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Jamieson et al.

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[54] **VARIABLE DISPLACEMENT APPARATUS FOR PLATEN AND TRACTOR FEED**

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[52] **U.S. Cl.** **74/405**

[51] **Int. Cl.** **F16h 57/00**

[58] **Field of Search** ..... 74/421 A, 405

[56] **References Cited**

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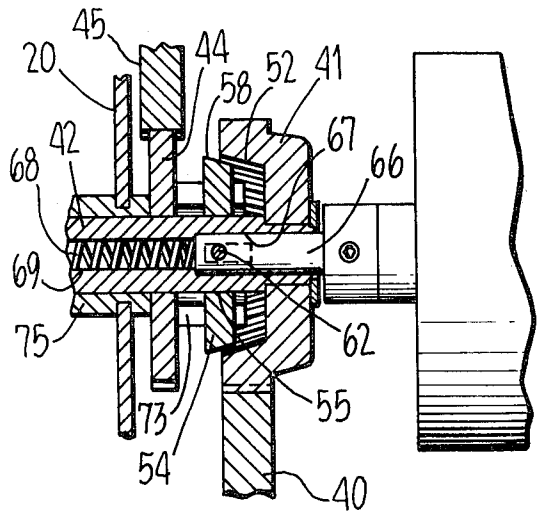
[57] **ABSTRACT**

An apparatus for enabling manual alignment of a flexible sheet in a sheet transport device having automatic detent. An incremental stepping motor providing document detent drives a platen and a tractor feed apparatus via a unique drive train. The drive train includes a first gear rotatably mounted on the platen shaft, a second gear secured to the platen shaft inboard of the first gear and a motion transfer plate slideably and rotatably received on the platen shaft. The motion transfer plate has a pair of arcuately shaped beveled gear surfaces normally engaged with a beveled inner gear surface of the first gear when the transfer plate is in a first position on the platen shaft. The beveled gear surfaces are joined by a pair of wall surfaces which are embraced by a pair of arms integral with the second gear. The motion transfer plate is secured to a control shaft having an adjustment knob, the control shaft being slideably received in a bore in the platen shaft and normally biased by a spring to the first position. The sheet is aligned relative to the detent position by displacing the control shaft inwardly until the motion transfer plate is disengaged from the first gear and by rotating the transfer plate by means of the knob and control shaft to adjust the angular position of the platen, the second gear and the tractor feed apparatus relative to the stepping motor detent position. Upon release, the control shaft and motion transfer plate return under the action of the spring to the first position.

A pair of alignment devices are used in conjunction with two independently rotatable platen halves and independently operable drive trains and stepping motors to provide independent alignment of a pair of flexible sheets associated thereto.

15 Claims, 5 Drawing Figures



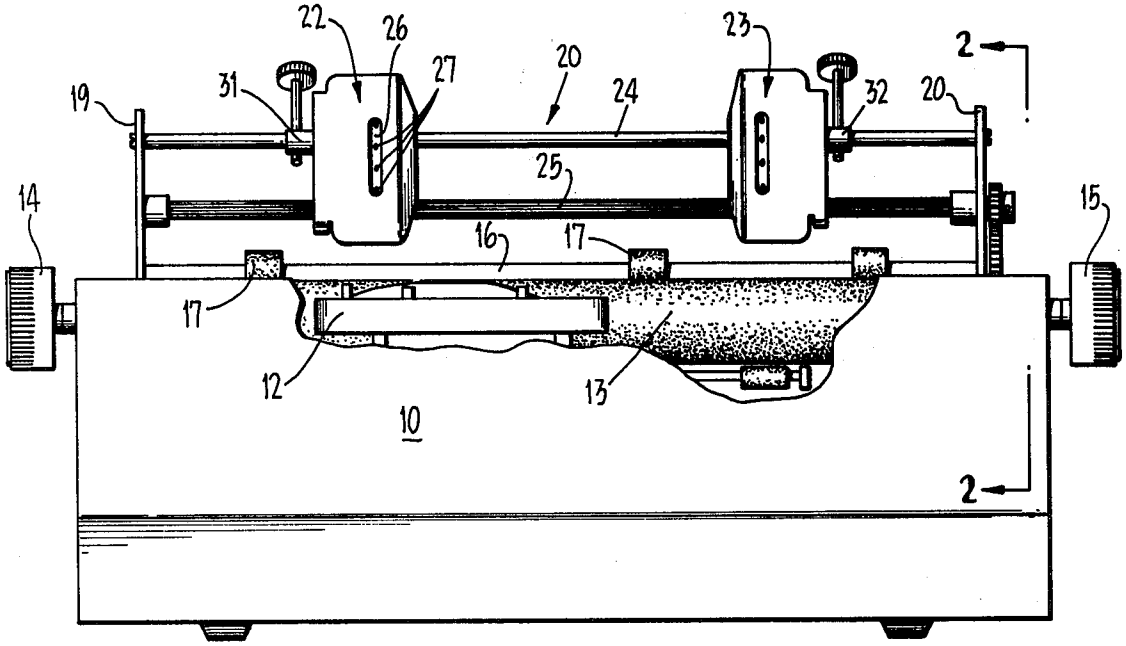

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Fig_1

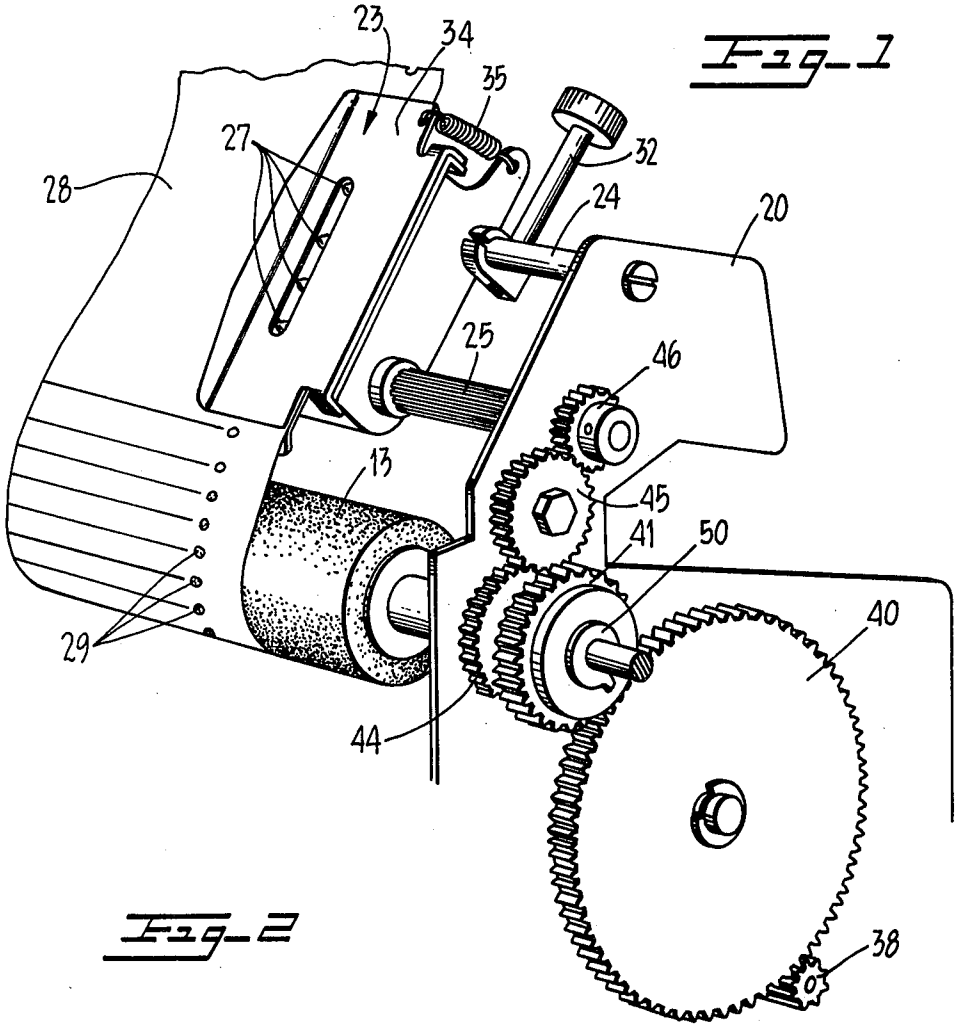
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Fig_2

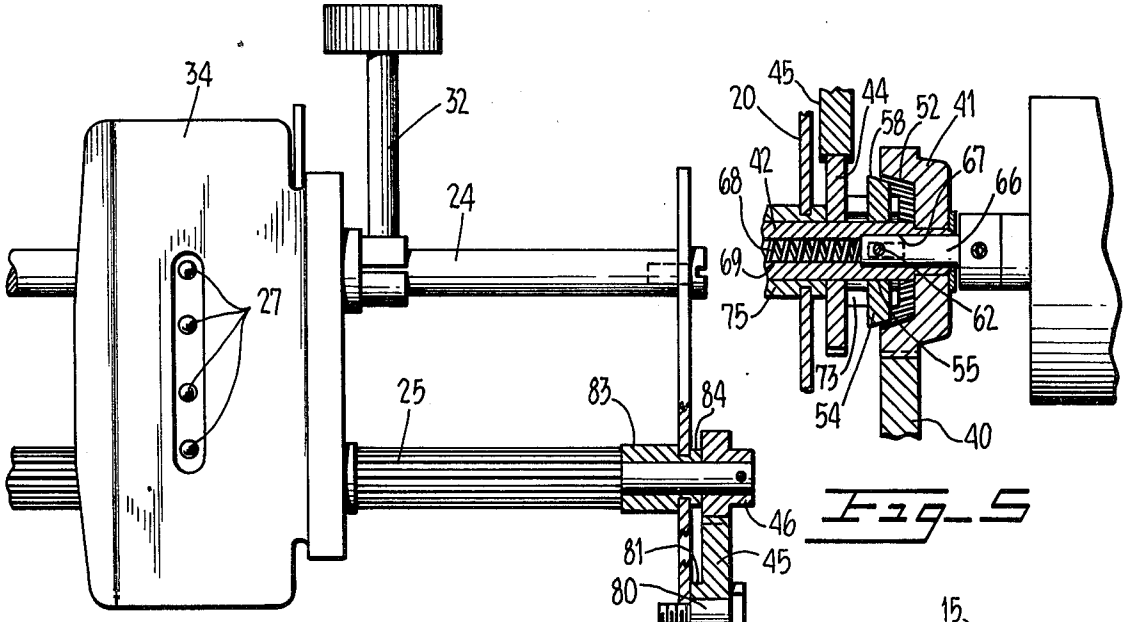

Fig_5

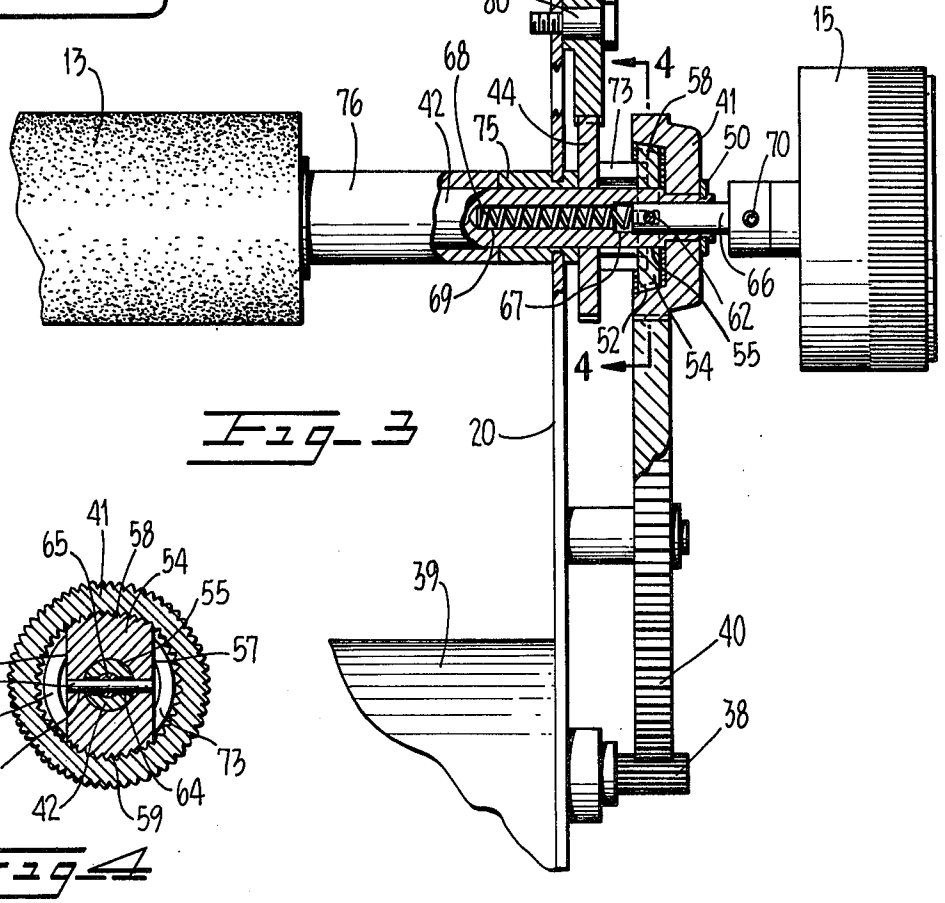

Fig_3

Fig_4

VARIABLE DISPLACEMENT APPARATUS FOR PLATEN AND TRACTOR FEED

BACKGROUND OF THE INVENTION

This invention relates to document feed mechanisms which are used to transport sheet-like materials along a feed path past a work station. More particularly, this invention relates to document feeding mechanisms in which the document is incrementally fed past the work station and is maintained in a stationary position for a finite period of time by a detent mechanism.

Document transport mechanisms are known in which a flexible sheet of material, e.g., paper, is intermittently transported past a work station, such as the platen print area of a typewriter or a rotary printer. In typical installations of this type, the drive mechanism includes a detent device for maintaining the flexible sheet at a fixed position while a line of characters is being printed. Both mechanical detents and also stepping motors having a detent provided by electrical means have been employed for this purpose. The detent provided by the drive arrangement is ordinarily fixed so that for each incremental movement between adjacent detent positions of the feed device, the flexible sheet is transported a fixed linear distance.

It frequently occurs that in many applications various kinds of documents are used in which the initial alignment criteria are different. For example, the flexible sheet on which characters are to be printed may have been preprinted with other textual material, or with lines, with reference to which the characters to be added during the printing process must be aligned. If the linear distance from the leading edge of the flexible sheet to the first of such reference lines is not an integral multiple of the unit detent spacing, the characters will inevitably be misaligned after printing.

SUMMARY OF THE INVENTION

The invention comprises an apparatus for enabling manual alignment of a flexible sheet in a transport device having automatic detent, which apparatus is inexpensive to fabricate, reliable in operation and capable of providing variable alignment over the entire detent interval. In the preferred embodiment of the invention, an incremental stepping motor providing document detent drives a unique clutch assembly through an intermediate gear. The clutch assembly includes a first gear rotatably mounted on a platen shaft and having a toothed outer periphery in engagement with the intermediate gear and an inner beveled gear surface opening outwardly in the inboard direction of the printing device. A motion transfer plate having a pair of opposed arcuately shaped gear surfaces beveled in the same direction as the inner gear surface of the first gear and joined by a pair of wall surfaces is slideably and rotatably received on the platen shaft, the gear surfaces of the first gear and the motion transfer plate being designed for mutual engagement. A second gear secured to the platen shaft inboard of the first gear has a pair of arcuately shaped extension arms which embrace the sidewalls of the motion transfer plate to be driven thereby. The motion transfer plate is secured to a control shaft having an adjustment knob, the shaft being slideably received in a bore on the platen shaft and normally biased by a spring to a first position in which the beveled gear surfaces are enmeshed.

In operation, alignment of the flexible sheet carried by the platen and a tractor feed apparatus is effected by displacing the central shaft in the inboard direction to disengage the motion plate from the first gear and by rotating the motion transfer plate by means of the knob and shaft to thereby adjust the angular position of the platen, second gear and tractor feed apparatus relative to the detent position while maintaining the motion transfer plate free of the first gear. After alignment, the shaft is released and the shaft and motion transfer plate are returned to the normal first position by the spring so that the beveled gear surfaces are enmeshed. Operation of the stepping motor drives the platen incrementally via the intermediate gear, the first gear, the motion transfer plate and the second gear. Operation of the stepping motor also drives the tractor feed apparatus via the second gear, an additional intermediate gear and a tractor feed drive gear.

For a fuller understanding of the nature and advantages of the invention, reference should be had to the ensuing detailed description taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a front view of a printer incorporating the preferred embodiment of the invention;

FIG. **2** is a perspective view of one end of the printer of FIG. **1** illustrating the sheet transport drive train;

FIG. **3** is a partial sectional view illustrating the preferred embodiment of the invention in the normal drive position;

FIG. **4** is a sectional view taken along lines **4-4** of FIG. **3**; and

FIG. **5** is a partial sectional view illustrating the relative position of certain elements of the invention during document alignment.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Turning now to the drawings, FIG. **1** is a front elevational view, partially broken away, of a printer embodying the preferred embodiment of the invention. The printer includes a cover member **10** enclosing a printing mechanism of the flying wheel type which includes an inked ribbon cartridge **12** of the type disclosed in co-pending patent application, Attorney Docket No. 5381-3 filed herewith, the cartridge **12** being mounted on a traveling carriage for lateral movement along a conventional platen **13.**

Platen **13** is provided with a pair of adjustment knobs **14, 15** at opposite ends thereof to enable manual feeding of a document along a feed path. Mounted in operative relation to platen **13** is a conventional bail **16** having a plurality of rollers **17** mounted thereon.

Secured to a pair of sidewalls **19, 20** of the printer is a tractor feed mechanism indicated generally by reference numeral **21.** As will be apparent to those skilled in the art, tractor feed mechanism is a conventional device for feeding sheet-like material from the print station located therebelow and having a pair of feed heads, **22, 23** adjustably carried by a support rod **24** and a splined drive shaft **25.** Each feed head **22, 23** includes a belt **26** composed of rubber or other suitable high friction material and having a plurality of spaced cone-like projections **27** insertable through correspondingly spaced perforations **29** in the edge of the sheet material **28** (See FIG. **2**). Each feed head **22, 23**

is secured to support rod 24 by releasably locking devices 31, 32. Each feed head 22, 23 further includes cover 34 provided with a bias spring 35 for holding the cover in the open position during loading of the sheet material 28.

FIG. 2 shows a perspective view of the right end of a portion of the printer shown in FIG. 1 with cover elements and knob 15 removed and illustrates the sheet transport drive train arrangement employed therein. A gear 38 coupled to the output shaft of a conventional stepping motor 39 (FIG. 3) is mounted in driving engagement with an intermediate gear 40 rotatably mounted on sidewall 20. Intermediate gear 40 drives a gear 41 rotatably mounted on platen shaft 42. Gear 41 drives a gear 44 in a manner to be described which in turn is coupled to a gear 45 rotatably mounted on sidewall 20. Gear 45 drives a gear 46 which is secured to tractor feed drive shaft 25.

With reference to FIGS. 3 and 4, gear 41 is rotatably mounted on a reduced diameter portion of platen shaft 42 and secured in place by a clip ring 50. Gear 41 has an inner beveled gear surface 52 which opens outwardly in the inboard direction. A motion transfer plate 54 having a central bore 55 best shown in FIG. 4 is slideably received on the outer surface of platen shaft 42. Platen 54 has a pair of parallel sidewalls 56, 57 terminating in a pair of oppositely disposed arcuately shaped beveled gear surfaces 58, 59 having a contour conformable with inner gear surface 52 of gear 41. Plate 54 is also provided with a transverse bore 61 for receiving a locking pin 62 translatably received in a transverse slot 64 in platen shaft 42 and passing through a transverse bore 65 in a stub shaft 66. Stub shaft 66 is reciprocably received in a counter bore 67 in platen shaft 42 and is normally biased in the outboard direction of the printer by a bias spring 68 disposed in a blind bore 69 in platen shaft 42. Knob 15 is secured to the outer end of stub shaft 66 by means of a lock screw 70 or other equivalent means.

Parallel sidewalls 56, 57 of plate 54 are embraced by a pair of arcuately shaped extension arms 72, 73 integrally formed on gear 44 which, as noted above, is pinned to platen shaft 42 inboard of gear 41. Platen shaft 42 is rotatably carried in sidewall 20 by a bearing 75 and is provided with a conventional outer sleeve 76 located between the inner end of bearing 75 and the outer end of platen 13. The opposite (left) end of platen 13 is provided with a similar bearing 75 and sleeve 76, and knob 14 is rigidly secured to the outer end of platen shaft 42 in a manner similar to knob 15.

Gear 45 is rotatably secured to sidewall 20 by means of a bearing bolt 80 and spacer 81, bearing bolt 80 being threaded into a threaded opening in sidewall 20.

Tractor feed drive gear 46 is pinned to the outer end of tractor feed drive shaft 25, the latter element being supported in end wall 20 by means of bearings 83, 84.

In normal operation, as stepping motor 39 intermittently rotates output gear 38, this rotation is transmitted to platen 13 and tractor feed drive shaft 25 via elements 40, 41, 54, 44, 42, 45, and 46. As will be evident, when stepping motor 39 is in the detent mode of operation, both platen 13 and tractor drive assembly 21 are locked to prevent movement of sheet material 28. To provide alignment of sheet material 28 relative to the detent position of drive gear 38, the preferred embodiment is operated in the following manner.

With reference to FIG. 5, knob 15 and shaft 66 are manually translated in the inboard direction, thereby compressing spring 68 and causing motion transfer plate 54 to be correspondingly translated by pin 62 in the inboard direction a sufficient distance to cause gear surfaces 58, 59 to move clear of inner gear surface 52 of gear 41. Knob 15 and shaft 66 are next rotated in the desired direction to cause platen 13 and tractor drive shaft 25 to be correspondingly rotated via gear 44 and platen shaft 42 and gears 45 and 46, respectively. Once thr relative adjustment required to align sheet material 28 has been made, knob 15 is released and spring 68 forces shaft 66 in the outboard direction to the normal rest position shown in FIG. 3, As shaft 66 moves outwardly, pin 62 translates motion transfer plate 54 a corresponding amount to the normal rest position in which gear surfaces 58, 59 are engaged with inner gear surface 52 of gear 41. After alignment, of sheet material 28, normal drive operation may then proceed.

As will now be apparent, document feed mechanisms constructed in accordance with the above invention enable alignment of the transported document over the entire detent range provided by the stepping motor 39. It should be noted that the arrangement described above may be used in other document feed applications in which a tractor feed assembly is not required. Further, by a simple extension of the invention a split platen comprising two axially divided independently rotatable platen halves may be employed, with each platen half incorporating independently operable document feed devices, each having a construction substantially identical to that described above. An installation of this type has the further advantage that two document feed devices which are independently operable may be individually adjusted to conform with differing alignment requirements. Such an arrangement enables a single printer to operate on pairs of documents which may be individually aligned in accordance with the requirements of any given application.

While the above provides a full and complete disclosure of the preferred embodiments of the invention, various modifications, alternate constructions and equivalents may be employed without departing from the true spirit and scope of the invention. Therefore, the above description and illustrations should not be construed as limiting the scope of the invention which is defined by the appended claims.

What is claimed is:

1. In combination with a drive train for coupling rotary motion from a source to a platen having a shaft, said drive train including means for providing positive motion detent, the improvement comprising means for enabling variable positional alignment of said platen relative to said positive detent means, said alignment means including:

first gear means coupled to said drive train;

second gear means coupled to said platen;

motion transfer means coupled to said second gear means and normally coupled to said first gear means when in a first position; and

means for translating said motion transfer means to a second position in which said first gear means is disengaged therefrom and for enabling rotation of said motion transfer means independently of said first gear means.

2. The combination of claim 1 wherein said first gear means is rotatably mounted on said platen shaft and has

an outer gear surface driven by said drive train and a beveled inner gear surface; said motion transfer means comprises a gear plate translatably received on said platen shaft adjacent said first gear and having a pair of oppositely disposed beveled gear surfaces joined by a pair of wall surfaces and engageable with said inner gear surface; and said second gear means is secured to said platen shaft adjacent said motion transfer means and is provided with a pair of arms extending towards said gear plate and embracing said wall surfaces thereof.

3. The combination of claim **2** wherein said translating means comprises a translatable shaft secured to said motion transfer means, said translatable shaft being received in an open bore in the end of said platen shaft, and means for biasing said shaft in an axial direction to urge said motion transfer means to said first position.

4. The combination of claim **3** wherein said platen shaft is provided with an axially extending transverse slot and said translatable shaft and said motion transfer means are provided with a transverse bore, and further including a lock pin received in said transverse bores and said slot.

5. The combination of claim **1** further including a tractor drive assembly having a drive gear coupled to said second gear means via an intermediate gear.

6. For use in a printer having a print station, the combination comprising:

a housing;

a stepping motor mounted on said housing and having an output gear, said stepping motor providing a detent position;

a platen having a shaft rotatably mounted on said housing for feeding flexible sheet material past said print station;

a first gear means driven by said output gear;

a second gear means secured to said platen shaft;

motion transfer means for transferring motion of said first gear to said second gear when said motion transfer means is in a first position; and

means for translating said motion transfer means to a second position in which said first gear means is disengaged therefrom and for enabling rotation of said motion transfer means independently of said first means to enable alignment of said sheet material relative to said detent position.

7. The combination of claim **6** wherein said first gear means is rotatably mounted on said platen shaft and has an outer gear driven by said output gear and a beveled inner gear surface; said motion transfer means comprises a gear plate translatably received on said platen shaft adjacent said first gear and having a pair of oppositely disposed beveled gear surfaces joined by a pair of wall surfaces, said beveled gear surfaces being engageable with said inner gear surface of said first gear means; and said second gear means is secured to said platen shaft adjacent said motion transfer means and is provided with a pair of arms extending towards said gear plate and embracing said wall surfaces thereof.

8. The combination of claim **7** wherein said translating means comprises a translatable shaft secured to said motion transfer means, said translatable shaft being received in an open bore in the end of said platen shaft, and means for biasing said translatable shaft in an axial direction to urge said motion transfer means to said first position.

9. The combination of claim **6** further including a tractor drive assembly having a drive gear coupled to said second gear means via an intermediate gear.

10. The combination of claim **8** wherein said platen shaft is provided with an axially extending transverse slot and said translatable shaft and said motion transfer means are each provided with a transverse bore, and further including a lock pin received in said transverse bores and said slot.

11. The combination of claim **6** further including a second stepping motor mounted on said housing and having an output gear, said second stepping motor providing a dentent position;

a second platen having a shaft rotatably mounted on said housing for feeding flexible sheet material past said print station;

a third gear means driven by said output gear of said second stepping motor;

a fourth gear means secured to said second platen shaft;

second motion transfer means for transferring motion from said third gear to said fourth gear when said second motion transfer means is in a first position; and

means for translating said second motion transfer means to an alternate position in which said third gear means is disengaged therefrom and for enabling rotation of said second motion transfer means independently of said third gear means to enable alignment of said sheet material relative to said detent position provided by said second stepping motor.

12. The combination of claim **11** wherein said third gear means is rotatably mounted on said second platen shaft and has an outer gear driven by said output gear of said second stepping motor and a beveled inner gear surface; said second motion transfer means comprises a gear plate translatably received on said second platen shaft adjacent said third gear and having a pair of oppositely disposed beveled gear surfaces joined by a pair of wall surfaces, said beveled gear surfaces of said second motion transfer means being engageable with said inner gear surface of said third gear means; and said fourth gear means is secured to said second platen shaft adjacent said second motion transfer means and is provided with a pair of arms extending towards said gear plate of said second motion transfer means and embracing said wall surfaces thereof.

13. The combination of claim **12** wherein said means for translating said second motion transfer means comprises a translatable shaft secured to said second motion transfer means and received in an open bore in the end of said second platen shaft, and means for biasing said last-named translatable shaft in an axial direction to urge said second motion transfer means to said alternate position.

14. The combination of claim **11** further including a second tractor drive assembly having a drive gear coupled to said fourth gear means via an intermediate gear.

15. The combination of claim **13** wherein said second platen shaft is provided with an axially extending transverse slot and said last-named translatable shaft and said second motion transfer means are each provided with a transverse bore, and further including a lock pin received in said transverse bores and said slot.

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