

[54] **GRIPPER-BAR BUMPER PADS**

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[51] Int. Cl. **G03g 15/04**

[58] Field of Search **271/45, 79, 6, 7, 82, 85,**
271/204; 355/3; 198/133, 180

[56] **References Cited**

UNITED STATES PATENTS

3,199,866	8/1965	Eichorn et al.	271/79
3,578,859	5/1971	Stillings	271/DIG. 2
3,663,014	5/1972	Wasylenko	271/82

Primary Examiner—Evon C. Blunk

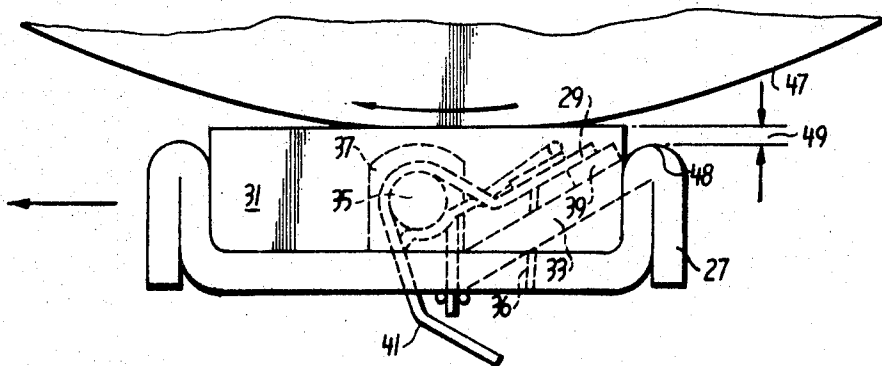
Assistant Examiner—Bruce H. Stoner, Jr.

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[57] **ABSTRACT**

An endless-chain transport system for a photocopy machine is described for gripping copy sheets at a paper-feed station, transporting the copy sheets past a photoconductive drum while holding surfaces of the copy sheets in close proximity to the drum, and transporting the copy sheets to a copy-sheet-delivery station. The transport system comprises gripper bars mounted on transport chains having gripper jaws which are opened and closed by cams to grip and release the copy sheets. Gripper-bar bumper pads are mounted on the gripper bars to hold the gripper bars away from the photoconductive drum.

3 Claims, 4 Drawing Figures



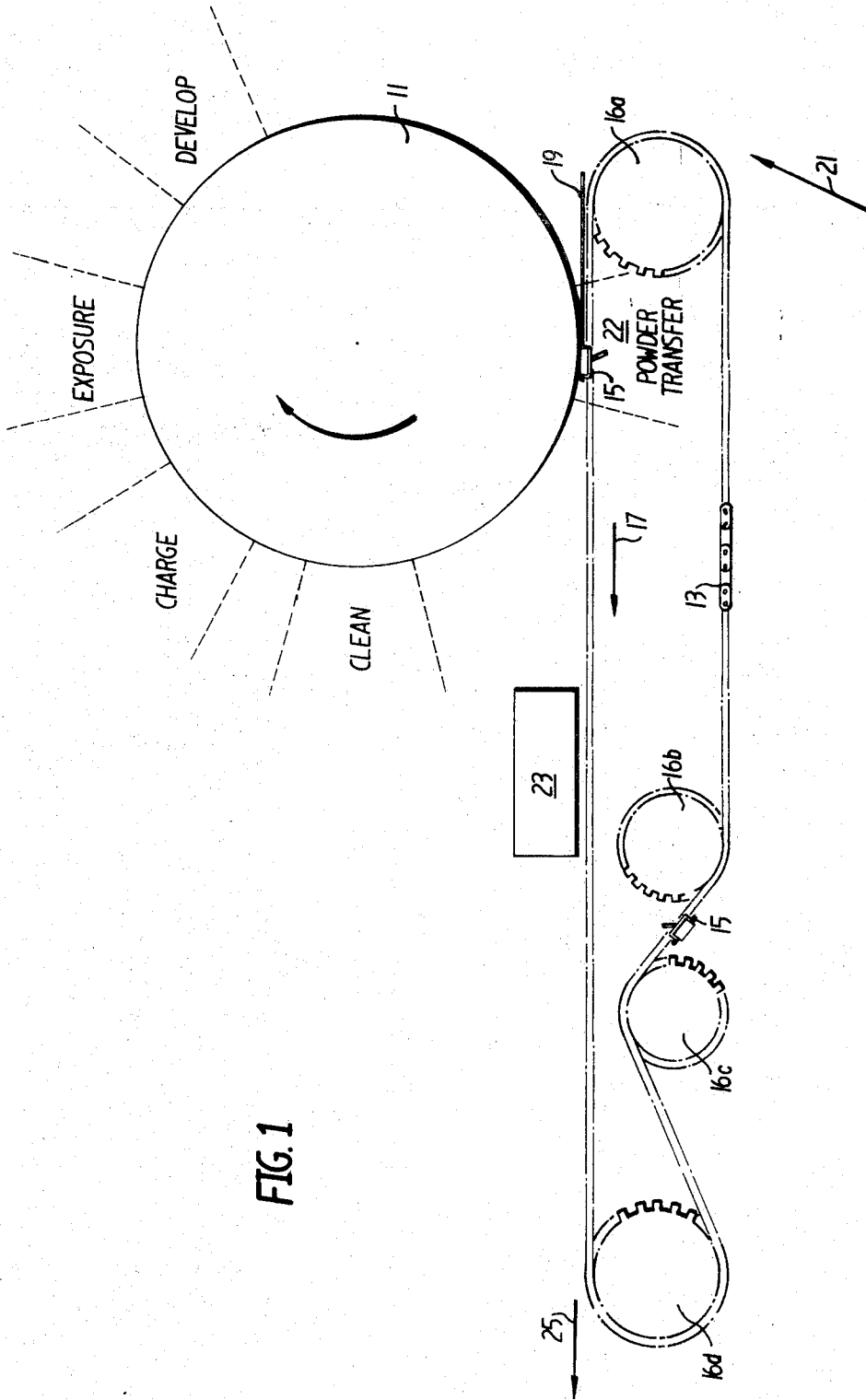
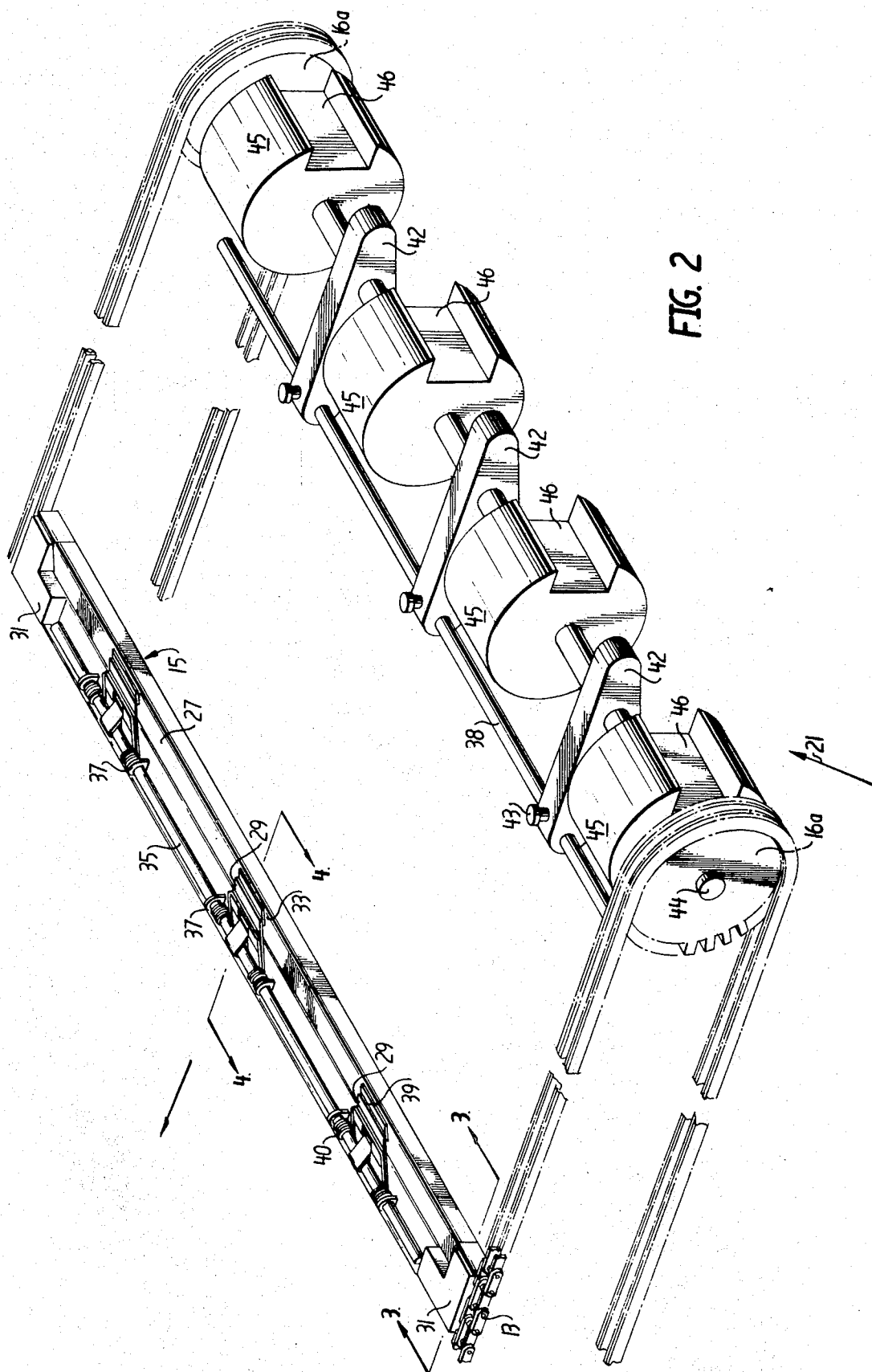


FIG. 1



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SHEET 3 OF 3

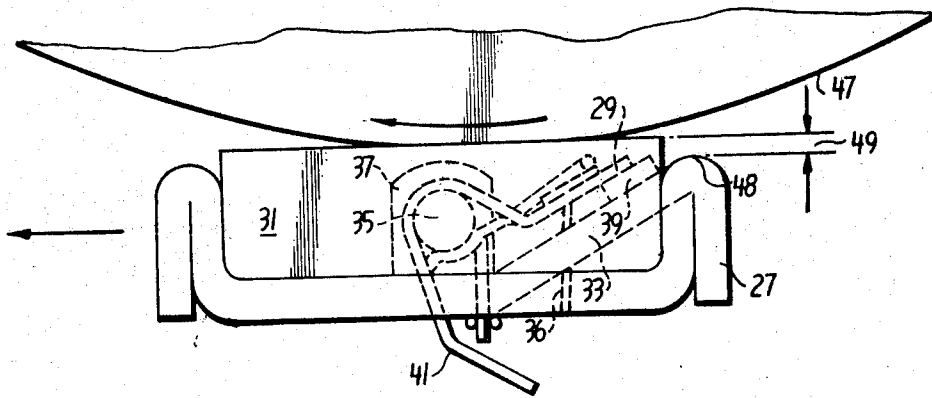


FIG. 3

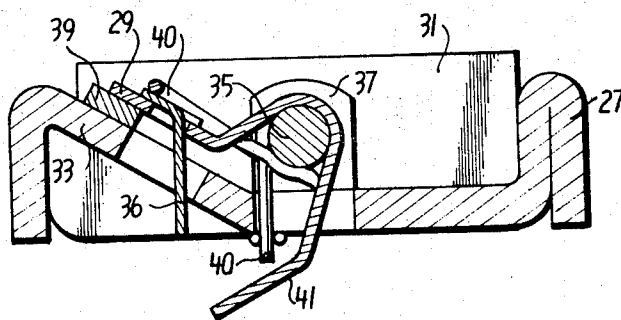


FIG. 4

GRIPPER-BAR BUMPER PADS

BACKGROUND OF THE INVENTION

This invention relates broadly to the art of photocopy machines and more specifically to photocopy machines which employ endless-chain type paper-sheet transport systems to transport copy sheets past processing stations including photoconductive drums.

Examples of such machines are described in U.S. Pat. No. 3,071,370 to Hunt et al.; 3,148,874 to Eichorn; 3,275,318 to Lavander; and 3,628,785 to Lavander.

In this type of photocopy machine the endless-chain transport system has a gripper-bar mechanism mounted thereon to grip copy sheets and transport them through a predetermined path. In this regard, the gripper bar grips copy sheets and pulls them past a photoconductive drum where xerographic powder on the drum is transferred to the copy sheets. The gripper bar should move closely past the drum, but yet not scrape the drum and thereby damage it. At least one prior-art patent solves this problem by positioning a gripper below the pitch line of endless transport chains whereby the gripper bar, as it passes beneath a drum, will not jam against the peripheral surface of the drum (Column 6, lines 1 through 6, Eichorn et al. U.S. Pat. No. 3,199,866). However, in this system, the gripper bar is not positively held away from the drum.

In most prior art photocopy machines of the endless-chain transport type this "scraping" problem is not especially significant because rotational speeds of photoconductive drums are synchronized with movements of transport chains such that the same areas of the photoconductive drums come into contact with the gripper bars on each revolution. Thus, portions of the drum that are used for transferring images are not damaged by such scraping.

However, it has now been suggested to drive drums nonsynchronously with copy sheet transport chains so that the drums can be continuously turning while the transport systems remain stationary in positions from which they can readily feed copy sheets past the drums when activated. Such a system is described in copending U.S. Pat. application Ser. No. 327,405 filed concurrently herewith entitled Xerographic Copier with Asynchronous Copy Feed by Ronald F. Pichierri. When this is done, the "scraping" problem mentioned above is magnified because the gripper bar contacts the drum at various locations.

Thus, it is an object of this invention to provide a gripper bar for a photocopy-machine paper-sheet transport system which can pass closely to a photoconductive drum, but yet not scrape or otherwise damage the drum.

It is a further object of this invention to provide such a gripper bar which is reliable in operation.

SUMMARY OF THE INVENTION

According to the principles of this invention, relatively soft bumper pads are mounted at each end on the top surface of a gripper bar to come in contact with a photoconductive drum at a non-critical outside edge area and thereby hold hard portions of the gripper bar away from the critical center area of the drum. The gripper bar comprises a plurality of jaws which are individually cam actuated.

DETAILED DESCRIPTION OF THE DRAWINGS

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of a preferred embodiment of the invention, as illustrated in the accompanying drawings in which reference characters refer to the same parts throughout the different views. The drawings are not necessarily to scale, emphasis instead being placed upon illustrating the principles of the invention in a clear manner.

FIG. 1 is a simplified side elevation of a photocopy machine which employs gripper bar bumper pads of this invention;

FIG. 2 is an isometric view of a portion of the photocopy machine of FIG. 1 which includes a gripper bar assembly having bumper pads mounted thereon;

FIG. 3 is a sectional view taken on line 3—3 in FIG. 2; and

FIG. 4 is a sectional view taken on line 4—4 in FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIGS. 1 and 2, there is shown the general outline of a photocopy machine comprising basically a photoconductive drum 11 and two parallel paper-sheet transport chains 13.

Gripper-bar assemblies 15 are mounted between the paper-sheet transport chains 13. The transport chains 13 ride on sprockets 16a-d. The gripper bar assemblies 15, as they are transported by the paper-sheet transport chains 13 in the direction indicated by an arrow 17, grip copy sheets 19 at a paper-feed station 21 and transport them past the photoconductive drum 11 at a powder transfer station 22. As is well known in the art, the photoconductive drum 11 has xerographic powder images formed thereon which are transferred to the copy sheet 19 as they move through the powder transfer station and these images are fused onto the copy sheets 19 by a fuser 23. These copies are then delivered to a copy-sheet-delivery station 25 where they are released by the gripper-bar assemblies 15. Various work stations for the photoconductive drum 11 are labeled on FIG. 1; however, the method by which the photoconductive drum 11 transfers images is well known and, therefore, not described herein.

Referring now to FIGS. 2, 3 and 4, each gripper bar assembly 15 mainly comprises a metallic gripper bar frame 27, metallic movable jaws 29 and bumper pads 31. The gripper bar frame 27 is attached to the chains 13 by any suitable fastening means.

A single stationary jaw 33 is formed out of a portion of the gripper-bar frame 27. The movable jaws 29 are rotatably mounted to the gripper-bar frame 27 on a pivot rod 35; and the pivot rod 35 is, in turn, mounted on tabs 37 which are integral with the gripper-bar frame 27.

Stops 36 are welded onto the movable jaws 29 and extend between the movable jaws 29 and the stationary jaw 33 to stop the leading edges of copy sheets which are inserted between these two jaws.

The stationary jaw 33 has gripper pads 39 mounted on the upper surfaces thereof which come in contact with the movable jaws 29, and the movable jaws 29 are respectively biased by springs 40 toward the stationary jaw 33. It can be seen in FIG. 2 that each of the springs

40 is wrapped about the pivot rod 35 on both sides of a movable jaw 29, with a portion thereof extending over the respective movable jaw in mouse trap fashion. Each of the springs 40 is anchored in the gripper-bar frame 27 (FIG. 4) on both sides of a movable jaw.

Integral with the movable jaws 29 are gripper fingers 41 (FIGS. 3 and 4) which strike stationary cams 42 (FIG. 2) as the gripper bar assembly moves past the paper-feed station 21, thereby opening the movable jaws 29. Similar cams are positioned at the copy-sheet-delivery station 25 (FIG. 1), however, they are not shown in the drawings. The lateral positions of the stationary cams 42 can be adjusted by loosening screws 43, sliding the cams laterally, and tightening the screws 43 on a mounting shaft 38. Copy sheets are held by the gripper bar between the gripper pads 39 and the movable jaw 29.

With reference to FIG. 2, sprockets 16a are rigidly mounted on a shaft 44 along with guide members 45 so that the shaft 44, the sprockets 16a and the guide members 45 turn together. The guide members 45 have slots 46 therein in which the gripper-bar assemblies 15 ride as they negotiate a turn defined by the sprockets 16a. It is during this turn that the movable jaws 29 are opened by the cams 42, which strike the gripper fingers 41, and these slots help to stabilize the positions of the gripper-bar assemblies 15 as copy sheets are inserted between the movable jaws 29 and the stationary jaw 33.

The bumper pads 31 are "soft" relative to other portions of the gripper-bar assemblies, such as the metallic gripper-bar frame 27. In the preferred embodiment the bumper pads 31 are made of a plastic such as, for example nylon. Although it is hard relative to some foam or sponge plastics, it is soft relative to most metals and some very hard plastics. It is important that the bumper pads 31 be constructed of a material which is nonabrasive.

Referring now to FIG. 3, the bumper pads 31 are high enough so that they extend beyond the highest point 48 of other portions of the gripper bar assembly and thereby form a protection gap 49 between the highest point 48 and the drum surface 47.

As can be seen in FIG. 2, the bumper pads 31 are located so as to contact the photoconductive-drum surface outside the image area.

In operation, movable jaws 29 of the gripper-bar assemblies 15 are opened and closed by the stationary cams 42, which strike the gripper fingers 41, to grip copy sheets at the paperfeed station 21, transport them through the powder transfer station 22 and deliver them to the copy-sheet delivery station 25.

As the gripper-bar assemblies 15 transport copy sheets past the photoconductive drum 11 at the powder transfer station 22 the bumper pads 31 make contact with the drum surface 47 and thereby prevent harder portions of the gripper-bar assemblies 15 from contacting the drum surface. Further, if the drum surface 47 and the gripper-bar assemblies 15 are moving at different speeds, the bumper pads 31 allow relative sliding between these two members without damaging the drum surface 47.

It should be noted that this system reduces damage

on the drum surface 47 especially in the imaging area thereof.

Perhaps even more importantly, the bumper pads allow a non-synchronous relationship to exist between the photoconductive drum 11 and the paper-sheet transport chains 13 because the bumper pads allow the gripper-bar assemblies to register with the photoconductive drum 11 at a variety of locations about the circumference of the drum while positively preventing damage to the imaging area of the drum.

While the invention has been particularly shown and described with reference to a preferred embodiment, it will be understood by those skilled in the art that various changes in form and detail may be made therein without departing from the spirit and scope of the invention, for example, the gripper-bar assemblies 15 could have various forms so long as they also include bumper pads which extend above "hard" portions of the gripper-bar assemblies. In addition, this system could be used with endless-belt type conveyors other than chain conveyors.

The embodiments of the invention in which an exclusive property or privilege are claimed are defined as follows:

1. In a copying machine of the type comprising a photoconductive drum;

a gripper-bar means for gripping copy sheets and transporting said copy sheets past said photoconductive drum while holding surfaces of said copy sheets in close proximity to said drum; wherein said gripper-bar means includes a bumper pad mounted on a side of said gripper-bar means which passes closest to size drum, said bumper pad being of such a size as to come into contact with said drum as said gripper-bar means passes said drum and to prevent contact between other portions of said gripper bar means and said drum, said bumper pad being of a material which is soft relative to said other portions of said gripper bar and non-abrasive to said photoconductive drum.

2. In a copying machine as claimed in claim 1, an endless-belt transport system on which said gripper-bar means is mounted.

3. In a copying machine as claimed in claim 2 wherein;

said endless-belt transport system comprises two chains between which said gripper-bar means is mounted;

stationary cams; and

said gripper-bar means comprises:

an elongated frame which defines a stationary jaw;

a plurality of movable jaws mounted on said frame, said movable jaws being biased toward said stationary jaw but said movable jaws having cam followers integral therewith which strike said stationary cams as said gripper bar means passes said stationary cams thereby separating said movable jaws from said stationary jaw; and at least two of said bumper pads, with one bumper pad being mounted at each end of said frame.

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