Nov. 7, 1939. J. R. WOOD ET AL 2,178,713

SHEET DETECTOR

Filed March 30, 1937 5 Sheets-Sheet 1

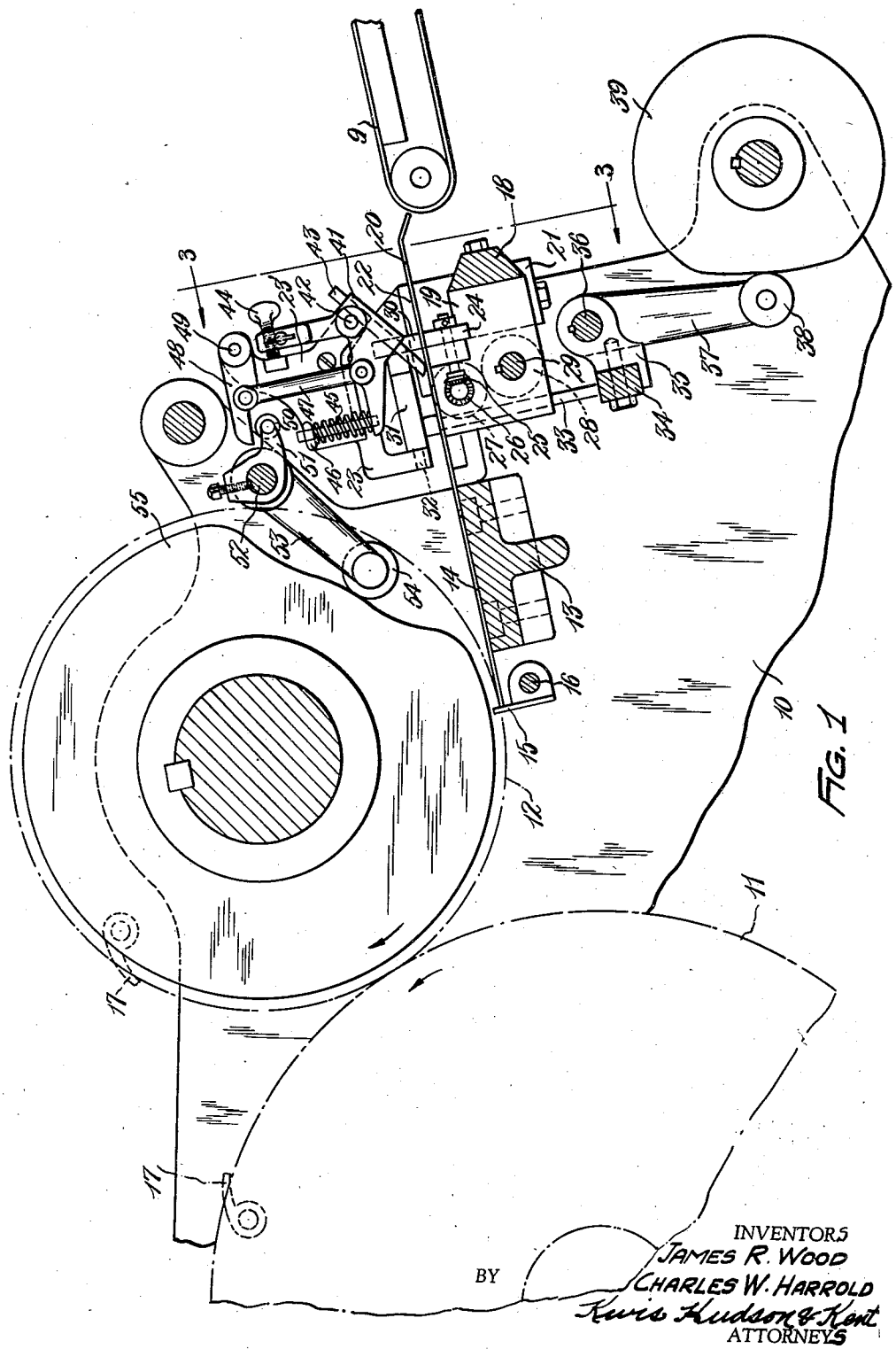


FIG. 1

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SHEET DETECTOR

Filed March 30, 1937 5 Sheets-Sheet 2

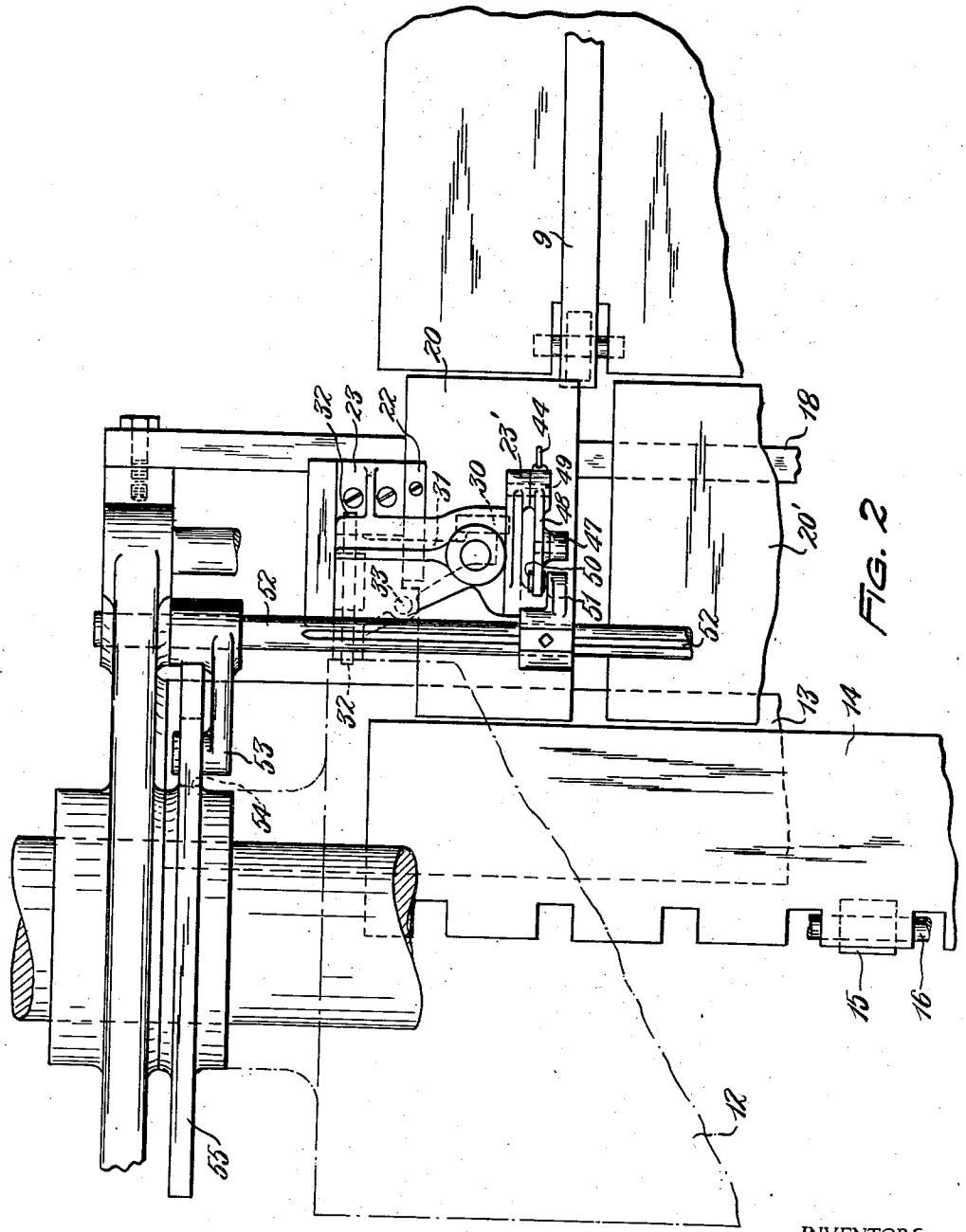


FIG. 2

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Filed March 30, 1937 5 Sheets-Sheet 3

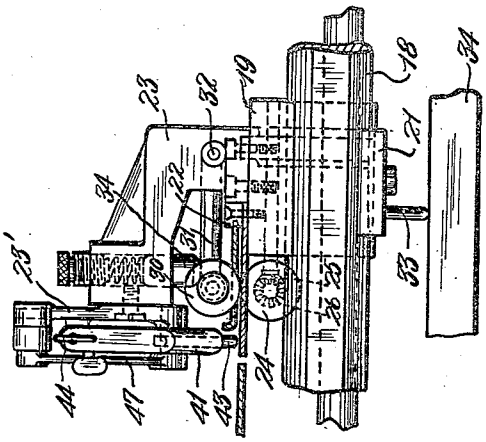


FIG. 3

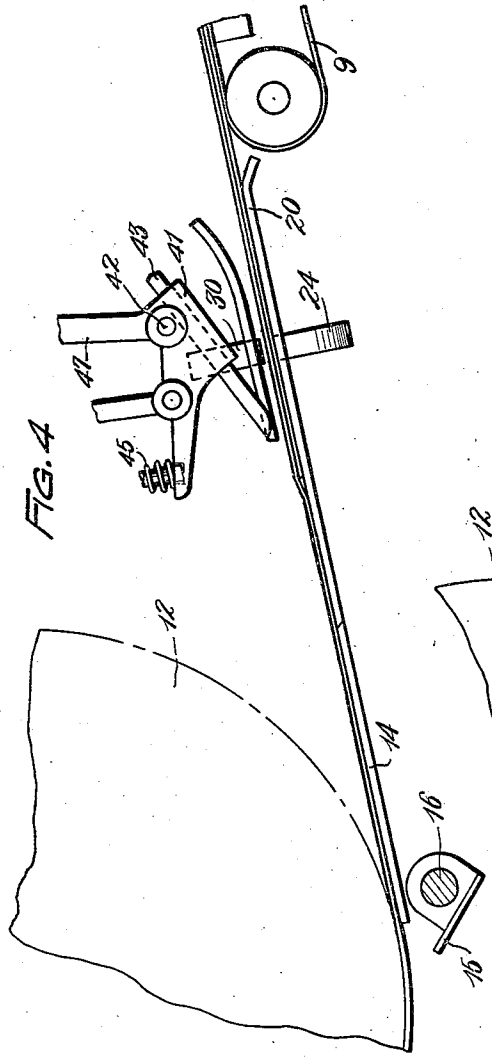


FIG. 4

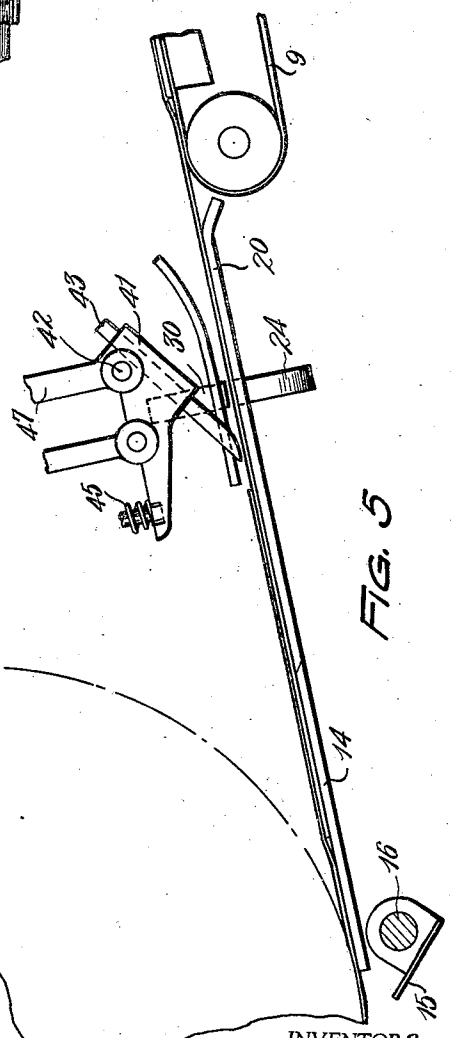


FIG. 5

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SHEET DETECTOR

Filed March 30, 1937 5 Sheets-Sheet 4

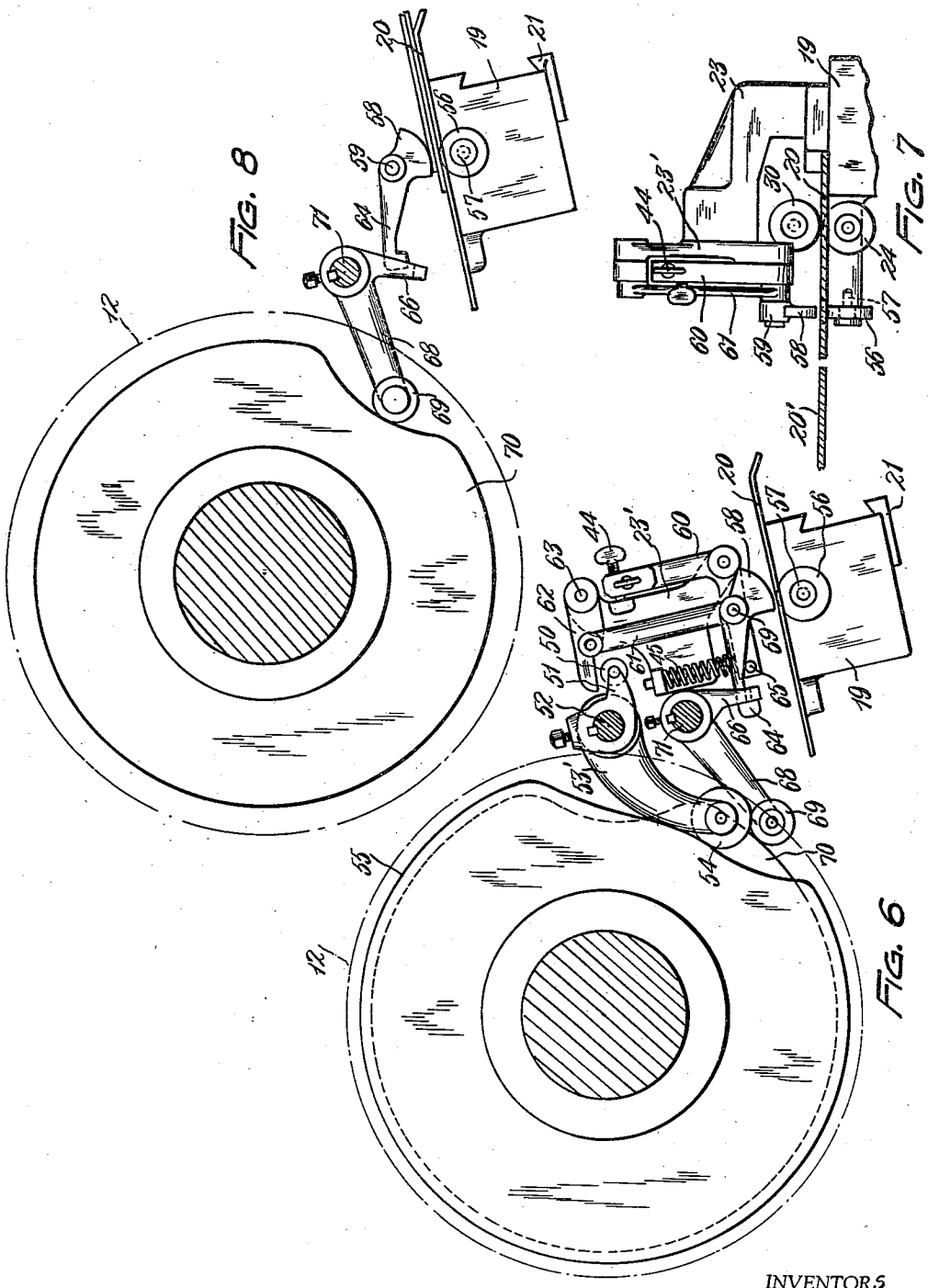


FIG. 8

FIG. 7

FIG. 6

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SHEET DETECTOR

Filed March 30, 1937 5 Sheets-Sheet 5

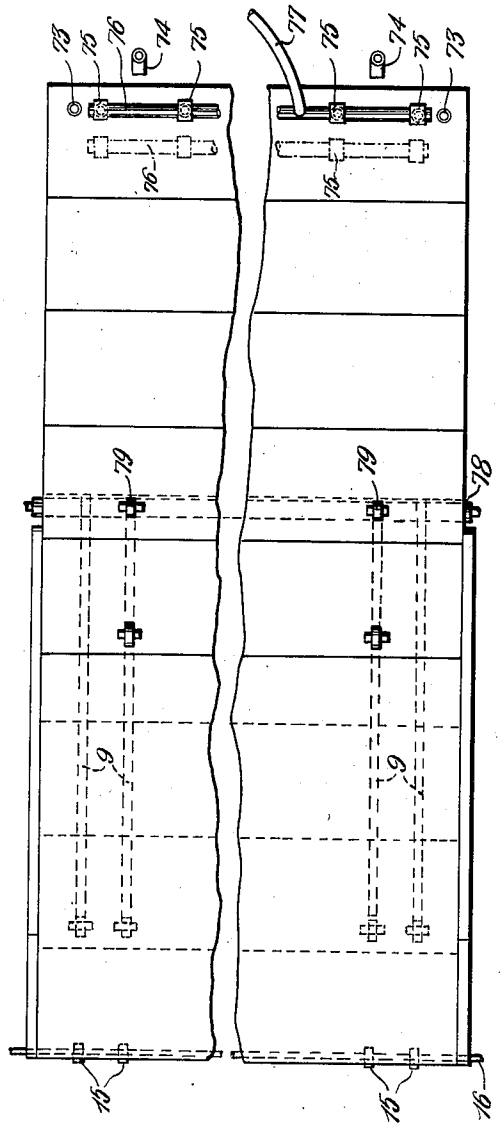


FIG. 10

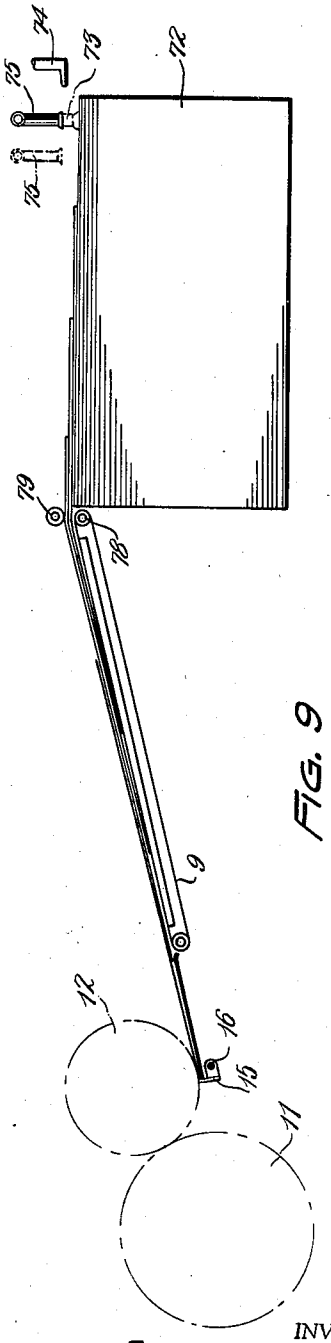


FIG. 9

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Patented Nov. 7, 1939 2,178,713

UNITED STATES PATENT OFFICE

2,178,713

SHEET DETECTOR

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Application March 30, 1937, Serial No. 133,914

17 Claims. (Cl. 271—56)

This invention relates to improvements in sheet detectors, and has reference particularly to machines employed for feeding sheets in underlapped formation to a printing press or other paper handling machine working at high speed. This type of feeding is frequently termed stream feeding. The stream of sheets is caused to flow toward the front stops of the printing press at a speed which is slow in comparison to the speed of the press. For instance, if there are five sheets in the stream at its thickest point the speed of flow may be of the order of one-fifth that of the press speed. Each sheet as it reaches the foremost position in the stream is removed rapidly by the press.

The detecting of an inaccuracy in the feed of a stream of sheets, that is where two sheets are fed instead of one or where a crumpled or folded sheet is fed, is more difficult than the detection of an inaccuracy in the feed of sheets singly. The ordinary sheet detector if applied to a stream of sheets is not very satisfactory, because when an extra sheet comes down the feed board the variation in thickness over normal may be only 20% or 25% instead of 100% as in single sheet feeders. Furthermore, there is a normal change in stream thickness as the rear edge of the top-most sheet of the stream moves out from under the detector.

These difficulties are overcome in the practice of our invention by positioning the detector at the forward end of the stream where the stream, for a part of the time at least, is one sheet thick only, and by withdrawing the detector bodily in an upward direction away from operative position except for the small portion of each cycle during which it does its work, that is while the stream thickness beneath it continues constant.

One of the objects of the invention therefore is the provision of a sheet detector which is located, constructed and operated so as to be especially suitable for use in connection with stream fed sheets.

Another object is to so operate and control the sheet detector that it will be effective intermittently only, for the purpose of permitting more than a predetermined thickness of sheets to pass freely at certain times and to prevent the passage of more than said predetermined thickness at other times.

Another object is the provision of a device of this character which is rigid in construction, capable of being accurately set, and therefore sensitive in operation.

Still another object is to provide means for quick and easy adjustment of the device for different sizes of sheets, this adjustment being preferably incidental to the adjustment of the side registering mechanism.

Other objects and features of novelty will appear as we proceed with the description of those embodiments of the invention which, for the purposes of the present application, we have illustrated in the accompanying drawings, in which

Fig. 1 is a side elevational view partly in vertical section of a preferred embodiment of the invention.

Fig. 2 is a fragmental plan view of the same.

Fig. 3 is a transverse sectional view taken substantially on the line 3—3 of Fig. 1.

Figs. 4 and 5 are diagrammatic side views showing a choke bar in momentarily inoperative and momentarily operative positions, respectively.

Fig. 6 is a view somewhat similar to Fig. 1 showing a modification of the invention with the detector in normal working position.

Fig. 7 is a transverse sectional view of the same.

Fig. 8 is a fragmental view similar to Fig. 5, but showing the detector tripped by a greater than normal stream thickness.

Fig. 9 is an elevational view showing diagrammatically a complete feeder of the type to which this invention is particularly applicable, and

Fig. 10 is a plan view of the same.

Referring first to the disclosure in Figs. 1 to 5 inclusive, wherein is disclosed the preferred embodiment of the invention, the frame side members of the printing press are indicated at 10. The impression cylinder of the press is shown at 11, and a sheet transfer mechanism for taking the sheets from the feeder, accelerating their movement to press speed, and delivering them to the impression cylinder, is shown at 12. This transfer mechanism may operate in different ways, but preferably rotates always in the same direction, coming to a complete stop at the point of gripping the forward end of the foremost sheet on the feeder, and thereafter accelerating until it reaches the speed of cylinder 11 at the point where the transfer of the sheet takes place. Means for driving this rotary transfer mechanism forms per se no part of the present invention and is not herein illustrated, but reference may be had to application Serial No. 98,900, filed September 1, 1936, by Christen R. Kaddeland and ourselves for a

detailed disclosure and description of such mechanism.

A cross bar 13 extends transversely between frame members 10, to which it is suitably connected, and on its upper surface it carries a plate 14 which constitutes a part of the feed board or table. Beyond the front end of plate 14 front register stops 15 are carried by an oscillating shaft 16 which, at the proper time and in a manner well known in the art rocks forward to throw the stops out of the way. These stops when in their operative position, shown in Fig. 1, are adapted to receive and register successively the forward edges of the sheets of the stream, and are maintained in that position while each sheet is being registered against the side guide. They swing down out of the way just after the sheet is grasped by the sheet grippers 17 of the rotary transfer member 12. The feed board also comprises endless tapes 9 which are driven at predetermined speed and by means of which the stream of sheets is advanced down the feed board.

Between the plate 14 and the tapes 9, and below the level of the table, we mount a beveled bar 18 which is bolted to the frame sides 10 and serves as a support for a transversely adjustable block 19 which carries the side registering mechanism and sheet detector mechanism presently to be described. This block has fastened to its upper surface a plate 20 which bridges the space between plate 14 and that part of the table in which the tapes 9 are located. Another plate or plates 20' supported by other suitable means may be provided to fill up the remainder of the gap between the plate 14 and the main part of the feed board. In the usual construction of a printing press two blocks such as the block 19, each with side register and sheet detector means, would be provided for the opposite sides of the press so as to permit side registering either side of the sheets to be fed. The block 19 may be adjusted on the bar 18 by manually sliding it thereon, and it may be secured in adjusted position by means of a clamp 21.

Secured to the upper face of clock 19 above plate 20 there is a side gauge 22, and beyond that an upwardly extending bracket 23 is also mounted on the block. This bracket carries a portion of the side register mechanism as well as the detector mechanism and most of its operating means.

Below the table a roller 24 is journaled in relatively fixed bearings carried by block 19, and projects through a slot in plate 20 so as to be substantially flush with the upper surface of that plate. This roller is positively driven by suitable means, as for instance by bevel gears 25 and 26, the latter gear being turned by a spur gear 27 meshing with a spur gear 28 keyed to a shaft 29 which is continuously driven from the press. The gears 27 and 28 of course move with the block when its adjustment transversely is changed.

A second roller 30 is arranged directly above roller 24, being mounted upon an arm 31 which is pivotally mounted upon trunnions 32 in the bracket 23. The arm 31 is arranged to be swung up and down for each cycle of the machine, this movement being effected by a headed pin 33 which bears on the lower side of the arm at a point between its trunnions 32 and the roller 30. The pin 33 at its lower end rests upon a bar 34 which is carried by a pair of crank arms 35 that are keyed to a rock shaft 36 which is adapted to be oscillated through a small angle by an arm 37 carrying a roller 38 which runs upon a cam 39, the latter being driven by the press and turning through one revolution for each cycle of the press.

While the roller 30 is in the raised position due to the movement of pin 33 upwardly a sheet may be moved along the feed board above roller 24. After the sheet has advanced sufficiently to be registered against the front stops 15 the roller 30 is lowered by the mechanism described, and presses the sheet into engagement with roller 24, thereby providing the necessary traction to enable roller 24 to move the sheet rapidly sidewise up to and into engagement with the side gauge 22. If desired the action of gravity on roller 30 may be augmented by a spring pressed plunger 34 arranged to bear upon the arm 31.

The bracket 23, in addition to carrying the upper roller of the side registering mechanism, has a further overhanging portion 23' in which is mounted the detector mechanism. This mechanism comprises a rocking member 41, somewhat in the form of a bell crank, which is mounted for oscillating motion on a pivot 42. This rocking member carries an inclined bar 43 which we term a choke bar, inasmuch as its function is to stop the movement of a sheet when a greater than normal thickness is encountered. An adjustment for this bar in the member 41 may be provided if desired. In one arm of the bell crank rocking member 41 there is threaded a thumb screw 44, the end of which bears on the bracket portion 23' and works against a coil spring 45 which bears at one end against an abutment 46 on the bracket and at the other end against the remaining arm of the bell crank. By turning the adjusting screw 44 therefore the choke bar 43 may be given a fine adjustment, determining its lowermost position.

A link 47 joins the rocking member 41 to a lever 48 pivoted at 49 to bracket 23. A roller 50 is adapted to bear against the lower side of the free end of this lever, and this roller is carried by a short crank 51 which is keyed to but adjustable lengthwise upon an oscillatable shaft 52, journaled in the frame of the machine. Near one of its ends this shaft carries an arm 53 upon the end of which there is a roller 54 which runs upon a cam 55 that is carried by the shaft of the rotary transfer member 12.

It will be observed therefore that when the roller 54 reaches the low spot of cam 55 the roller 50 is free to descend. This permits lever 48 to swing down and link 47 to descend, whereupon spring 45 acts to lower choke bar 43 into operative position. This position is indicated in Fig. 5. When the low spot of the cam moves out of engagement with roller 54 however, arm 53 is swung counterclockwise, causing roller 50 to swing lever 48 upwardly. An upward pull is thereby exerted through link 47 upon the forward portion of the rocking member 41, compressing spring 45 and lifting choke bar 43 out of operative position. This latter position of the parts is illustrated in Fig. 4.

In Fig. 4 a sheet is being drawn off the feed board at high speed by the rotary transfer member 12 of the press. The remainder of the stream of underlapped sheets in the meantime is coming down the feed table at a much lower rate of speed. The forward portion of the first sheet of this slower moving portion of the stream has passed between the registering rollers and beneath the choke bar 43 which has been raised out of the

way for this purpose. Fig. 5 shows a somewhat later stage of sheet movement. Here the rear edge of the rapidly moving sheet has just passed out of the field of operation of the detector mechanism. The forward end of the slow moving portion of the stream is now exposed, and this end portion is one sheet thick only. Just at this time the low spot of cam 55 lowers the choke bar to the operative position illustrated in Fig. 5, the adjustment of the bar being such that one sheet is permitted to pass beneath it, but more than one sheet or a crumpled or doubled sheet would jam in the choke and be stopped thereby.

In case the choke bar does act to stop sheet travel, then subsequently the feeder will be stopped by the absence of a sheet at the front stops 15. We have not disclosed herein the usual trip mechanism located at the front stops to detect the absence of a sheet and effect a stoppage of the feeder, but such mechanism is well known in the art and furthermore forms no part of the present invention.

In that form of the invention illustrated in Figs. 6, 7 and 8 the sheet detector instead of merely effecting a stoppage of the stream and permitting the front stop mechanism to trip the feeder, itself serves to set in motion the tripping of the feeder. In this form of the invention the general construction is the same as before, that is to say the mechanism is carried by a transversely adjustable block 19, which also carries the side register mechanism comprising upper and lower rollers 30 and 24. In this case however the detector comprises two sheet calipering elements, a lower roller 56 which is carried on a stud 57 mounted on the block 19, and a segment 58 pivotally mounted at 59 on a rocking member 60, similar to rocking member 41 of the first described form of the invention. A link 61 connects the rocking member 60 with a lever 62 pivoted to the bracket at 63, as in the first form of the invention. The lever 62 is actuated in the same way as in the first form, that is by means of cam 55, roller 54, arm 53', shaft 52, adjustable crank 51, and roller 50. Coil spring 45 acts in opposition to the upward movement of lever 62, as before.

Segment 58 is provided with an extension in the form of a hook 64, and the extension normally rests against a pin 65 on the rocking member 60. The hook 64 serves normally to latch back another hook 66 adjustably splined to a shaft 71, upon which there is a crank 68 which carries a follower roller 69 adapted to run upon another cam 70 which is likewise keyed to the shaft that carries rotary transfer member 12. Any suitable spring or weight means may be employed tending to turn shaft 71 in the clockwise direction, as viewed in Figs. 6 and 8. During most of the cycle the cam 70 holds hook 66 in the position of Fig. 6. The hook 64 therefore is required to function for latching back hook 66 only during the time that segment 58 is lowered to operative position. Now, if more than the desired predetermined thickness of sheets enters the gap between roller 56 and segment 58 when the segment is in its lowered or operative position, the sheets will be pinched between the segment and roller and further movement of the sheets will cause the segment to rotate, thus lifting hook 64 out of engagement with hook 66. This action will permit the cam roller 69 to follow its cam into the low spot of the latter, causing the shaft 71 to be oscillated, as indicated in Fig. 8. The movement of shaft 71 in this way may be utilized to trip the sheet feeder in a manner well understood by those skilled in the art.

In order to indicate as simply as possible the principal field of usefulness for the invention, we have shown diagrammatically in Figs. 9 and 10 a pile feeder designed to forward sheets in under-lapped formation. In these figures the pile of sheets to be fed is indicated at 72. Rear corner lifting suckers 73 are arranged to move up and down to raise the rear edge of the sheet above the level of the pile, it being understood that some suitable means, sheet combers for example, may be employed for separating the top sheet prior to its being taken by the lifting suckers. When the rear edge of the top sheet is lifted blowers 74 may be caused to discharge streams of air beneath the sheet to "wind" the sheet, that is to partially support it upon air and to impart to it a forwarding impulse. While the top sheet is still under the control of the lifting suckers 73, forwarding suckers 75, then positioned between the lifting suckers 73, are caused to grip the sheet. These forwarding suckers if desired may be carried by a transverse manifold pipe 76 with which an exhaust pipe 77 is connected. Then the lifting suckers are caused to release their grip upon the sheet and the forwarding suckers 75 move forward a distance which is a small part of the dimension of that part of the sheet which is parallel to its path of movement. We have indicated in these figures by broken lines a position which the forwarding suckers may assume at the end of their forward movement. It will be understood that the forward movement of each sheet results partly from the push given it by the forwarding suckers and partly from the impetus it receives from the forwardly moving layer of air beneath it. The forward movement is sufficient in any case to cause the front edge of the sheet, while still under control of the forwarding suckers, to pass between pull-out roller 78 and cooperating wheels 79. The roller 78 is positively driven, while the wheels 79 are arranged directly above the roller and may be spring loaded so as to insure proper traction upon the stream of sheets. The stream will usually be several sheets thick at intermediate points, although at the front and rear ends respectively it is one sheet thick only. The extent to which each sheet under-laps those ahead of it governs the speed with which the stream must be fed forward, as the stream must progress forward the length of one underlap for each cycle of the press. In some cases the stream may travel at a speed as low as one-sixth or one-seventh of the press speed, although as a rule a speed of one-fourth or one-fifth is low enough to insure accurate and easy feeding. This low speed is very beneficial, as it affords ample opportunity for the detector to work in spite of the comparatively short part of the stream, that is between the forward edges of succeeding sheets, upon which it must act.

It will be seen that the present invention provides a method of calipering the sheets of a stream individually, that is at a point and during a period of the cycle such that only one thickness of sheet lies on the feed board. The addition of one thickness under these conditions is easily detected, and the setting of the choke or calipering device may therefore be made less sensitive.

In accordance with certain aspects of the invention the upper and lower choke or calipering members may be placed in any position crosswise of the sheet, and may be used in any number, but it is preferred to use one such device near

each edge of the sheet path, and to carry the device upon the same support as that which carries the side registering mechanism. In this way a rigid mounting is secured for both the lower and the upper members of the detector, thereby making it unlikely that the detector will get out of adjustment, and also making its action positive. This mounting furthermore serves to adjust the position of the detector simultaneously with the adjustment of the side registering means.

As indicated by the above description, the term detector as hereinafter employed is intended to apply to means which operates on variations from the normal thickness of the stream of sheets.

Having thus described our invention, we claim:

1. In a sheet feeder, a bracket structure mounted for adjustment transversely of the path of movement of the sheets, side register mechanism carried by said bracket structure, and excess sheet detector mechanism also carried by said bracket structure, whereby the side register and sheet detector mechanisms are maintained in a given relative adjustment for all positions of the bracket structure.

2. In a sheet feeder, a bracket structure mounted for adjustment transversely of the path of movement of the sheets, side register mechanism carried by said bracket structure, excess sheet detector mechanism also carried by said bracket structure, means for moving said detector mechanism periodically between operative and inoperative positions, and other means for periodically operating said side register mechanism.

3. In a sheet feeder for forwarding sheets in lapped formation, sheet detecting means responsive to more than a desired sheet thickness without regard to sheet translucency arranged to act at a point of the stream where, and at a time in the feeding cycle when, the stream is normally one sheet thick only, said means comprising members on opposite sides of and adjacent to said stream defining a passage through which the stream is forwarded, and means for altering the distance between said members to permit the forward movement of one sheet only between the members at certain times in the feeding cycle and the forward movement of more than one sheet between the members at other times.

4. In a sheet feeder for forwarding a stream of paper sheets in lapped formation to a printing press or the like, excess sheet detecting means arranged to act near the forward end of the feeder at a point where the stream is at times normally one sheet thick only and adapted to measure stream thickness without regard to sheet translucency, and means for causing said detecting means to move into operative position momentarily respecting each sheet individually after the rear edge of the preceding sheet has passed said detecting means and before the next succeeding lapped sheet reaches said detecting means.

5. In a sheet feeder for forwarding a stream of sheets in lapped formation to a position where they are engaged successively by devices adapted to separate them one at a time from the stream, excess sheet detecting means adapted to measure stream thickness without regard to sheet translucency at a point where the stream is at times normally one sheet thick only, said means being arranged to act with respect to a given sheet in that portion thereof which extends beyond the next succeeding lapped sheet and during the interval after the preceding sheet has been engaged by said devices and before said next succeeding lapped sheet has reached said detecting means.

6. In a sheet feeder for forwarding a stream of paper sheets in lapped formation to a printing press or the like, excess sheet detecting means arranged to act near the forward end of the feeder at a point where the stream is at times normally one sheet thick only and adapted to measure stream thickness without regard to sheet translucency, and means for initiating the action of said detecting means respecting each sheet during such times after the rear edge of the preceding sheet has passed said detecting means and before the rear edge of said preceding sheet has passed off the sheet to be acted upon by the detecting means.

7. In a sheet feeder for forwarding a stream of paper sheets in lapped formation to a printing press or the like, excess sheet detecting means arranged to act near the forward end of the feeder at a point where the stream is at times normally one sheet thick only and adapted to measure stream thickness without regard to sheet translucency, said means comprising members on opposite sides of and adjacent to said stream defining a passage through which the stream is forwarded, and means for moving one of said members towards the other member momentarily to cause said detecting means to function respecting each sheet individually after the rear edge of the preceding sheet has passed said detecting means and before the next succeeding lapped sheet reaches said detecting means.

8. In a sheet feeder for forwarding a stream of paper sheets in lapped formation to a printing press or the like, excess sheet detecting means arranged to act near the forward end of the feeder at a point where the stream is at times normally one sheet thick only and adapted to measure stream thickness without regard to sheet translucency, said detecting means comprising a choke bar movable toward and away from the stream, and means for moving the choke bar to operative position momentarily with respect to a given sheet after the front edge of said given sheet has reached said choke bar and before the next succeeding lapped sheet reaches said choke bar.

9. In a sheet feeder for advancing a stream of lapped sheets to a printing or other machine, sheet detecting means arranged for action on the front of the stream in an area where at intervals it is normally one sheet thick only, means for rendering the sheet detecting means effective without regard to sheet translucency for detecting the presence of more than one sheet at a time in said area during said intervals and for rendering the sheet detecting means ineffective at intervals when the stream is normally more than one sheet thick, and means responsive to the action of the sheet detecting means for stopping the feeder when said sheet detecting means detects more than one sheet at a time in said area during any one of said first mentioned intervals.

10. In a sheet feeder, a support mounted on the feeder for adjustment transversely thereof, sheet calipering means and sheet side registering means both mounted on the support for transverse adjustments simultaneously therewith, said calipering and side registering means each comprising two elements one movable toward and away from the other and between which the sheets pass during feeding thereof, and mechanism for operating the movable elements of the

sheet calipering and side registering means in proper timed relation regardless of the position of adjustment of said means with said support.

11. In a sheet feeder for feeding a stream of lapped sheets to a printing or other machine, sheet side registering means and sheet calipering means each including two elements one movable toward and away from the other, means supporting both the side registering and calipering means at the front of the feeder for action upon the leading end of the stream in an area where at intervals it is normally one sheet thick only, said supporting means being adjustable transversely of the feeder to simultaneously bring both the side registering means and the calipering means into different operative positions for each of the same, and means for operating the movable elements of the side registering and calipering means in proper timed relation during said intervals and in any of said positions whereby both means are rendered effective to side register and caliper the sheets respectively.

12. In a sheet feeder for forwarding a stream of sheets in lapped formation to a printing press or the like, an excess sheet detector and a side registering device each arranged to act at the forward end of the stream where the latter is at times normally one sheet thick only, means for rendering said detector effective once for each cycle of the press and for a portion only of the cycle, said means being timed to initiate the action of said detector respecting a given sheet after the rear edge of the preceding sheet has passed said detector and before the next succeeding lapped sheet has reached said detector, and means effective thereafter in the same portion of the cycle for causing the side registering device to act on said given sheet.

13. In mechanism of the class described, means for advancing a stream of lapped sheets toward a machine to be fed with the head of each sheet extending beyond the front edge of the next following sheet, means for removing a sheet from the stream during each cycle of operation of the machine, means acting upon variations of stream thickness without regard to sheet translucency for detecting the presence of an excess sheet in the stream, said detecting means being located at a point along the path of travel of the sheets where during a portion of each cycle of operation of the machine the head of the sheet next following the sheet being removed is lapped at the detecting point by the tail of the sheet being removed and during the remaining portion of said cycle of said machine the head of said next following sheet is exposed at the detecting point, and means for rendering the detecting means inoperative at the time the tail of the sheet being removed laps the head of said next following sheet at the detecting point and for rendering said detecting means operative to detect at the time the head of said next following sheet is exposed at the detecting point.

14. In mechanism of the class described, means for advancing a stream of lapped sheets toward a machine to be fed, means for removing a sheet from the stream during each cycle of operation of the machine, said stream advancing means and said sheet removing means being so arranged that at a given point along the path of travel of the sheets only the sheet being removed and the next following sheet are present for a portion of the cycle of operation of the machine and only said next following sheet is present during another portion of said cycle, means located at said point acting upon variations of stream thickness without regard to sheet translucency for detecting the presence of an excess sheet in the stream, and means for operating said detecting means to detect during said last mentioned portion of said cycle only.

15. In mechanism of the class described, means for advancing a stream of sheets in lapped formation toward an operating machine, means for removing each sheet in turn from the stream, an excess sheet detector and a side registering device each arranged to act upon the sheet following the sheet being removed at a point where and a time when the stream is one sheet thick only, means for rendering said detector effective once for each cycle of the operating machine, said means being timed to initiate the action of said detector respecting a given sheet during that portion of each cycle corresponding to the period between the passing beyond a given point of the rear edge of the sheet being removed and the front edge of the second sheet thereafter, and means effective subsequently during the same period for causing said side registering device to act on the sheet following the sheet being removed.

16. In mechanism of the class described, means for advancing a stream of sheets in lapped formation toward an operating machine, means for removing each sheet in turn from the stream, an excess sheet detector and a side registering device each arranged to act upon the first sheet following the one being removed in that portion of said first sheet which extends beyond the second sheet following the sheet being removed, means for rendering said detector effective during that portion only of the cycle of the machine between the passage of the rear edge of a sheet being removed and the front edge of said second sheet past the point of operation of said detector, means for operating said side registering device during that portion only of the cycle of the machine between the passage of the rear edge of a sheet being removed and the front edge of said second sheet past the point of operation of said side registering device, said last mentioned operating means being arranged to operate said side registering device after initiation of operation of said detector.

17. In mechanism of the class described, means for advancing a stream of lapped sheets toward a machine to be fed, devices engaging the front edge of each sheet in turn to register the same, means operating on each sheet in turn after it has been registered to completely withdraw the same from the next following lapped sheet, means acting upon variations of stream thickness without regard to sheet translucency for detecting the presence of an excess sheet in the stream, said detecting means being arranged near said registering devices where the stream is at times normally one sheet thick only, and means for momentarily rendering said detecting means effective at such times respecting each sheet before the same reaches said registering devices and after the sheet being removed has passed the detecting means.

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