defining guides 15 and 16, with a selectively operable gate at junction 18 to direct the sheets into one of paths 15 and 16. Path 15 terminates at exit tray 20, whereas sheets from path 16 are passed to vacuum belt conveyor system 22 either directly or after being turned in inverter 24.

A pair of flexible belts 31A and 31B (see also FIG. 4), are arranged in a continuous loop around elongated vacuum plenum 28. Belts 31 are continuously driven by means not shown and the air pressure within inner chamber of plenum 28 is reduced, also by means not shown. Thus, as sheets exit from output guide 27, they are drawn to the surface of belts 31 and held there due to the air pressure differential. These sheets are conveyed to distributor 30 where they turn with the belts toward the openings of receptacles or bins 32A - 32T. Bins 32 are arranged with the openings 34 thereof in a common plane, indicated generally at 35.

Belts 31 are diverted away from the first path as defined by the surface of plenum 28 by pulley 37 and roller 38 so that the sheet or sheets conveyed thereby are initially turned at least in the general direction of plane 35 formed by bin openings 34. Belts 31 are then returned to parallel orientation relative to the surface of plenum 28 by roller 39. Distributor 30 is indexed from one bin opening to the next until it reaches the bottom bin. At the end of any given run whatever its length, distributor 30 can be returned directly to the top bin 32A or can be incremented upward while continuing to distribute sheets into bins 32.

The detail of distributor 30 is best seen in FIGS. 2 - 4. Rollers 37 - 39, as well as kicker rollers 40 and 41 are all rotatably mounted between an end bracket 42 and either an upper bracket 43 or lower bracket 44. The end brackets such as 42 are further attached to wheel mounts so that the carriage is allowed to move vertically. The crossbar portions of the carriage are attached to a toothed belt 64 visible in FIG. 4, which is employed to provide indexing motivation to the entire carriage 30 in response to appropriate control signals by conventional means (not shown).

As is known, the reduced air pressure internally of vacuum plenum 28 cooperates with belts 31 to hold paper or sheets against belts 31. Movement of belts 31 drives that paper in a downward direction in the configuration shown in the drawings, although it will be readily recognized that the positive paper retention of a vacuum conveyor can transport sheets in either vertical or horizontal directions with equal ease. The paper bins 32 and paper deflectors 58 remain stationary. The movable carriage 30 indexes up and down and its assembly includes rollers 37, 38, 39, and 40, and idler roller 41 which is spring loaded by means not shown, along with the appropriate interconnecting elements and brackets. Note that pulley shoulders mounted on the same axles as rollers 37 and 40 accommodate drive belts 45.

Belts 31 transport paper or sheets to the nip formed with rollers 37 at which point normal force due to tension of belts 31 against rollers 37 drives the paper against the stationary deflector 58. Deflector 58 guides the paper toward the nip between rollers 40 and 41 which then drive the paper completely into the associated bin 32. Belts 31 provide rotary motion to rollers 37 and, by means of interconnecting belts 45, likewise produces the power for

rollers 40 and 41. Jam clearance can be accomplished by releasing tension on belts 31 by any known means and releasing force on the spring loaded idlers 41. Note that an upwardly directed spring bias on the mounting shafts for rollers 39 provides tensioning for belts 31. The interleaved relation of deflector 58 relative to the belt diverting transport or carriage 30, and the intersecting relation of the plane of deflector 58 relative to the plane of belts 31 between rollers 37 and 38 allows minimal diversion of the belts while still obtaining the benefits of both a travelling distributor collator and a multiple gate type collator. That is, the completion of the paper input path by plates or deflectors 58 reduces the sheet deflection function that must be accomplished by belt diverting carriage 30.

Note further that, if the mouths 34 of the bins 32 can be positioned in greater proximity to the diversion belt pulleys or rollers 38, the additional drive or kicker rollers 40 and 41 and their powering mechanism can be completely omitted. That is, the distance that sheets must travel over deflector plates 58 may be sufficiently short if openings 34 can be kept in proximity to rollers 38 so that additional driver means are not required. Note further that other kicker, deflector or guide means can be included if desired. For instance, passive guide plates can be used in lieu of kicker rollers 40 and 41 along the outer edges of the paper. The deflector plates 58 can be pivotally attached to the faces of bins 32 to further augment jam clearance if desired. Conversely, deflector plates 58 can be formed as an integral part of the associated bin 32.

CLAIMS

1. Sheet collating apparatus including a plurality of sheet collecting bins (32) having sheet receiving openings (34) positioned in a common plane (35), a sheet conveyor (22) including a belt (31) movable along a path parallel to said common plane, a distributor device (30) arranged to co-act with the belt to divert it from said path towards said common plane, said distributor being movable to positions corresponding to said openings thereby to deflect sheets carried by the conveyor towards said openings, characterised in that each bin has associated therewith a sheet guide (58) which extends from the bin opening towards said path to a position short of said path but into intersecting relationship with the belt when diverted.

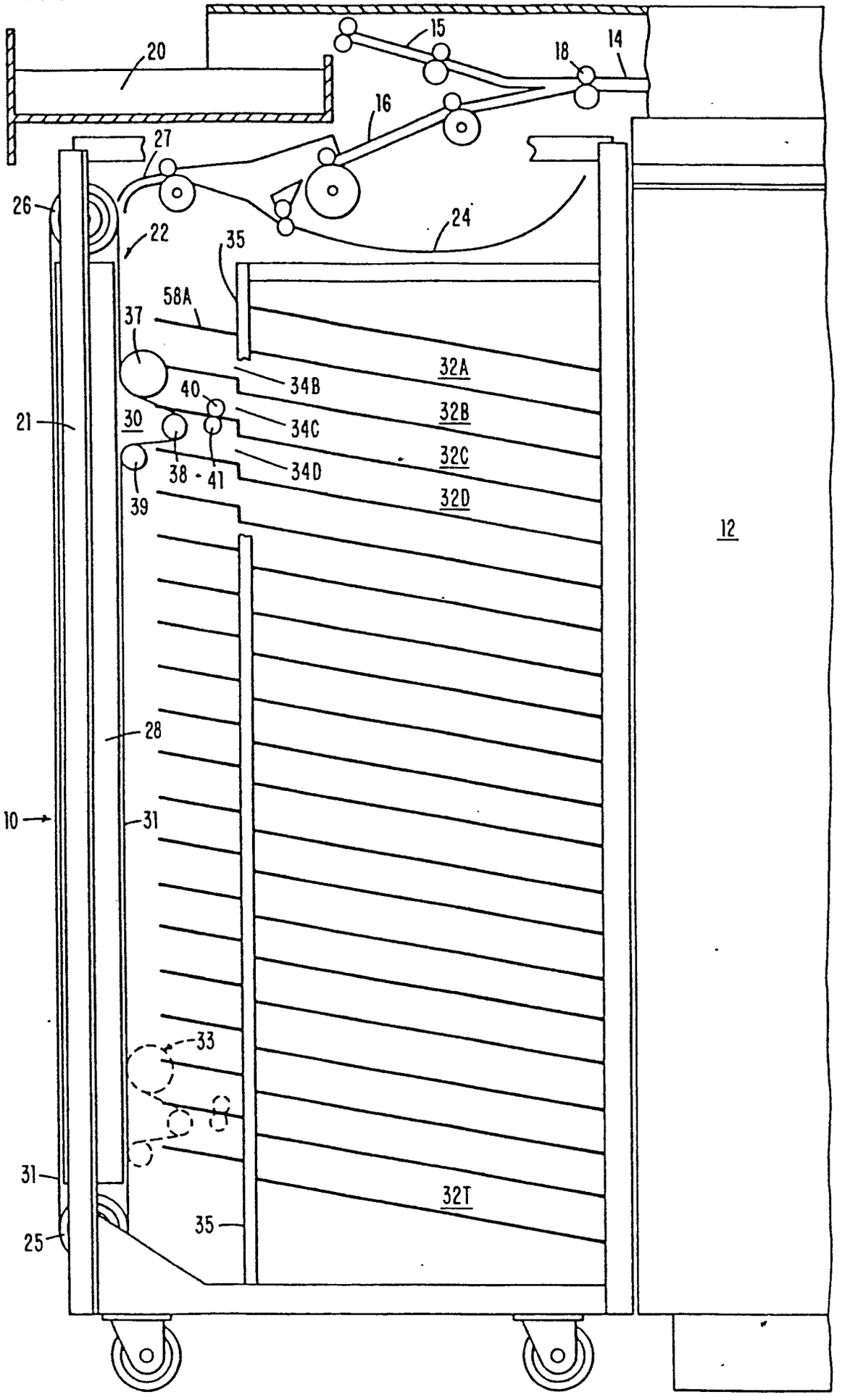
2. Sheet collating apparatus as claimed in claim 1 further characterised in that said distributor device comprises a carriage assembly (42, 44) carrying rollers (37, 38, 39) about which the belt is entrained, the rollers being positioned such that the belt is diverted thereby away from the path and thereafter back into the path.

3. Sheet collating apparatus as claimed in claim 2 further characterised in that the carriage assembly carries further rollers (40, 41) which are rotatable and positioned to drive a deflected sheet into a sheet collecting bin adjacent the distributor device.

4. Sheet collating apparatus as claimed in any of the previous claims further characterised in that said sheet conveyor includes a further belt positioned in parallel with said belt and correspondingly diverted by the distributor device.

5. Sheet collating apparatus as claimed in any of the previous claims in which the, or each, belt is perforated and coacts with a vacuum plenum (21) to hold sheets thereon.

FIG. 1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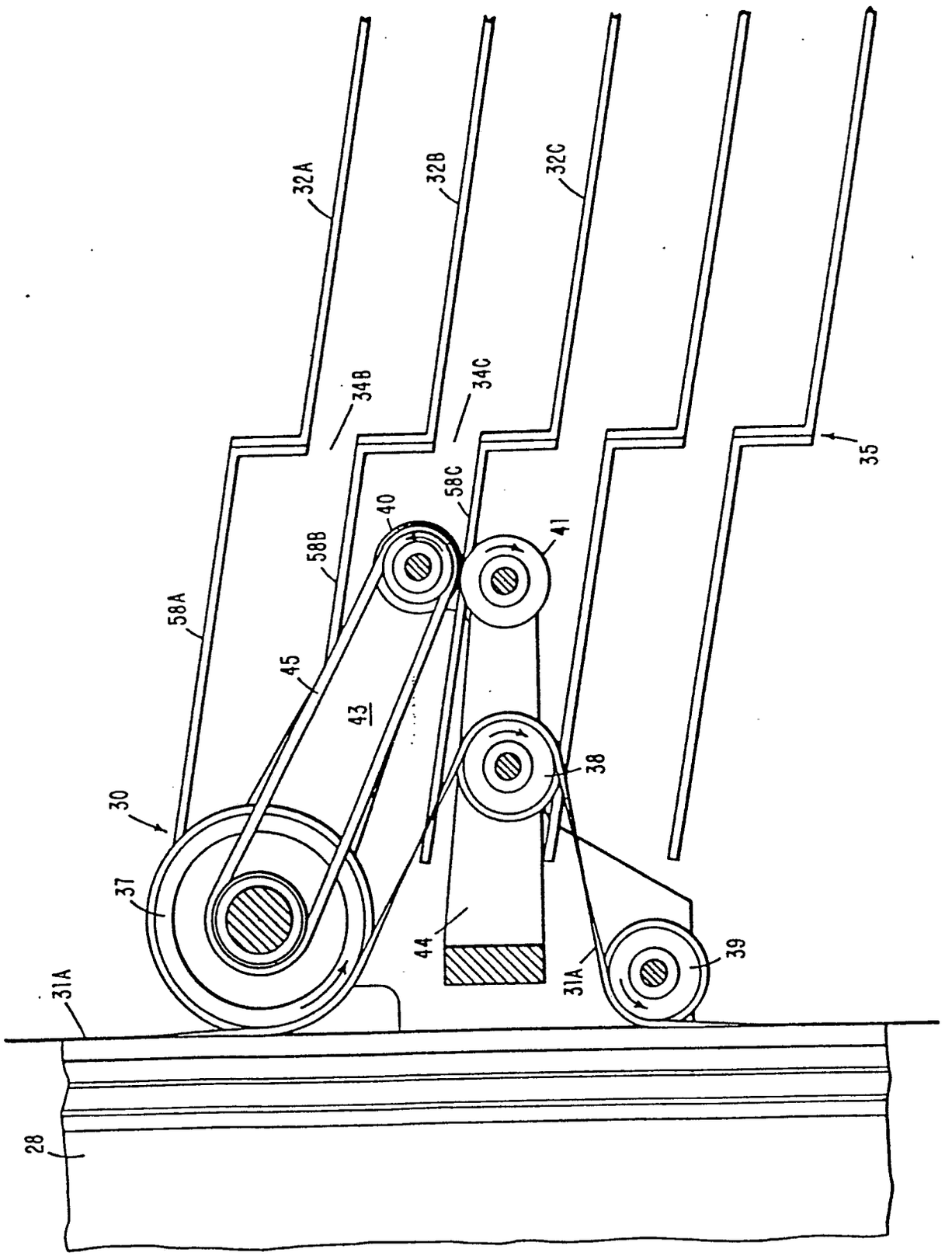
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31A
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FIG. 2

FIG. 3

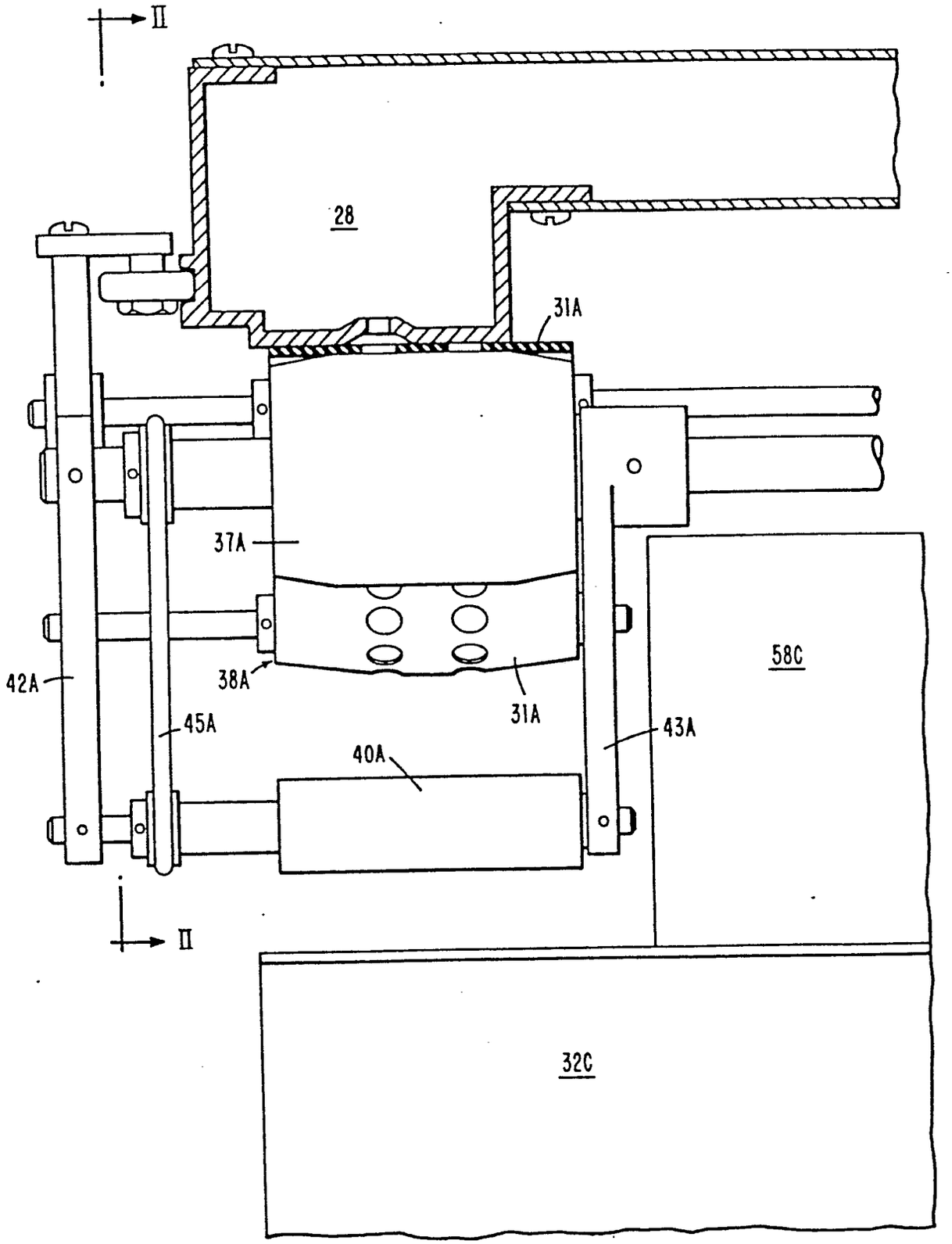

FIG. 4