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Bell et al.

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[54] **PAPER FEEDER**

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[52] **U.S. Cl.** **271/52,** 271/59

[51] **Int. Cl.** **B65h 7/10,** B65h 9/16

[58] **Field of Search** 271/52, 59, 49, 55

[56] **References Cited**

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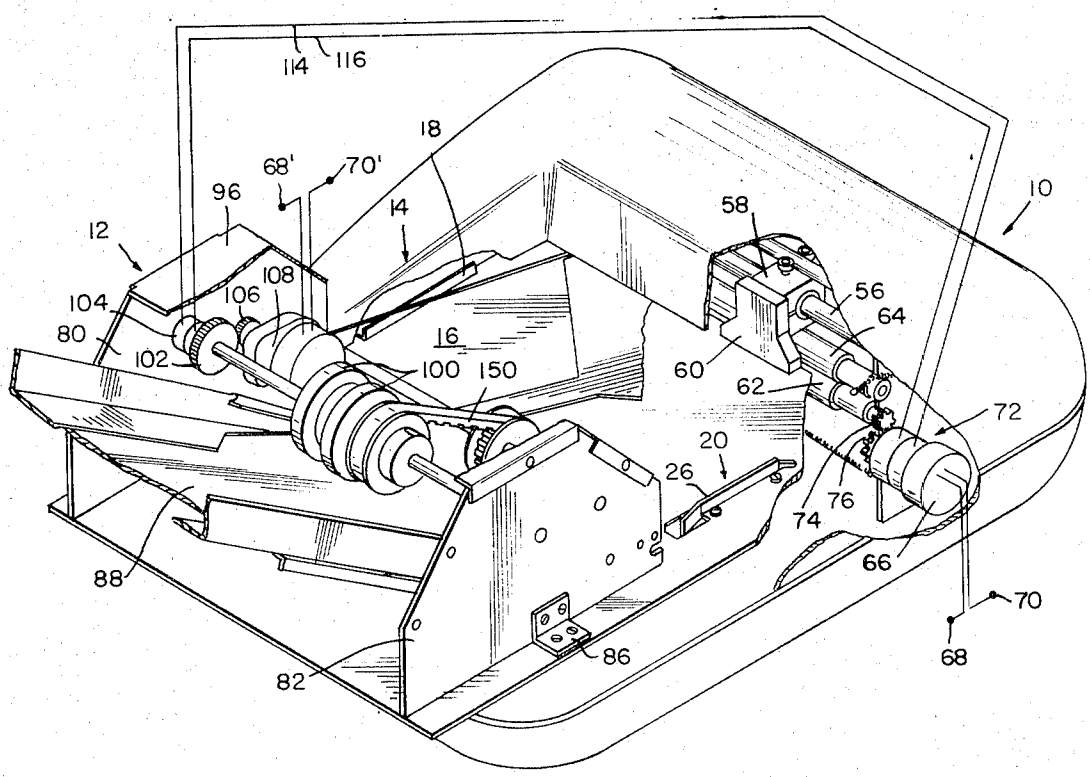
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[57] **ABSTRACT**

A paper feed and alignment mechanism comprising a device for moving sheets of paper longitudinally forwardly and a cooperating guide system, the guide system including a longitudinally extending alignment reference for engaging one side edge portion of such sheets and a device for urging such sheets against the reference. The moving device includes wheels which are proportioned and designed intermittently to engage such sheets and urge them forwardly as the wheels rotate. The alignment mechanism acts on the sheets to align them with the reference during the periods of disengagement by the wheels.

30 Claims, 5 Drawing Figures



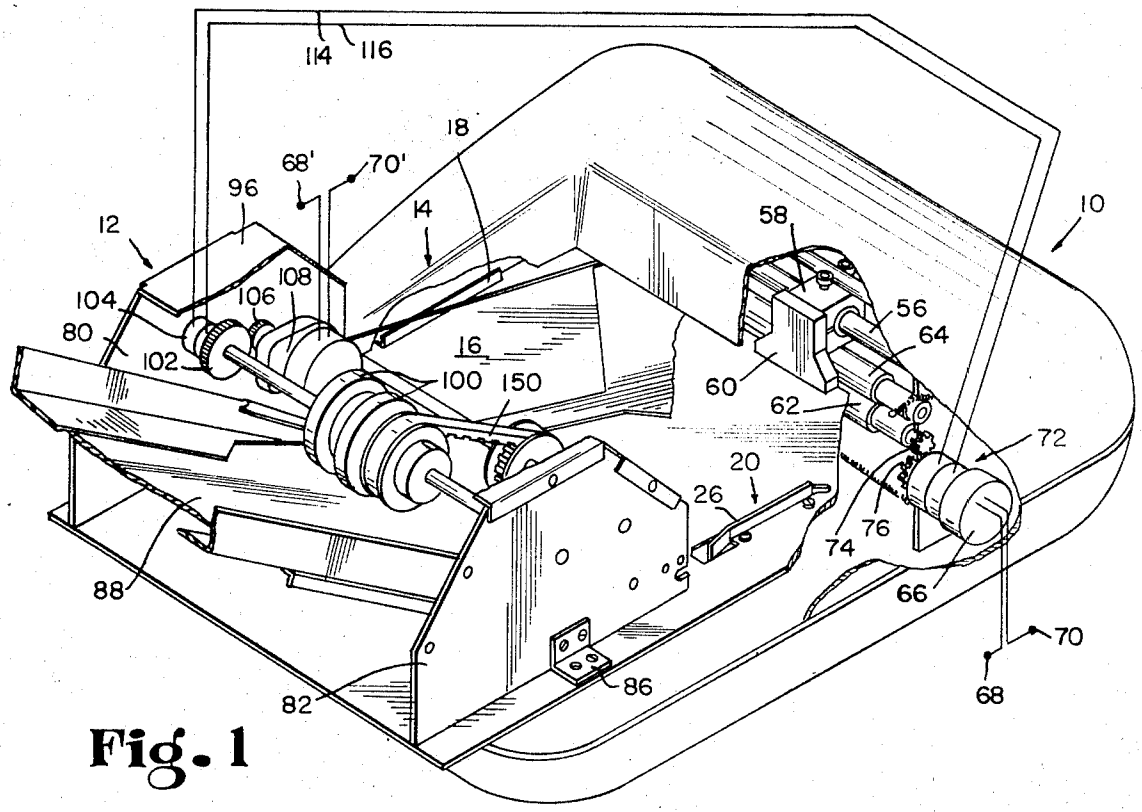


Fig. 1

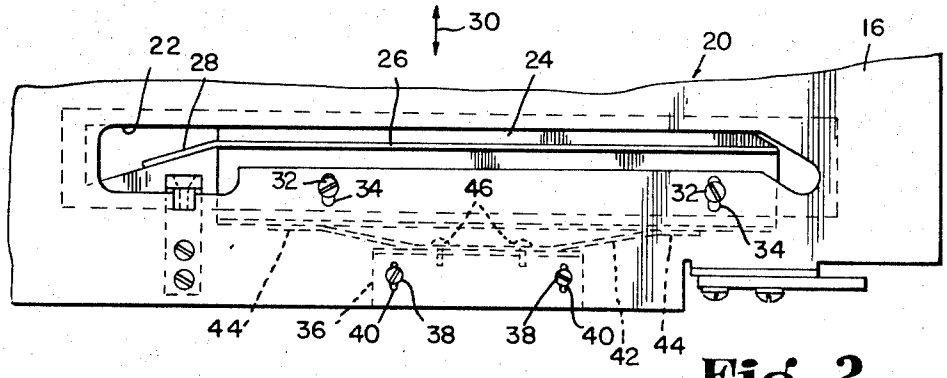


Fig. 2

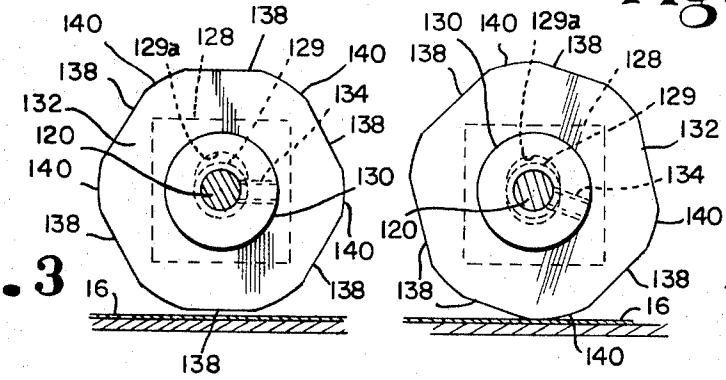


Fig. 3

Fig. 4

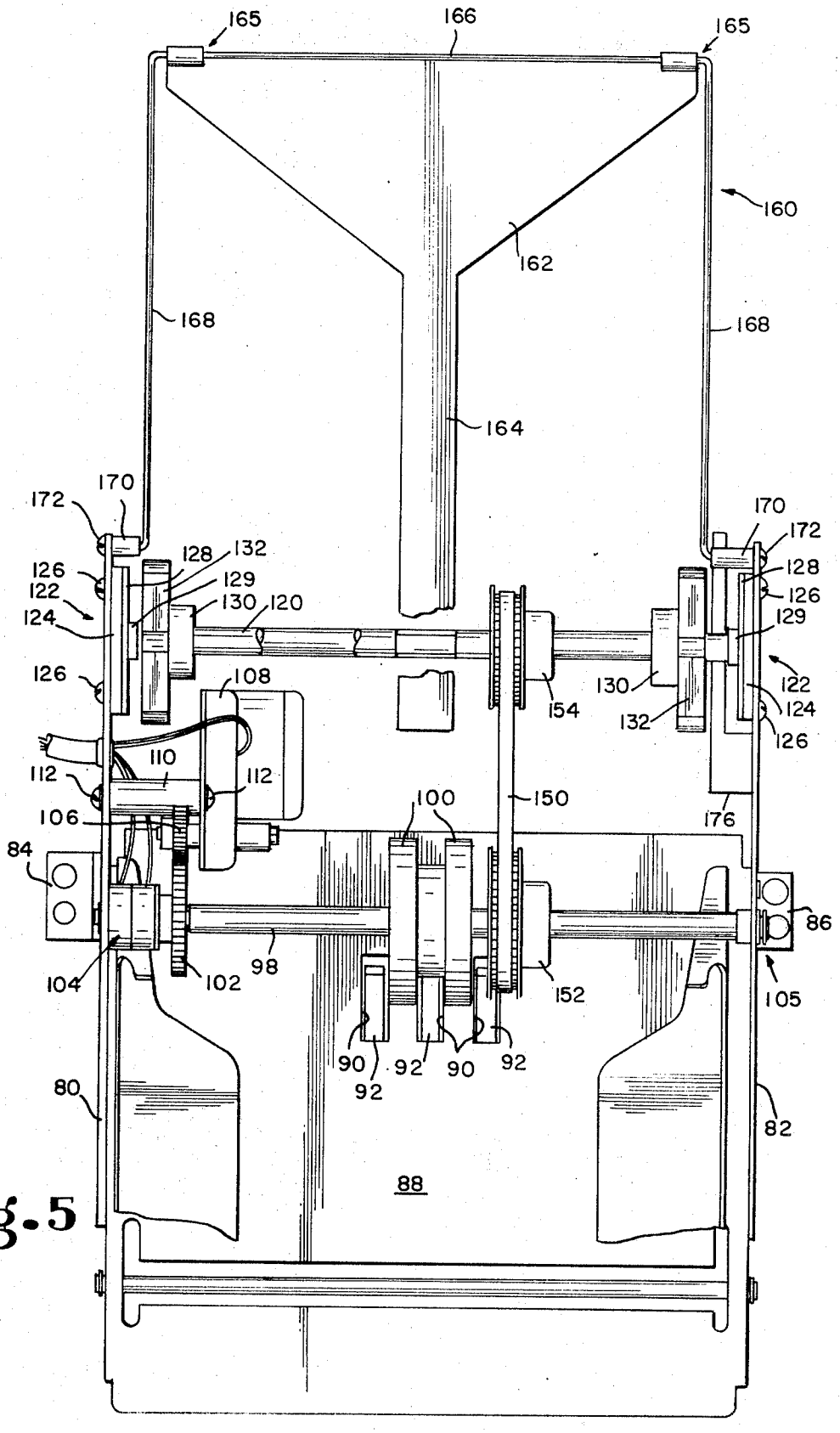

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Fig. 5

PAPER FEEDER

It is an object of our invention to provide a paper feed and alignment mechanism which will very efficiently feed sheets of paper and also very accurately align the sheets of paper such that transversely extending lines of data printed thereon can be scanned.

There are many machines of various types which feed sheets of paper into processing units, such as copying machines. Generally, a stack of sheets of paper is placed in a chute and then the sheets are fed serially through the processing unit. Generally, since the sheets of paper are merely copied by photographic or other such processes, there is no real requirement for accurate alignment of the paper.

Now, with the advent of optical reading equipment, and particularly the type of equipment which includes a transversely movable scanning head arranged optically to read or scan transversely extending lines of data typed or printed on sheets of paper, the existing problem is to feed the paper and align it such that the longitudinally spaced apart lines of data thereon will be exactly parallel to the path of the scanning head.

One advantage of optical reading systems is that the data to be read can be typed or printed on rather inexpensive thin sheets of ordinary typing paper. Such sheets of paper are in contrast to relatively expensive and stiff and easy to handle computer cards and other such stiff documents. A card or stiff document can be relatively easily dropped into an alignment fixture for reading purposes. Sheets of paper are relatively difficult to feed and align because they are so flexible and will readily buckle and twist.

We refer to the U.S. Pat. No. 3,600,557 to Joseph M. Zappia granted Aug. 17, 1971, as well as to a prior copending application Ser. No. 71,505 filed Sept. 11, 1970 by Higginbotham, et al., both of which disclose the type of optical reading device for which our paper feed and alignment mechanism is ideally suited. As will be more fully discussed hereinafter, our feed and alignment mechanism is preferably slaved to the reader such that it feeds sheets of paper forwardly in a step-by-step manner because that is the way in which the sheets of paper are advanced through the reader. Particularly, such a reader includes a longitudinal feed system which advances the sheets forwardly in a step-by-step manner to place each line of data to be read under the transversely movable scanning head. The manner in which the scanning head moves above a line of data and is then returned to its initial starting position is clearly described in both the said Zappia patent and the said Higginbotham et al application.

Our concept of a feed and alignment mechanism involves intermittently engaging each sheet of paper and, during the engagement, moving the paper longitudinally forwardly. Then, during each period of disengagement, our alignment device is effective to straighten or align the piece of paper. We accomplish this intermittent engagement and movement of the paper by providing wheel means and means for driving the wheel means, the wheel means being provided with peripherally spaced apart radially outwardly disposed protrusions which momentarily engage such sheets as the wheel means rotates and surfaces between adjacent protrusions disposed at a radius such that such sheets are not engaged thereby.

Other objects and features of our present invention will become apparent as this description progresses.

To the accomplishment of the above and related objects, our invention may be embodied in the form illustrated in the accompanying drawings, attention being called to the fact, however, that the drawings are illustrative only and that change may be made in the specific construction illustrated and described, so long as the scope of the appended claims is not violated.

In the drawings:

FIG. **1** is a fragmentary perspective view, partially sectioned and cut away, showing an optical reader system with our feeder and alignment mechanism in combination therewith and slaved thereto;

FIG. **2** shows a fragmentary enlarged view of a portion of the aligned mechanism of our invention;

FIG. **3** is an enlarged fragmentary sectional view showing a feeder wheel disengaged from a sheet of paper;

FIG. **4** is a fragmentary sectional view showing the feeder wheel engaged with the sheet of paper; and

FIG. **5** is an enlarged fragmentary elevational view of our feeder mechanism.

Referring particularly to the drawings, which are not necessarily drawn to any scale, it will be seen that we have shown a reader, indicated generally at **10**, a paper feeder indicated generally at **12**, and an alignment mechanism indicated generally at **14**. The reader **10** is provided with an upwardly facing, generally horizontally extending support surface **16** upon which sheets of paper are placed and fed toward the optical reading system of the reader. As discussed in the aforesaid Higginbotham et al application, sheets of paper upon which transversely extending lines of data have been typed or printed may be manually placed upon the surface **16** and moved toward the scanning head of the optical reader.

The alignment mechanism **14** includes, at the left-hand side of the support surface **16**, a longitudinally extending reference guide **18** which engages the left-hand side edges of the sheets of paper being fed and aligned. This reference guide **18** may be a member rigidly attached to the support surface **16** or, preferably, to some other part of the frame of the reader **10** so that it is directly adjacent to the left-hand side of the support surface. In some cases, it is necessary to remove the plate providing the support surface **16** to gain access to the internal workings of the reader **10**. For this reason, it is better to have the member providing the reference **18** rigidly attached to another portion of the reader **10** so that it will always maintain its factory established alignment.

At the right-hand side of the support surface **16** is an urging means indicated generally by the reference numeral **20**. This urging means **20** is proportioned and designed to engage the right-hand side edges of sheets of paper to urge the sheets to the left toward the reference guide **18**. The details of the illustrative urging means **20** are shown in FIG. **2**. Referring to FIG. **2**, it will be seen that the support surface **16** is provided with a longitudinally extending opening **22** below which a longitudinally extending member **24** is disposed. This member **24** carries a vertically upwardly and longitudinally extending flange **26**, the entry end portion **28** of which is turned outwardly to facilitate the entry of sheets of paper between the guide **18** and the urging means **20**. This flange **26** may or may not be an integral portion of the member **24**.

The member 24 and the flange 26 are supported for generally horizontal movement toward and away from the guide 18 as indicated by the arrow 30. For instance, the member 24 may be supported for such movements by means of the illustrated screws 32 extending downwardly through elongated slots 34 threadedly to engage the member 24 with the heads of the screws spanning the slots.

There is a bracket 36 to the right of the member 24 and adjustably secured to the surface 16 by means of screws 38 which extend through elongated slots 40 threadedly to engage the bracket 36 with the heads of the screws spanning the slots. A strip metal spring 42 is secured at its ends to the member 24 as indicated at 44 and in its central region to the bracket 36 as indicated at 46. This spring 42 serves yieldably to urge the member 24 and the flange 26 toward the reference guide 18. The urging movement of the flange 26, i.e., the tension of the spring 42, may be adjusted by loosening the screws 38 and adjusting the position of the bracket 36.

The purpose of the urging means 20, therefore, is to provide a biasing means or means for urging sheets of paper toward the accurately aligned rigid reference guide 18. This action will be more fully discussed hereinafter. The reference guide 18 is perpendicular to a transversely extending guide rod 56 upon which a carriage 58 is mounted for transverse reciprocation. An optical scanning head 60 is mounted on this carriage 58 for transverse movement as clearly discussed in the aforesaid Higginbotham et al. application.

Below the guide rod 56 are transversely extending feed roller means including a lower roller 62 and an upper roller 64 which are driven by a motor 66, the electrical terminals for which are indicated at 68, 70. As clearly described in the said Higginbotham et al application, electrically operated clutch and brake means 72 and gears 74, 76 drivingly connect the motor 66 to the feed rollers 62, 64. The motor 66 is continuously running and the clutch means is actuated to start rotation of the feed rollers 62, 64 and then the brake means is actuated by a control system instantly to stop the feed rollers at the proper time. The proper time is when the scanning head 60 is disposed directly above a line of data to be scanned.

It will be seen that the feeder 12 comprises a frame including side walls 80, 82, each of which is held to the platform 16 by means of a hold down bracket 84, 86. Between the side walls 80, 82 is a forwardly and downwardly sloping chute 88 of the type included in conventional paper feeding devices. For instance, the chute 88 has three elongated, centrally located apertures 90, up through each of which extends a conventional paper engaging stone. Adjustable stone covers 92 are conventionally provided. A cover 96 is mounted on the side walls 80, 82, only fragments of the cover being illustrated.

A shaft 98 extends transversely across the chute 88 to carry rubber drive roller means which, in the illustrative embodiment, includes a pair of drive rollers 100. A gear 102 is journalled for rotation on the shaft 98 and an electrically operated clutch means 104 is provided for drivingly connecting the gear 102 to the shaft 98. The clutch means 104 is mounted on the wall 80 and serves to support the left-hand end of the shaft 98. The right-hand end of shaft 98 is journal mounted by the wall 82 as indicated at 105. The gear 102 is meshed with the gear 106 on the output shaft of a continuously-running electric motor 108, the power terminals for which are indicated at 68', 70'. The motor 108 may be rigidly secured to the side wall 80 by means such as the illustrated standoffs 110 and screws 112. Somewhat diagrammatically, with wires 114, 116, we have shown the clutch means 104 electrically connected to and dominated by the clutch and brake means 72. It will be appreciated, however, that the clutch means 104 may be dominated by the same control means which dominates the clutch and brake means 72 to accomplish our objectives. Particularly, our system is such that, when the feed rollers 62, 64 are being driven, the clutch means 104 is operated drivingly to connect the gear 102 to the shaft 98 to rotate the drive rollers 100. The clutch means 104 is effective to cause rotation of the drive rollers 100 when the feed rollers 62, 64 are driven through the clutch and brake means 72. The feed rollers 62, 64 advance a sheet through the reader 10 in a step-by-step manner so that the scanning head 60 can scan each line of data on the sheet while the drive rollers 100 advance the paper in a step-by-step manner to keep a sheet of paper moving toward the feed rollers at the proper interval. The feeder 12 is, therefore, slaved to the reader 10.

While the drive rollers 100 move a sheet of paper from the top of the stack toward the scanning head 60, we provide means for moving the sheets of paper through the alignment mechanism 14, this last said means comprising a shaft 120 which extends between the walls 80, 82 to be parallel to the support surface 16 and perpendicular to the direction in which the sheets of paper are moved to the feed rollers 62, 64. Journal means 122 are provided for each end of the shaft 120, each illustrative journal means including a spacer 124 attached to the wall 80, 82 by means such as the illustrated screws 126 and a support block 128 attached to the spacer. Each end of the shaft 120 is supported in a bearing 129 which is received in a vertically elongated slot 129a in the adjacent block 128. The bearings 129 will move in the vertically elongated slots 129*a* so that the shaft 120 can move vertically. Particularly, each bearing 129 can move between a lower position and a higher position, each bearing 129 constituting a vertically movable journal bearing.

A pair of laterally spaced apart hubs 130 are mounted on the shaft 120 for rotation therewith, each hub carrying a rubber or rubber-like advance wheel 132. As shown in FIGS. 3 and 4, set screws 134 are provided for adjustably positioning the hubs 130 on the shaft 120.

Each wheel 132 is formed to provide six equally peripherally spaced flat surfaces or flats 138 on its outer periphery with six equally peripherally spaced cylindrical portions 140 disposed respectively between the flats 138. We have successfully made and used wheels 132 from 50 durometer natural rubber bonded to aluminum hubs 130 with cylindrical portions defining a radius of 1⅛ inches and the distance between each flat and the axis of the shaft 120 being 1 1/16 inches. Each flat 138 is parallel to the axis of the shaft 120 and perpendicular to a radially extending plane which includes the axis.

Each cylindrical portion 140, therefore, constitutes a radially outwardly disposed protrusion while each flat 138 constitutes a radially inwardly disposed surface. The slots 129*a* are located relative to the support surface 16 such that, as the shaft 120 rotates, the cylindri-

cal portions 140 will engage the surface to move the shaft upwardly from its lower portion. Referring to FIGS. 3 and 4, it will be seen that the flats 138 are at a radius such that they will not contact the support surface 16 or the sheet of paper supported thereon even when the shaft 120 is in its lowermost position but that, as the wheel rotates, the cylindrical portions 140 will contact the sheet of paper on the support surface. For instance, if the wheel 132 rotates clockwise, the portion 140 will move the sheet to the left as viewed in FIGS. 3 and 4.

Thus, as each wheel 132 rotates, it intermittently engages and disengages the sheet of paper disposed therebelow on the support surface 16. During the period of engagement, the wheel 132 moves the sheet of paper to the left as the wheel rotates clockwise (FIGS. 3 and 4). Each sheet of paper, therefore, is moved in a step-by-step manner toward the feed rollers 62, 64 by the wheels 132. When the wheels 132 are not engaging the sheet of paper, the sheet is free to move laterally on the support surface 16. Since the wheels 132 are disposed between the chute 88 and the feed rollers 62, 64, and since the alignment mechanism 14 is disposed between the wheels 132 and the feed rollers, the wheels 132 move each sheet through the alignment mechanism. Since each sheet is free to move laterally when it is disengaged by the wheels 132, the urging means 20 of the alignment mechanism is effective during the periods of disengagement to move the sheet toward and against the reference guide 18.

Our feeding and aligning system, therefore, involves intermittently engaging and disengaging each sheet of paper a plurality of times with the alignment function being accomplished during the periods of disengagement. The wheels 132 will push each sheet forwardly during each period of engagement.

In the illustrative embodiment, a cog belt 150 is trained about a cog wheel 152 mounted on the shaft 98 for rotation therewith and another cog wheel 154 mounted on the shaft 120 for rotation therewith, the flexibility of the cog belt 150 accommodating the vertical movement of the shaft 120. The shaft 120, therefore, rotates when the shaft 98 rotates which, in turn, rotates when the feed rollers 62, 64 rotate.

Between the wheels 132, and the feed rollers 62, 64, we use a buckle deflector 162 to prevent the sheets of paper from buckling under the urging of the means 20 and the wheels 132. The buckle deflector 160 comprises a sheet metal deflector having a flat, triangularly shaped major body portion 162 and a rearwardly and upwardly extending strip portion 164. The portion 162 is connected as indicated at 165 to the base 166 of an inverted U-shaped wire frame, the legs 168 of which are connected to the walls 80, 82 as indicated at 170 for pivotal movement about a horizontal axis. Particularly, the proximal end of each leg 168 is bent to extend outwardly and to be received in a bearing fastened to the adjacent wall 80, 82 by means of a screw 172.

We use a small sheet metal paper deflector 176 to the right of the right-hand wheel 132 which serves to guide the sheets longitudinally forwardly to engage the means 20.

In using our system, a stack of sheets of paper may be fanned with the upper sheet forwardly and then placed in the chute 88 to be fed one at a time to the reader 10. The top sheets are sequentially engaged by the drive rollers 100 and moved forwardly. The wheels 132 then take over and start movement of each sheet forwardly into engagement with the alignment mechanism 14. By the time each sheet reaches the feed rollers 62, 64, it is aligned such that its left-hand edge is perpendicular to the axes of the feed rollers and the axis of the guide rod 56 on which the scanning head 60 reciprocates. Any tendency of the rollers 132 to move the sheets laterally will be corrected by the alignment mechanism 14. Since the wheels 132 are preferably identical, they can be adjustably positioned on the shaft 120 so that they will evenly engage and move the sheets straight forwardly.

What is claimed is:

1. A paper feed and alignment apparatus comprising a chute for holding paper, means for moving sheets of such paper longitudinally forwardly, and guide means for such sheets paced forwardly of said moving means and cooperating therewith to align such sheets, said moving means being spaced forwardly of said chute, said moving means being proportioned and designed intermittently to engage such sheets to urge them forwardly into engagement with said guide means, and said guide means being effective to align such sheets during the periods of disengagement by said moving means.

2. The apparatus of claim 1 in which said moving means includes wheel means and means for driving said wheel means, said wheel means being provided with peripherally spaced apart radially outwardly disposed protrusions which momentarily engage such sheets as said wheel means rotates and surfaces between adjacent protrusions disposed at a radius such that such sheets are not engaged thereby.

3. The apparatus of claim 1 in which said moving means includes wheel means and means for driving said wheel means, said wheel means including a pair of laterally spaced apart rubber-like wheels journalled for rotation about an axis generally perpendicular to the direction such sheets are fed, each said wheel being provided with a plurality of peripherally spaced apart radially outwardly extending portions for momentarily engaging such sheets as said wheel rotates.

4. The apparatus of claim 1 in which said moving means includes wheel means and means for driving said wheel means, said wheel means including a pair of laterally spaced apart rubber-like wheels journalled for rotation about an axis generally perpendicular to the direction such sheets are fed, each said wheel being provided with a plurality of peripherally spaced apart flat portions on its outer periphery and cylindrical portions between adjacent flat portions, each said flat portion being parallel to the axis of said wheel and perpendicular to a radial plane including said axis, each said wheel being disposed such that its cylindrical portions momentarily engage such sheets as said wheel rotates while its flat portions are out of contact with such sheets.

5. The apparatus of claim 1 including a support surface on which such sheets are longitudinally forwardly moved by said moving means, and in which said moving means includes a pair of rubber-like wheels laterally spaced apart and disposed above said support surface for rotation about an axis parallel to said surface and perpendicular to the direction in which such sheets are moved thereon, and means for driving said wheels about said axis, each said wheel being provided with peripherally spaced apart radially outwardly disposed

protrusions which momentarily engage such sheets as said wheel rotates and surfaces between adjacent protrusions disposed at a radius such that such sheets are not engaged thereby.

6. The apparatus of claim **5** in which each said wheel is formed such that said surfaces are flat surfaces parallel to said axis and perpendicular to a radial plane including said axis and said protrusions are cylindrically formed about said axis.

7. The apparatus of claim **6** in which each said wheel is formed to have six equally peripherally spaced flat surfaces.

8. The apparatus of claim **5** including a shaft upon which said wheels are mounted, means for journal mounting the ends of said shaft, said journal mounting means being supported for movement between a lower position and a higher position, said journal mounting means and said wheels being proportioned and designed such that, when said journal mounting means is in its said lower position, said surfaces between said protrusions will not contact said support surface.

9. The apparatus of claim **8** in which said journal mounting means is driven upwardly by each protrusion as it engages said support surface.

10. The apparatus of claim **8** including a second shaft journal mounted above said chute, drive roller means mounted on said second shaft and arranged to engage such sheets and feed them to said wheels, and a motor for driving said second shaft.

11. The apparatus of claim **10** in which said means for driving said wheels includes means for drivingly connecting said first mentioned shaft to said second shaft.

12. The apparatus of claim **11** including electrically-operated clutch means for drivingly connecting said second shaft to said motor, feed roller means for receiving such sheets from said wheels and moving them longitudinally forwardly in a step-by-step manner, a second motor, second electrically-operated clutch means for drivingly connecting said feed roller means to said second motor, and control means for operating said first mentioned and second clutch means to drive said wheels each time said feed roller means is advanced.

13. The apparatus of claim **5** including a second shaft journal mounted above said chute, drive roller means mounted on said second shaft and arranged to engage such sheets and feed them to said wheels, and a motor for driving said second shaft.

14. The apparatus of claim **13** in which said means for driving said wheels includes means for drivingly connecting said first mentioned shaft to said second shaft.

15. The apparatus of claim **14** including electrically-operated clutch means for drivingly connecting said second shaft to said motor, feed roller means for receiving such sheets from said wheels and moving them longitudinally forwardly in a step-by-step manner, a second motor, second electrically-operated clutch means for drivingly connecting said feed roller means to said second motor, and control means for operating said first mentioned and second clutch means to drive said wheels each time said feed roller means is advanced.

16. The apparatus of claim **1** in which said guide means includes a longitudinally extending reference guide for engaging one side edge of such sheets and means for engaging the other side edge of such sheets and urging them toward said reference guide.

17. The apparatus of claim **1** in which said guide means includes a longitudinally extending reference guide for engaging one side edge of such sheets and means for urging such sheets into engagement with said guide.

18. The apparatus of claim **17** including means for engaging the top surface of such sheets to prevent them from being buckled by said urging means.

19. The apparatus of claim **17** in which said urging means includes a longitudinally extending, laterally movable guide for engaging the opposite side edge of such sheets and spring means for urging said movable guide toward said reference guide.

20. The apparatus of claim **2** in which said guide means includes a longitudinally extending rigid reference guide for engaging one side edge of such sheets, a longitudinally extending, laterally movable guide for engaging the opposite side edge of such sheets, and spring means for yieldably urging said movable guide toward said rigid guide.

21. The apparatus of claim **3** in which said guide means includes a longitudinally extending rigid reference guide for engaging one side edge of such sheets, a longitudinally extending, laterally movable guide for engaging the opposite side edge of such sheets, and spring means for yieldably urging said movable guide toward said rigid guide.

22. The apparatus of claim **5** in which said guide means includes a longitudinally extending rigid reference guide for engaging one side edge of such sheets, a longitudinally extending, laterally movable guide for engaging the opposite side edge of such sheets, and spring means for yieldably urging said movable guide toward said rigid guide.

23. The apparatus of claim **12** in which said guide means includes a longitudinally extending rigid reference guide for engaging one side edge of such sheets, a longitudinally extending, laterally movable guide for engaging the opposite side edge of such sheets, and spring means for yieldably urging said movable guide toward said rigid guide.

24. A paper feed and alignment mechanism comprising means for moving sheets of paper longitudinally forwardly and guide means spaced forwardly of said moving means, said guide means including longitudinally extending alignment reference means and means for urging such sheets against said reference means, said moving means including means for intermittently engaging such sheets and urging them forwardly, and said urging means being effective to move such sheets toward said reference means during the periods of disengagement by said moving means.

25. The mechanism of claim **24** including feed roller means for receiving such sheets from said moving means and moving them longitudinally forwardly, a motor, electrically-operated clutch means for drivingly connecting said roller means to said motor, means for scanning longitudinally spaced apart and transversely extending lines of data on such sheets, control means for operating said clutch means to drive said feed roller means in a step-by-step manner to place each such line of data in a position to be scanned by said scanning means, said moving means including wheel means providing peripherally spaced apart radially outwardly disposed protrusions which momentarily engage such

sheets as said wheel means rotates and surfaces between adjacent protrusions disposed at a radius such that such sheets are not engaged thereby, and means for rotating said wheel means.

26. The mechanism of claim **25** including a chute for holding a stack of such sheets, friction roller means journalled above said chute and arranged to feed such sheets to said wheel means, and a drive motor for said friction roller means.

27. The mechanism of claim **26** including another electrically-operated clutch means for drivingly connecting said friction roller means to its said drive motor, said second mentioned clutch means being operated by said control means to advance said friction roller means each time said feed roller means is advanced.

28. The mechanism of claim **27** in which said means for rotating said wheel means includes means for drivingly connecting said wheel means to said friction roller means.

29. The mechanism of claim **24** including a horizontally extending, upwardly facing support surface on which such sheets are longitudinally forwardly moved by said moving means and in which said moving means includes a shaft extending perpendicularly to the direction in which such sheets are fed, a journal block for each end of said shaft, means for supporting each journal block for movement between a lower position and an upper position, a pair of wheels mounted on said shaft and axially separated to engage opposite lateral side edge portions of such sheets, and means for driving said shaft, each of said wheels providing peripherally spaced apart radially outwardly disposed protrusions for momentarily engaging such sheets and moving them forwardly on said support surface and radially inwardly disposed surfaces between adjacent protrusions, said protrusions being effective to lift said journal blocks from their lower position when they engage said support surface.

30. The mechanism of claim **29** in which said means for urging such sheets against said reference means includes a longitudinally extending movable member for engaging such sheets and spring means for urging said member toward said reference means.

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