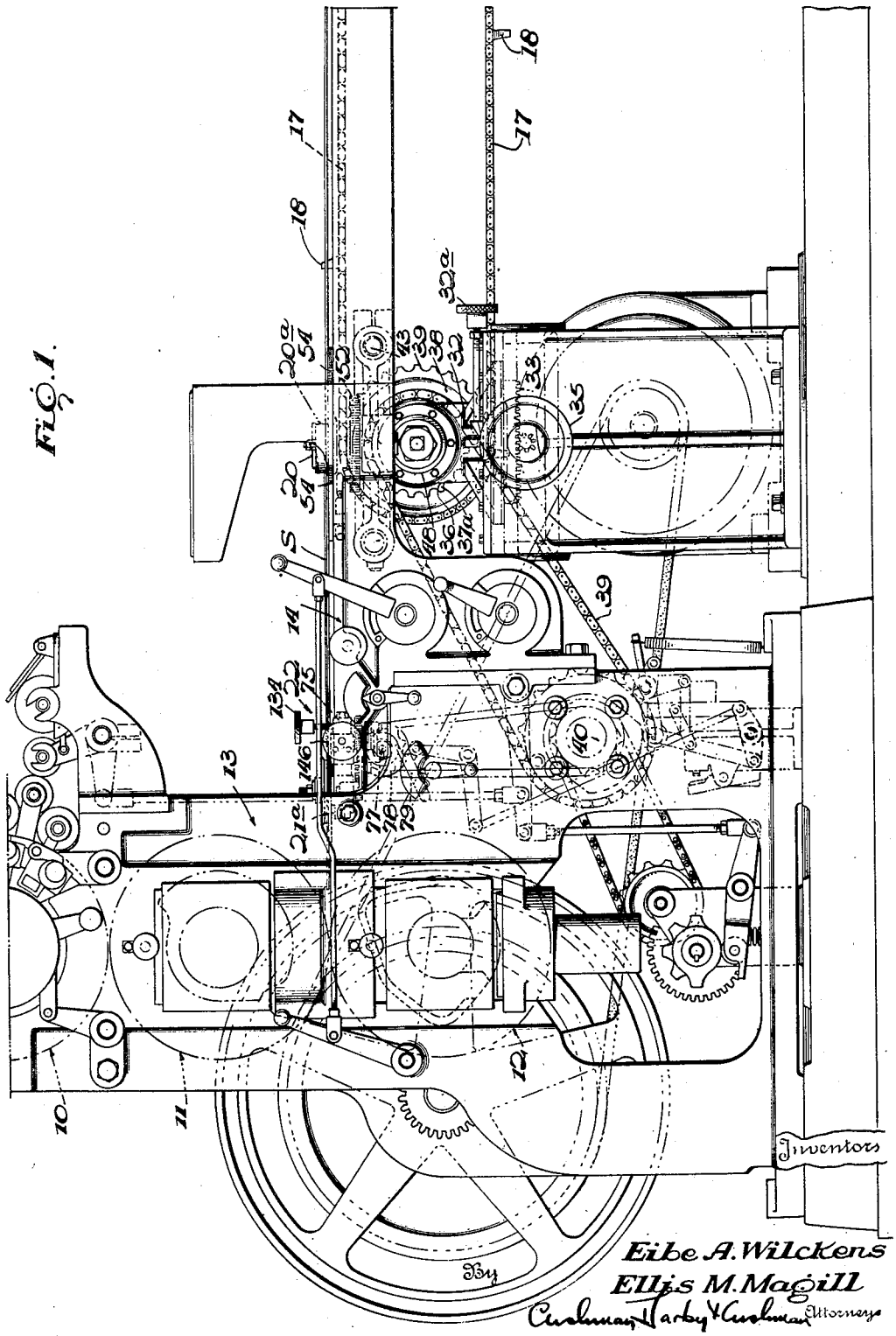
March 12, 1946. E. A. WILCKENS ET AL 2,396,481

SHEET FEEDING AND GAUGING MECHANISMS

Filed Jan. 2, 1943 5 Sheets-Sheet 1

FIG. 1.



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SHEET FEEDING AND GAUGING MECHANISMS

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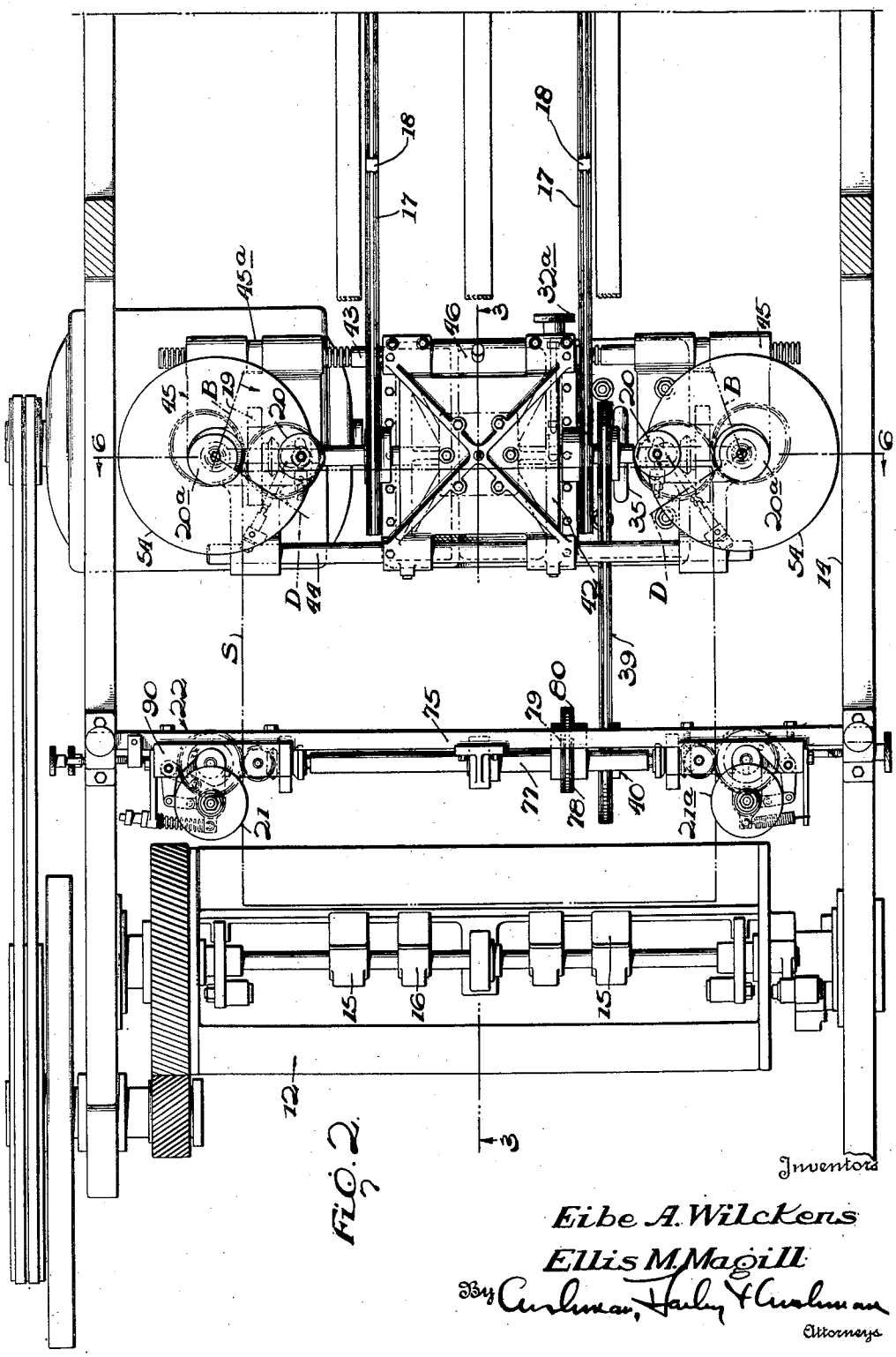


FIG. 2.

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SHEET FEEDING AND GAUGING MECHANISMS

Filed Jan. 2, 1943 5 Sheets-Sheet 3

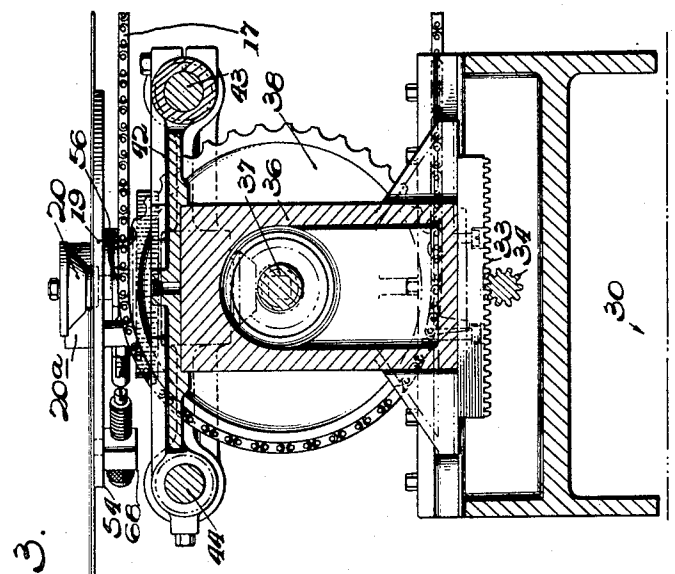


FIG. 3.

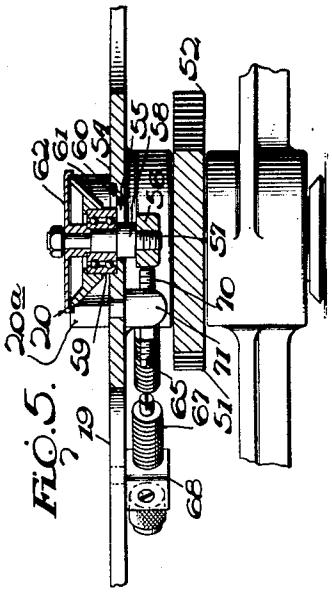
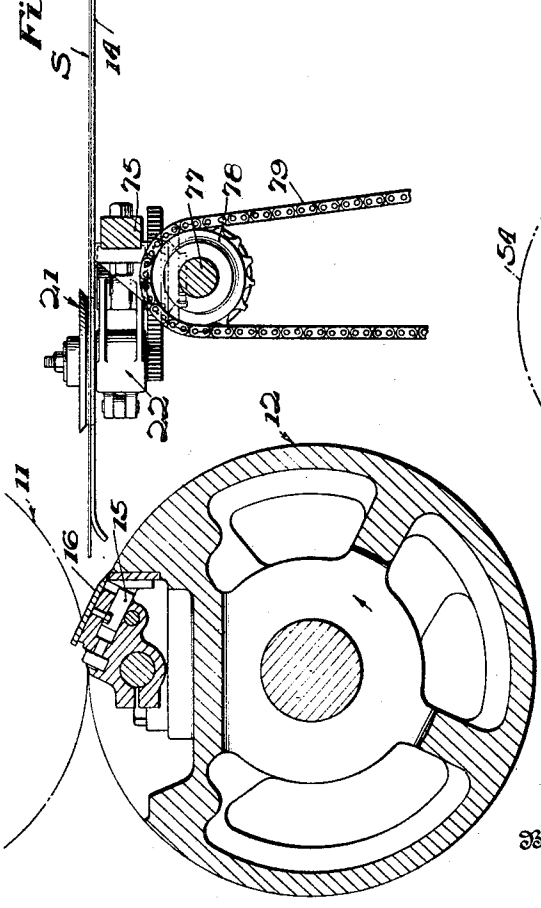


FIG. 5.



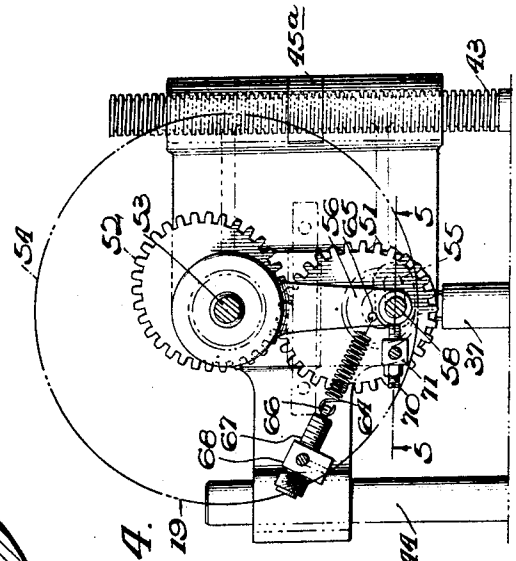


FIG. 4.

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SHEET FEEDING AND GAUGING MECHANISMS

Filed Jan. 2, 1943 5 Sheets-Sheet 4

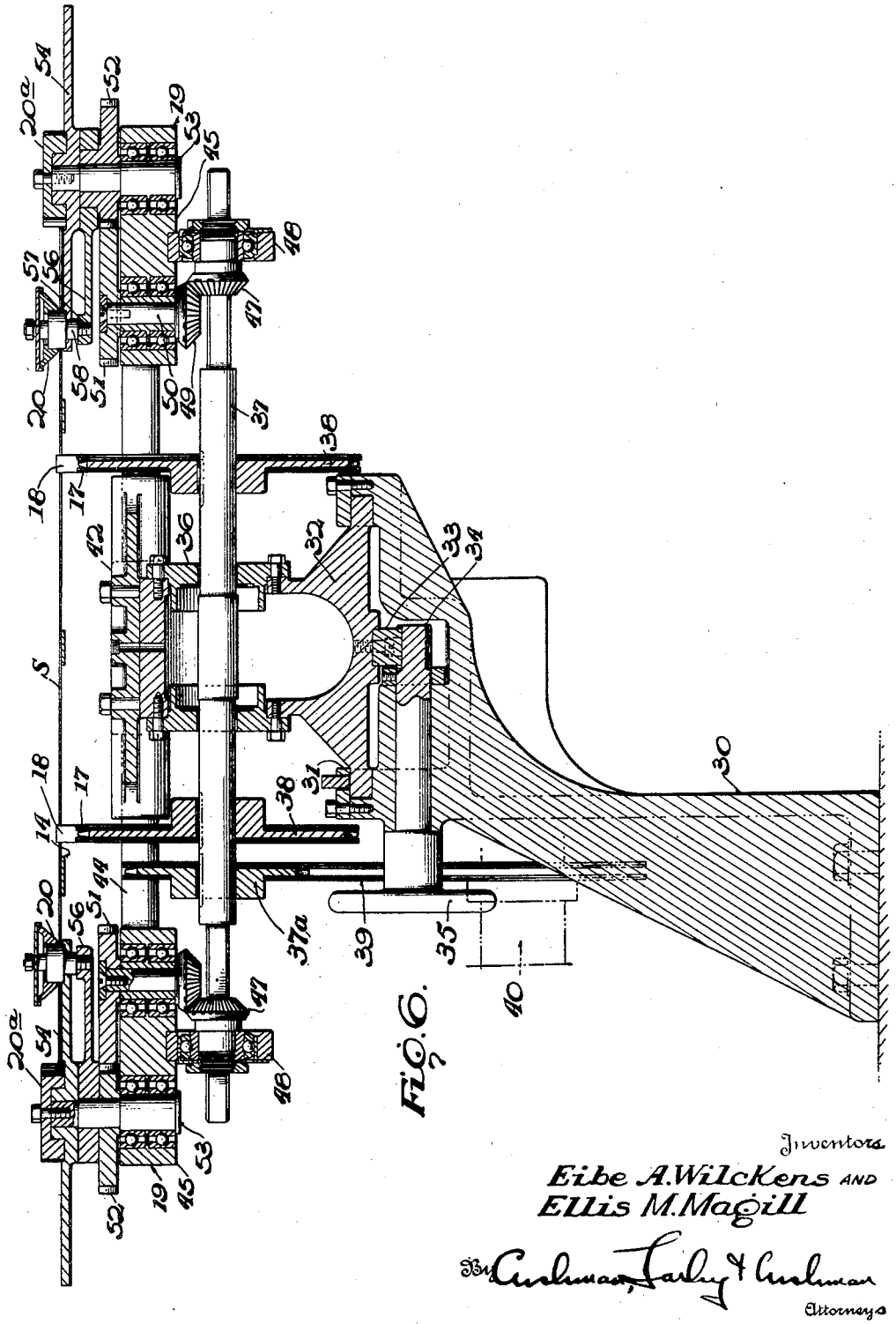


FIG. 6.

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SHEET FEEDING AND GAUGING MECHANISMS

Filed Jan. 2, 1943 5 Sheets-Sheet 5

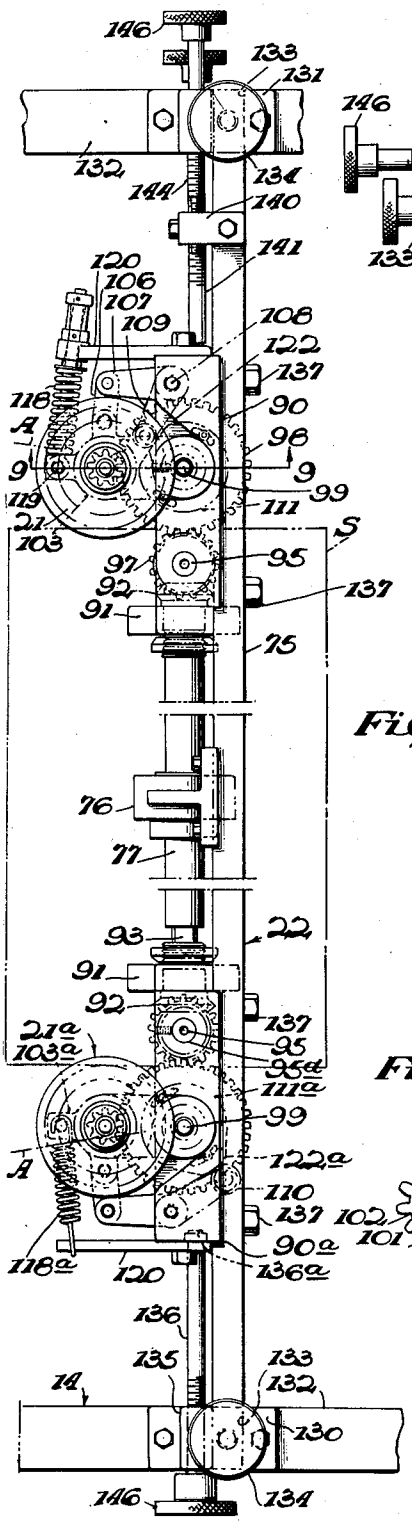


FIG. 8.

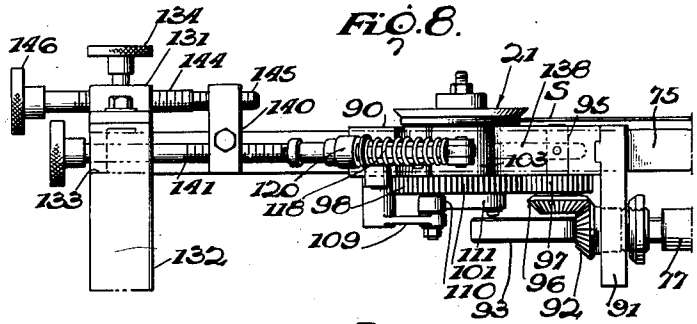


FIG. 9.

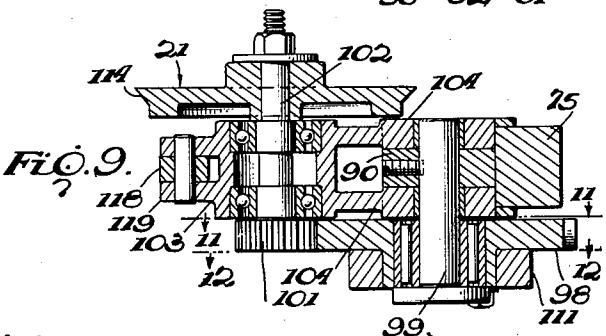


FIG. 7.

FIG. 10.

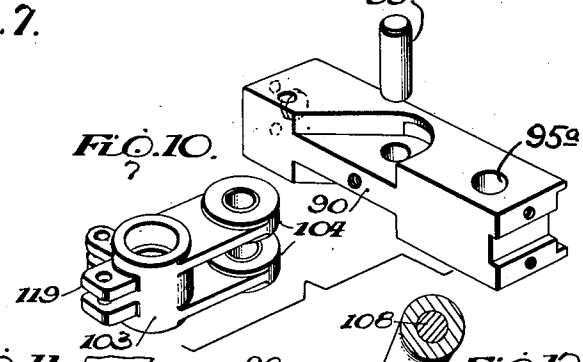


FIG. 11.

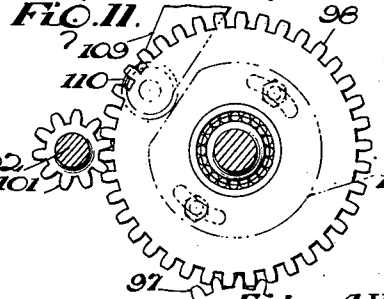
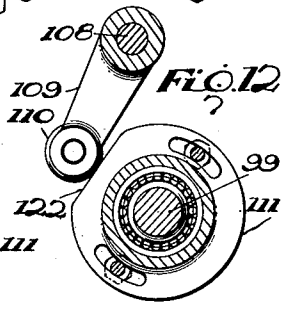


FIG. 12.



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Patented Mar. 12, 1946

2,396,481

UNITED STATES PATENT OFFICE

2,396,481

SHEET FEEDING AND GAUGING MECHANISMS

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Application January 2, 1943, Serial No. 471,168

25 Claims. (Cl. 271—58)

This invention relates to sheet feeding and gauging mechanisms.

Sheets delivered to a printing press or similar apparatus for operating upon sheets, and particularly upon sheets of tin plate, are ordinarily moved into the rolls of the press or printing couple by a pushing element which reciprocates on the press feed table. That is, the pushing element is ordinarily in the form of a bar extending transversely of the feed table and which is moved forwardly toward the press couple and in the reverse direction because of its connection to a long vertical and swinging lever pivoted adjacent the base of the press and operated by a large cam.

A serious objection to the use of the reciprocating feed element described above is that because it has a long stroke and hence must be of substantial length, the entire assembly through which it is operated must be correspondingly large and formed of heavy material, necessitating the use of powerful driving mechanism. In addition, because of the weight of the assembly, it cannot be moved at optimum high speed. The result is that the speed of operation of the press may well be limited because of the limitations upon the speed of movement of the feeding bar.

An important object of the present invention is to provide a sheet feeding mechanism which is of such design that it may be formed of relatively small parts and hence can be operated at optimum speeds and without use of powerful driving units.

Another disadvantage of a reciprocating pushing or feeding element carried by a heavy lever is the fact that because the feeding bar requires approximately as much time to return to a position to receive a new sheet as it does to advance a sheet, a substantial portion of its cycle of operation is wasted, insofar as any feeding movement is concerned.

Another object of the present invention is to provide a sheet feeding apparatus which is of such design that it may handle sheets in an almost constant stream, i. e., with little space between sheets, because of the fact that the elements of the feeding mechanism which make a return movement have a limited stroke and other elements move unidirectionally.

Another practical objection to the use of a reciprocating feeding mechanism or to one which has a long working stroke is that it is difficult to accelerate its movement. That is, in order to obtain as high speed of production as possible, it is usually necessary to operate such reciprocating elements at maximum speed through their entire movement, and hence there is no possibility of further accelerating their speed at periods when it would otherwise be desirable to do so. Furthermore, the feeding devices previously used have been positively actuated, i. e., with no resilient take-up elements. In feeding sheets to a printing couple or similar mechanism, it is desirable that the leading edge of the sheet be held in engagement with the gripping elements of the apparatus at the moment when the latter are about to close to engage the sheet. The only way in which this can be effected by a positively, i. e., non-resiliently, operated pusher such as previously used is to move the pusher with sufficient speed that it will exert pressure upon the trailing edge and so much pressure must ordinarily be exerted that the sheet may be slightly bent or canted.

A further object of the invention is to provide a feeding device which includes resiliently mounted elements to exert the necessary pressure to maintain the sheet in contact with the gripping devices. By the use of resiliently mounted feeding devices, the sheet may be held in contact with the gripping devices without being bent and sheets of extremely light material can thus be satisfactorily handled.

Another object of the invention is to provide a feeding device which will have an accelerated movement during portions of its stroke to exert pressure upon the sheet and hold it in engagement with the gripping devices. The use of feeding devices having the proper accelerated movement also enables the sheet to be held in contact with the gripping devices at the proper moment without necessarily bending the sheet.

A further object of the invention is to provide a gauging mechanism which is of such design that it will not exert a drag upon sheets.

The gauging devices ordinarily used for sheets being delivered to printing presses or the like are in the form or blocks or arms which move toward each other to insure that the sheet will be laterally registered and its leading edge placed in position to contact with all of the gripping devices and stops of the printing couple or other apparatus which is to operate upon the sheet.

The gauging device of the present invention is in the form of constantly driven rollers moving at a speed comparable with that at which the sheets are moving. As a result, no drag is placed upon the sheet.

The use of a constantly driven gauging mechanism in connection with the feeding device of

the present invention including elements having a comparatively short stroke is highly desirable because it insures that the advance of the sheet will not be retarded during the gauging.

Another object of the invention is to provide a gauging mechanism including elements adapted to be moved relative to each other and which are of such construction that this movement can be readily effected by a minimum number of parts.

While the feeding mechanism and gauging mechanism described above give optimum results when used together, it will be understood that either mechanism may be used without the other.

In addition to the gauging mechanism discussed above, the feeding mechanism of the present invention includes rotary gauging devices which center the sheets with respect to the feeding mechanism and thereby also preliminarily gauge the sheet with respect to the press rolls. They thereby co-operate with the above-described gauging mechanism in that they preliminarily gauge sheets for the latter.

Other objects and advantages of the invention will be apparent from the following specification and drawings.

Figure 1 is a side elevation of a printing press equipped with the present invention.

Figure 2 is a view in horizontal section through the printing couple, but showing the sheet feed table and the present invention in plan. In order to show the parts of the invention more clearly, the sheet supporting bars of the feed table are omitted.

Figure 3 is a vertical sectional view on the line 3—3 of Figure 2.

Figure 4 is a plan view, partly in horizontal section, of a rotary sheet feeding or pushing element of the invention.

Figure 5 is a vertical sectional view on the line 5—5 of Figure 4.

Figure 6 is a transverse vertical sectional view on the line 6—6 of Figure 2.

Figure 7 is a plan view of the sheet gauging mechanism showing the latter on a larger scale than it appears in Figure 2.

Figure 8 is an elevation of the portion of the sheet gauging mechanism shown at the upper end of Figure 7, the view looking toward the left with respect to Figure 7.

Figure 9 is a vertical sectional view on the line 9—9 of Figure 7.

Figure 10 is a perspective of a plate or carrier included in the gauging mechanism, the view also indicating the relation of other parts to the plate, and

Figures 11 and 12 are horizontal sectional views on the lines 11—11 and 12—12, respectively, of Figure 9.

The invention is illustrated in the drawings as applied to a printing press, but it will be understood that it is applicable for the feeding and gauging of sheets or similar articles in other apparatus through which sheets are moved.

The general construction and operation of the invention as applied to a printing press is as follows:

The printing press best shown in Figures 1 and 2 is of the type disclosed in Patent No. 2,205,720, for Printing press, George Goebel and Elbe A. Wilckens, issued June 25, 1940, and includes a plate cylinder 10, transfer cylinder 11, and impression cylinder 12, all mounted in a frame 13 including a sheet feed table 14. The impression cylinder 12 is equipped with sheet gripping elements 15 and stops 16 (Figure 2) of well-known construction, so that a sheet may be drawn through the printing couple with its leading edge properly positioned and aligned and the sheet held in register with the transfer cylinder 11.

Sheets S to be moved through the printing couple, for example, sheets of tin plate to have cap designs lithographed thereon, are preferably moved along the right-hand portion (Figure 2) of the sheet feed table 14 by uni-directionally moving elements or conveyor chains 17 provided with spaced ears 18. The chains 17, which form a portion of the invention, may have the sheets placed upon the same immediately in advance of the ears 18 by a sheet feeder of any well-known construction and the belts then carry the sheets toward the rotary feeding mechanism 19, one element of which is positioned adjacent each side edge of the feed table.

As the leading portion of a sheet S moves between the opposite elements of the sheet feeding mechanism 19, its edges will move between two spiraled cams 20*a* included in the feeding mechanism 19. At this time, the minimum radius of these cams will be opposite the sheet, but the cams are continuously rotating so that their greatest radii will eventually move alongside the sheet. Obviously, this action will preliminarily center the sheets. As is hereinafter explained, at least during the initial portion of the above action, the feeding rollers 20 will be positioned outwardly of and out of contact with the edges of the sheet. However, just before the trailing edge of the sheet comes abreast of the cams 20*a*, sheet feeding or pushing rollers 20 will come into contact with the trailing edge of the sheet. The travel of the ears 18 will be sufficient to bring the trailing edges of the sheets into the path of movement of the rollers 20.

The rollers 20 will engage the trailing edge of the sheet adjacent its side edges, and will move the sheet forwardly so that its leading edge will come into contact with the stops 16 on the impression cylinder 12 at the proper point in the rotation of the cylinder. The rollers 20 will also act to resiliently hold the leading edge of the sheet against the stops 16 as the rotating motion of cylinder 12 continues. As is hereinafter described, the sheet engaging rollers 20 of the feeding mechanism 19 move through an orbital path which is preferably in the plane in which the sheet moves and the rollers are so operated that their bodily movement is being accelerated at the moment that they first come into contact with the trailing edge of the sheet, thereby insuring that the sheet will be held in contact with the stops 16 of the impression cylinder 12 as the latter rotates to carry the stops and grippers 15 over top dead center of the axis of cylinder 12.

Immediately before the leading edge of the sheet has come into contact with the stops 16, the oppositely disposed and driven rollers 21 and 21*a* of the sheet gauging mechanism 22 will move toward each other to transversely center the sheet with respect to the cylinders 11 and 12. The rollers 21 and 21*a* are positively rotated at such speed as not to exert drag upon the movement of the sheet under the impetus of the feeding rollers 20. At the proper point in the cycle of operation of the impression cylinder 12, the grippers 15 associated with the cylinder will close to secure the sheet to the roll and conduct it away from the feeding rollers 20, the closing of the grippers usually occurring just before the leading edge of the sheet passes top dead center of the axis of cylinder 12. In any event, at the moment that

the grippers 15 engage the sheet to clamp it, the feeding rollers 20 will be resiliently exerting a feeding movement upon the sheet to hold it against the grippers and stops. After the grippers 15 have taken hold of the sheet, the gauging rollers will move out of contact therewith.

The detail construction of the sheet feeding mechanism 19 is as follows: Referring to Figure 6, the mechanism 19 includes a standard 30 mounted on the base of the printing press and including a slideway 31 extending longitudinally of the feed table. A supporting carriage 32 is mounted in the slideway 31, carriage 32 having a rack 33 secured to its undersurface which is engaged by a pinion 34 carried by a shaft provided with a handle 35. By this arrangement, the position of the feeding mechanism 19 longitudinally of the feed table 14 may be adjusted. A dog, not shown, may be provided to lock the supporting carriage 32 in adjusted position.

As shown in Figures 2 and 6, a housing 36 forming part of the carriage 32 has a shaft 37 journalled therein to extend transversely of the feed table and this shaft carries a sprocket wheel 37a driven through a chain 39 from a shaft 40 of the printing press. Shaft 37 has two sprocket wheels 38 keyed thereto which drive the sheet feeding chains 17.

Referring to Figures 2 and 3, a plate 42 forms the upper part of the housing 36 and parallel rods 43 and 44 extend laterally from the plate element and into horizontal bores in brackets 45 on which the sheet feeding rollers 20 are supported as subsequently described. The rod 44 is fixed in plate 42 but rod 43 is rotatable in lugs extending rearwardly from the plate and its ends are oppositely threaded. Each bracket 45 is connected to rod 43 by a nut 45a mounted in a cut-out in the bracket and held against rotation with respect to the latter. A sleeve 46 fixed to rod 43 between the ears of plate 42 is provided with sockets adapted to be engaged by a suitable tool so that rod 43 may be rotated to move the brackets 45, and hence the rollers 20 and cams 20a, with respect to the center line of the feed table 14.

As best shown in Figure 6, the shaft 37 extends beneath the brackets 45 and each of its end portions is squared to drivingly engage a beveled gear 47 journalled in a fitting 48 fixed to the lower side of each bracket 45. The beveled gears 47 may thus move along shaft 37 with the brackets 45 when the latter are adjusted laterally with respect to the feed table. Each beveled gear 47 meshes with a beveled gear 49 fixed to a stub shaft 50 journalled in the corresponding bracket 45 and each shaft 50 has a pinion 51 of elliptical form (Figure 4) fixed to its upper end. Each pinion 51 meshes with an elliptical pinion fixed to a stub shaft 53 also journalled in the corresponding bracket 45. In addition, each shaft 53 has locked thereto a disc or guide element 54 which, as best shown in Figure 4, is provided with a short circumferentially extending slot 55 adjacent one edge thereof.

Pinion 52 includes an upwardly extending hub portion and a carrier arm 56 is freely mounted on this hub portion between the pinion 52 and the disc 54 and so that it will be free to move relative to both. Each carrier arm 56 is provided at its free end with a threaded aperture 57 in which a pin 58 is mounted.

The pin 58 extends upwardly through the circumferential slot 55 in the disc 54, as best shown in Figure 5, and carries, on an anti-frictional mounting, the sheet feeding or pushing roller 20. It will be observed from Figure 5 that each roller 20 is formed of a sleeve 59 which extends into a recess 60 provided in the top face of disc 54 along slot 55. A tapered collar 61 with its smaller diameter downward overlies the upper portion of the sleeve 59, the sleeve and collar being held together by a small disc 62 locked in place by a nut threaded on the upper end of pin 58.

During the rotation of the two discs 54, the sheet feeding roller 20 associated with each disc is held in the leading end of the corresponding slot 55 through the action of a spring 64 extending between the carrier bar 56 and the disc 54. In more detail, as best shown in Figure 4, the spring 64 has one end thereof connected to an aperture 65 in arm 56 adjacent the pin 58, while the other end of the spring is connected to an aperture in a pin 66 rotatably mounted in a sleeve 67 threaded in a bracket 68 mounted for turning movement on the underside of disc 54, as also shown in Figure 5. The provision of the threaded sleeve 67 enables the tension exerted by the spring 64 to be adjusted. In addition, the extent of movement of the roller 20 and carrier arm 56 toward the leading end of slot 55 may be adjusted by a set screw 70 threaded in a fitting 71 also mounted on the underside of the disc 54.

As indicated by the arrows in Figure 2, the disc 54 at the right-hand side of the sheet feed table rotates in a clockwise direction, while the disc 54 at the left-hand side rotates in a counterclockwise direction. Since the carrier arm 56 associated with each disc must rotate with the disc under the action of its spring 64, it will be seen that the rollers move in from opposite sides of the sheet to come in behind the sheet and then, as they advance the sheet, move out of the path of the leading edge of the succeeding sheet. As is hereinafter described, the rotation of each disc imparted through the elliptical gears 51 and 52 is so timed that each disc 54 is rotating at relatively high speed while its roller 20 is exerting pushing action upon a sheet and is rotating at relatively low speed while the roller is out of the path of the sheet. However, because of the spring 64, the carrier arm 56 and roller 20 may move backwardly when resisted by a sheet, even though the disc 54 is simultaneously moving forwardly.

As best shown in Figure 6 each of the stub shafts 53 of the feeding mechanism has a cam 20a secured to its upper end by a set screw which holds the cam down upon the disk 54. As illustrated in Figure 2, the cams 20a are spiraled, i. e., progressively increase in radius from one point on their diameters to reach a maximum radius in 360°. Since these cams rotate with the stub shafts 53, they move at varying speed but they are so timed that their minimum radii will come opposite the leading portion of a sheet and, as the sheet moves between them under the action of the conveyors 17, their increasing radii will center the sheet. Finally, as the feeding rollers 20 come in behind the trailing edges of the sheet, still greater radii of the cams 20a will be opposite the side edges of the sheets to further center them.

It will be understood that even when the greatest radii of the cams 20a are facing each other, a space will be provided between them which is at least as great as the maximum permissible width of the sheets. This spacing will permit the cams 20a to preliminarily gauge or center the sheets without bending them.

The sheet gauging mechanism 22 is positioned forwardly of the sheet feeding mechanism 19 on the feed table 14 and is illustrated in Figures 7 to 12. Referring to Figure 7, the sheet gauging mechanism is supported from a bar 75 secured to the feed table as hereinafter described, bar 75 being provided with a centrally positioned depending journal 76 in which a shaft 77 is rotatable. Shaft 77 has a sprocket 78 secured thereto as shown in Figure 2 and this sprocket is driven by a chain 79 from a sprocket provided on the shaft 40 of the printing press.

Idler rolls or other take-up devices, not shown, may be provided to bear upon the sprocket chains 39 and 79 so that the feeding mechanism 19 and the gauging mechanism 22 may be adjusted longitudinally of the feed table without varying their drive.

Supporting plates or carriers 90 and 90*a*, the former of which is shown in detail in Figure 10, are mounted on the bar 75 as hereinafter described, and the supporting plates respectively carry the sheet gauging rollers 21 and 21*a*. The plates 90 and 90*a* have brackets 91 depending therefrom at their facing ends, the mounting of bracket 91 on plate 90 being shown in Figure 8, and each bracket has a horizontally arranged sleeve provided with a beveled gear 92 journalled therein. The sleeves have square apertures therethrough which fit upon the squared ends 93 of shaft 77. By this arrangement, the plates 90 and 90*a* may be moved along the supporting bar 75 without disturbing the driving connection between the shaft 77 and the beveled gears 92. Referring to the plate 90 appearing in the upper portion of Figure 7, and which is shown in perspective in Figure 10, a stub-shaft 95 (Figure 7) carrying a beveled gear 96 (Figure 8) at its lower end is journalled in a vertical bore 95*a* in the plate, gear 96 thereby meshing with the gear 92 on shaft 77. As best shown in Figure 8, a pinion 97 secured to shaft 95 meshes with a larger pinion 98 mounted beneath plate 90 on the lower end of a pin 99 (Figures 9 and 10) held against rotation in plate 90. The pinion 98 engages a smaller pinion 101 fixed to a stub shaft 102 journalled in an arm 103 which has its inner portion bifurcated as shown at 104 in Figure 10 to straddle a central recessed portion of plate 90. As also shown in Figure 9, this inner portion of arm 103 is pivoted on the pin 99. The relationship of the pinions 97, 98 and 102 is shown in Figures 7 and 11.

Referring to Figure 7, the arm or lever 103 is connected adjacent its free end to a link 106 and the other end of the link is connected to one arm of an acute angled bell crank 107 pivoted at 108 beneath plate 90. The other arm 109 of the bell crank carries a roller 110 which as best shown in Figures 11 and 12 bears against a cam 111 which rotates with the large pinion 98 on pin 99. Stub shaft 102 mounted in pivoted arm 103 has the sheet gauging roller 21 pinned to its upper end, the roller having a straight periphery at its lower portion and the upper portion being outwardly and upwardly bevelled as indicated at 114.

It will be observed from the above that the sheet gauging roller 21 and its pinion 101 will be rotated from the large pinion 98 driven by pinion 97 which is in turn driven from shaft 77 by the beveled gears 92 and 96. At the same time, because the roller 21 is mounted on the arm 103 pivoted concentric with the axis of large pinion 98, the roller 21 may swing circumferentially of pinion 98 with arm 103 according to the swinging movement imparted to arm 103 by the bell crank 107—109 by the cam 111 mounted co-axially with large pinion 98. The arm 103 carrying sheet gauging roller 21 is urged toward the center line of the sheet feed table 14 by a spring 118 having one end connected to arm 103, as indicated at 119, the other end of the spring having an adjustable swinging bearing upon a plate 120 fixed to the outer end of carrier 90.

As shown in Figures 11 and 12, the cam 111 is of uniform circumference, except that it includes a flattened portion or dwell 122 at one point in its periphery. This contour of cam 111 will cause roller 21 to be maintained outwardly with respect to the center line of the sheet feed table during the greater part of the rotation of cam 111. However, when dwell 122 comes opposite roller 110 the bell crank arm 107 may swing inwardly toward the axis of the cam so that roller 21 will move toward the center line of the sheet feed table under the action of the coil spring 118. The sheet gauging roller 21 will obviously be continually rotating at a uniform speed, regardless of its position.

The structure for mounting the sheet gauging roll 21*a* at the left hand side of the sheet feed table is similar to that used in connection with the roll 21 with the exception that the cam 111*a* used with the roller 21*a* structure has a rise 122*a* thereon instead of a dwell. In addition, the spring 118*a* of the latter structure tends to hold the bracket 103*a* away from the center line of the sheet feed table instead of pushing it toward the center line as does the spring 118 referred to above in connection with roller 21.

The cams 111 and 111*a* are circumferentially adjustable with respect to the pinions 98, preferably by means of bolts and arcuate slot connections as indicated in dotted lines in Figures 7 and 11. Therefore, the timing of the cams can be arranged as desired.

The operation of the sheet gauging mechanism 22 is as follows: As a sheet S first enters the space between the rollers 21 and 21*a*, the rollers will be positioned outwardly from each other so that their axes will be on approximately the dotted lines A indicated in Figure 7. This will be due to the fact that the rollers 110 associated with each of the cams 111 and 111*a* will be bearing on the normal diameter of these cams, and the bell cranks will therefore hold the sheet gauging rollers outwardly. It will be noted that the lines A extend through the axes of the pins 99 since the rollers swing bodily about these pins with the arms 103. Before the leading edge of a sheet comes into contact with the grippers 16 of the impression cylinder 12, the dwell 122 of cam 111 will move opposite the roller 110 associated with gauging roller 21 with the result that the roller will be bodily moved toward the center line of the feed table under the action of spring 118, as shown in Figure 7. Simultaneously the rise 122*a* of cam 111*a* will come beneath the roll 110 associated therewith so that the bell crank carrying roll 21*a* will be swung in a clockwise direction with respect to Figure 7 to move roller 21*a* toward the center line of the sheet feed table. This motion of roller 21*a* will be against the pull exerted by spring 118*a* and roller 21*a* will be rigidly held in the inward position by the rise 122*a*.

As a result of the above inward movement of the rollers described above, the rollers will engage the edges of the sheet S to properly align it with the press couple and as it moves forward under

the action of the sheet feeding mechanism 19 or any corresponding mechanism. Because of the fact that the gauging rollers are driven at such speed as to not retard or exert a drag upon the movement of the sheet, the forward pressure exerted upon the sheet by the feeding mechanism will not be resisted. Due to the fact that gauging roller 21a is positively held or locked in the inward position by the rise 122a of the cam 111a, the movement of the sheet to the left under the action of spring urged gauge roller 21 will be limited. However, spring 118 acting upon roller 21 is of insufficient strength to cause the sheet to be buckled in case it is of slightly greater than standard width. Hence, the sheet is fixedly registered at its left-hand edge, with roller 21 exerting the registering or gauging pressure. The tension of the spring 118 can, of course, be adjusted according to the rigidity of the material being handled.

The gauging rollers remain in inward position until just after the gripping rollers have firmly clamped the sheet and they then return to their normal outward position.

In order to adapt the gauging mechanism 22 to handle different widths of sheets and also to enable one gauging roller to be adjusted with respect to the other, the supporting bar 75 is mounted in brackets 130 and 131 in the opposite side frames 132 of feed table 14. Each of the brackets 130 and 131 is provided with apertures 133 in which bar 75 may have transversely slidable movement. However, the bar is normally held against such movement by hand screws 134 threaded in vertical bores of the two brackets. In addition, the end of the bar 75 which fits in the bracket 130 at the left-hand side of the feed table (lower portion of Figure 7) has secured thereto a block 135 which includes a horizontally extending bore in which a rod 136 is threaded. Rod 136 extends through an aperture in the arm 120 of the corresponding carrier 90 and has an enlarged head 136a which loosely fits in a recess in plate 90a so that the rod has rotatable movement with respect to the plate. Both carriers 90 and 90a are secured to the bar 75 by bolts 137 threaded in the carriers and extending through slots 138 in the bar as best illustrated in Figure 8. Obviously, if it is desired to adjust the position of the carrier 90a with respect to the bar 75, it is only necessary to loosen the bolts 137 and rotate the rod 136 in the desired direction. The bolts 137 may then be re-tightened to hold carrier 90a in the desired position with respect to the bar.

The opposite end of the bar 75, shown at the upper portion of Figure 7, has a block 140 secured thereto just inwardly of the feed table side frame 132. A rod 141 extending through bracket 131 is threaded in the block 140 and has its inner end connected to the plate or carrier 90 in the manner described above in connection with rod 136. Thus by loosening the bolts 137 which hold carrier 90 fixed to bar 75, the position of the carrier can be adjusted by rotation of the rod 141 relative to block 140.

In order that the bar 75 may be adjusted transversely of the sheet feed table so as to move the two carriers 90 simultaneously in the same direction and without varying their adjustment with respect to each other, a threaded rod 144 is provided in the bracket 131 secured to the side frame 132, the inner end of the rod being of reduced diameter as indicated at 145 and threaded in the block 140 fixed to bar 75. By this arrangement, when the hand screws 134 are released, the bar 75 can be moved transversely of the sheet feed table in either direction, and without disturbing the relative position of rollers 21 and 21a, by rotation of the handle 146 provided on the outer end of rod 144, the difference in the lead of the two threads on rod 144 permitting a very fine adjustment.

When any adjustment must be made to handle sheets of different width, the adjustment will ordinarily be made by operation of the threaded rod 141 which adjusts the carrier 90 carrying the resiliently actuated gauging roller 21.

The detailed manner of operation of the sheet feeding mechanism 19 in relation to the delivery of sheets thereto by the chains 17 and in time with the sheet gauging mechanism 22 is as follows: A sheet moving to the left in Figure 2 under the action of the ears 18 carried by the chains 17 will be preliminarily centered or gauged by the spiraled cams 20a and as it is carried forward by the ears 18. Use of the continuously moving chains 17 is desirable because, since they move uni-directionally, sheets can be placed thereon in rapid succession, as opposed to the space which must be maintained between sheets delivered to a reciprocating feed device. At the moment the trailing edge of a sheet passes the two sheet feeding rollers 20, these rollers will be approaching the sheet preparatory to moving in behind its trailing edge, being on about the lines B in Figure 2. This inward motion of the rollers 20 will be at medium speed because of the fact that the mean diameters of the elliptical gears 51 and 52 will be in mesh. However, the speed of movement will be accelerating, because the largest diameter of the driving pinions 51 will be approaching the smallest diameter of the driven pinions 52 with the result that the discs 54 which, through spring 64 are causing the rollers 20 to advance, are beginning to move faster than driving pinions 51. At the same time, the impression cylinder 12 of the press couple rotating in the direction of the arrow in Figure 3, will be bringing the stops 16 upwardly toward top dead center position. At this time the grippers 15 of cylinder 12 will be in open position.

At the moment that the sheet pushing rolls 20 actually come into contact with the trailing edge of a sheet, they will be moving at more accelerated speed and will quickly move the leading edge of the sheet into engagement with the stops 16. Immediately before this, the sheet gauging rollers 21 and 21a will move toward the center line of the press to properly position the sheet transversely of the feed table. Because of the fact that the sheet feeding rollers 20 are resiliently connected to the guide discs 54, firm contact between the leading edge of the sheet and all of the grippers will be assured even though it may result in the pushing rollers 20 being moved backwardly in the slots 55 of the guide discs 54 to prevent the sheet from buckling.

With the leading edge of the sheet now held against the stops 16 of cylinder 12, the stops 16 will be rapidly moving in the same direction as the sheet and will tend to move away from the sheet unless the advance of the sheet is accelerated by the feeders 20. Due to the fact that the feeders at this time will be moving at their greatest accelerated speed because the smallest diameters of driven elliptical gears 52 will now be opposite the largest diameters of the driving elliptical gears 51, this condition will be accommodated and the sheet will be kept in contact

with the stops 16. It is found desirable to so adjust the timing of the device that the pushers 20 will move somewhat faster than is necessary to hold the sheet against the stops 16, with the result that the pushers 20 will move backwardly in the slots 55 of the guide discs 54 against the pull of the springs 64.

At about the time that the axes of the rollers 20 will pass the dotted lines D in Figure 2, the grippers 15 of cylinder 12 will close by the action of gripper actuating mechanism of usual type and the sheet will now move through the press couple entirely under control of the cylinder 12. The pushers 20 will then begin decelerating because a diameter of the elliptical driving pinions 51 somewhat smaller than their larger diameter will be in mesh with portion of pinions 52 somewhat greater than their smaller diameter. The tendency to decelerate will continue as the rollers 20 move away from the center line of the feed table and backwardly toward sheet engaging position because during this interval the smallest diameters of the driving pinions 51 will mesh with the largest diameters of the driven pinions 52. Before the rollers 20 again advance to reach a position adjacent the lines B, a second sheet will be in their path.

It will be observed that because the rollers 20 move at varying speeds, i. e., accelerating when moving sheets and decelerating on return movement, they can impart the desired rate of speed to a sheet without having to move through a large orbital path. In other words, if a rotary feeding device moving at uniform speed were used, it would have to move through a large orbital path to impart the desired movement to one sheet and also be properly timed to engage the succeeding sheet.

As has been stated above, while the use of unidirectionally moving elements such as the chains 17 is highly desirable in order to obtain maximum production because it enables sheets to be delivered to the feeding rollers 20 in close relation, other means may be provided to deliver the sheets to rollers 20. In addition, while the continuously driven gauging elements 21 and 21*a* are preferably used with the feeding rollers 20 because they exert no drag upon an advancing sheet, other forms of gauging devices may be used.

The terminology used in the specification is for the purpose of description and not limitation.

We claim:

1. The combination in a printing press including a feed table and a printing couple cylinder provided with periodically operated sheet gripping devices, means to gauge sheets placed on the feed table including driven rotary elements laterally movable to align the leading edge of a sheet with the cylinder carried gripping devices, and driven rotary elements bodily movable in an orbital path to engage the trailing edge of a sheet to hold the latter in contact with the gripping devices.

2. The combination in a printing press including a feed table and a printing couple cylinder provided with periodically operated sheet gripping devices, means to gauge sheets placed on the feed table including driven rotary elements laterally movable to align the leading edge of a sheet with the cylinder carried gripping devices, and driven rotary elements bodily movable in an orbital path to engage the trailing edge of a sheet to hold the latter in contact with the gripping devices, said last-named rotary elements being movable at accelerated speed while in engagement with a sheet.

3. The combination in a printing press including a feed table and a printing couple cylinder provided with periodically operated sheet gripping devices, means to laterally gauge sheets placed on the feed table, and driven rotary elements bodily movable in an orbital path to engage the trailing edge of a sheet to hold the latter in contact with the gripping devices.

4. In a sheet handling mechanism, a feed table, unidirectionally moving means moving in the plane of the feed table to advance sheets along the latter, sheet edge engaging members extending through the plane of said feed table and rotatable on an axis normal to the feed table to receive sheets from said unidirectionally moving means, and means to so synchronize said members with said unidirectionally moving means that said members will engage the trailing edges of the sheets to advance the sheets.

5. In a sheet handling mechanism, a feed table, unidirectionally moving means moving in the plane of the feed table to advance sheets along the latter, sheet edge engaging members extending through the plane of said feed table and movable in an orbital path about an axis normal to the feed table to receive sheets from said unidirectionally moving means, and means to so synchronize said members with said unidirectionally moving means that said members will engage the trailing edges of the sheets to advance the sheets.

6. In a sheet handling mechanism, a feed table, means moving longitudinally of the table to advance sheets along the latter, sheet edge engaging means extending through the plane of said feed table and rotatable on an axis normal to the feed table to receive sheets from said first-named means, and means to so synchronize said members with said unidirectionally moving means that said members will engage the trailing edges of the sheets to advance the sheets.

7. In a sheet gauging mechanism, a support, means to move sheets periodically on said support, a rotary element adapted to engage a passing sheet, means to rotate said element, said element being mounted for bodily movement with respect to said support, and means to periodically and bodily move said element with respect to said support in synchronism with the operation of said sheet moving means.

8. In a sheet gauging apparatus, a sheet feed table, means to move sheets periodically along said table, a pair of rotary elements, one adjacent each lateral edge of said table, means to rotate said elements, said elements being mounted for movement with respect to each other to gauge a sheet relative to said feed table, and means to periodically bodily move said elements with respect to each other in synchronism with the operation of said sheet moving means.

9. In a sheet gauging apparatus, a sheet feed table, means to move sheets periodically along said table, a pair of rotary elements, one adjacent each lateral edge of said table, means to rotate said elements, said elements being mounted for movement toward each other to gauge a sheet relative to said feed table, and means to periodically bodily move said elements toward each other in synchronism with the operation of said sheet moving means.

10. In a gauging mechanism for a sheet feed table, a support, means to move sheets periodically on said support, a pair of spaced rollers mounted for bodily movement with respect to

said support, and means to constantly rotate said rollers and periodically bodily move at least one roller relative to the other in synchronism with the operation of said sheet moving means.

11. In a sheet gauging mechanism for a sheet feed table, a pair of gears journalled at laterally spaced points on said table, means to drive said gears, a roller rotated from each of said gears, at least one of said rollers being mounted for bodily movement about the axis of its associated gear, and means to move said bodily movable roller about the axis of its associated gear.

12. In a sheet gauging mechanism for a sheet feed table, a pair of gears journaled at laterally spaced points on said table, means to drive said gears, a roller rotated from each of said gears, at least one of said rollers being mounted for bodily movement about the axis of its associated gear, and means to move said bodily movable roller about the axis of its associated gear including a cam moving with said gear and a lever operatively connecting said roller and cam.

13. In a gauging mechanism for a sheet feed table, a pair of gears journalled adjacent the lateral edges of the table, means to rotate said gears, a lever mounted concentrically with the axis of each of said gears, a roller carried at the free end of said lever, means to drive said rollers from said gears, a cam rotatable with each of said gears, means connecting said lever and said cams whereby the rollers will be periodically moved toward each other, one of said cams being of such contour as to prevent movement of its associated roller away from the other roller and the other cam being of such contour as to permit its associated roller to move away from the other roller.

14. In a gauging mechanism for a sheet feed table, a pair of gears journalled adjacent the lateral edges of the table, means to rotate said gears, a lever mounted concentrically with the axis of each of said gears, a roller carried at the free end of said lever, means to drive said rollers from said gears, a cam rotatable with each of said gears, means connecting said lever and said cams whereby the rollers will be periodically moved toward each other, one of said cams being of such contour as to prevent movement of its associated roller away from the other roller and the other cam being of such contour as to permit its associated roller to move away from the other roller, and means to hold the operating connections between the cams and the levers in engagement with the cams.

15. In an apparatus of the class described including a sheet feed table, means to deliver a sheet to the table, means rotatable through an orbital path to move the sheet along the table, and means to rotate said rotary means at accelerated speed while it is moving through one portion of its orbit.

16. In an apparatus of the class described including a sheet feed table, means to deliver a sheet to the table, means rotatable in a plane parallel to the said table surface and through an orbital path to move the sheet along the table, and means to rotate said rotary means at accelerated speed while it is moving through one portion of its orbit.

17. In an apparatus of the class described including a sheet feed table, a support secured to the table, a pair of inter-engaged gears of elliptical form journalled on said support and lying in a plane parallel to the sheet feed table, means to drive one of said gears, a guide element secured to the other gear, a carrier resiliently secured to said guide to rotate therewith, and a sheet engaging roller mounted on said carrier and movable in said guide element.

18. In an apparatus of the class described including a sheet feed table, a support secured to the table, a pair of inter-engaged gears of elliptical form journalled on said support and lying in a plane parallel to the sheet feed table, means to drive one of said gears, and a sheet engaging roller movable with said second gear.

19. In an apparatus of the class described including a sheet feed table, a support secured to the table, a pair of inter-engaged gears of elliptical form journalled on said support and lying in a plane parallel to the sheet feed table, means to drive one of said gears, and a sheet engaging roller movable with said second gear, said roller being resiliently connected to said second gear for movement circumferentially of the latter.

20. In an apparatus of the class described including a sheet feed table, a support secured to the table, an element rotatable through an orbital path, a sheet engaging member movable with said rotatable element and resiliently connected to the latter to move circumferentially thereof, and means to drive said rotatable element at accelerated speed during its movement through a portion of its orbital path.

21. In an apparatus of the class described including a sheet feed table, sheet gripping means, means to deliver a sheet to the table, rotary sheet edge engaging means to move the sheet along the table and into engagement with said gripping means, and means moving coaxially with and in timed relation to said rotary means to center sheets with respect to the latter.

22. In an apparatus of the class described including a sheet feed table, continuously rotating sheet edge engaging elements to preliminarily gauge sheets moving on the table and means mounted separately from said elements to intermittently engage the sheets to finally gauge the same.

23. In an apparatus of the class described including a sheet feed table, continuously rotating spiraled cam elements to preliminarily gauge sheets moving on the table, and separate means to intermittently engage the sheets to finally gauge the same.

24. In an apparatus of the class described including a sheet feed table, gauging mechanisms spaced longitudinally of the table, each mechanism including two gauging devices respectively positioned adjacent opposite edges of the table, the devices of the mechanism closest to the receiving end of the table serving to preliminarily gauge sheets and the other mechanism finally gauging the sheets.

25. In an apparatus of the class described including a sheet feed table, means to deliver a sheet to the table, sheet edge engaging means extending through the plane of said table and bodily movable in an orbital path which is intersected by the lateral edge of the path of movement of the sheets, and means to drive said sheet edge engaging means in synchronism with said sheet delivering means, so that said sheet edge engaging means will engage the trailing edges of the sheets.

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