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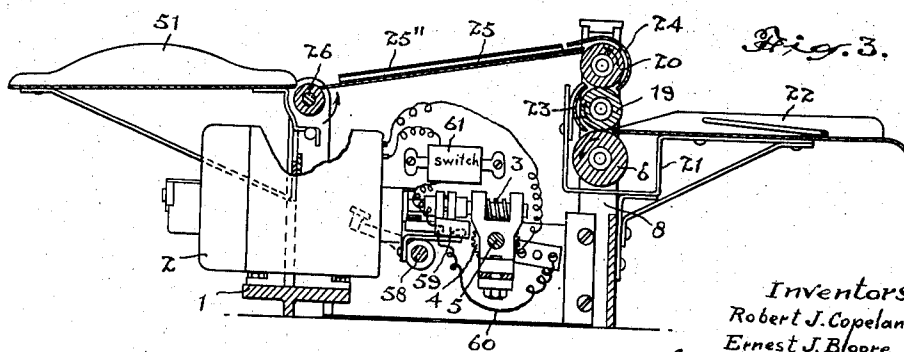
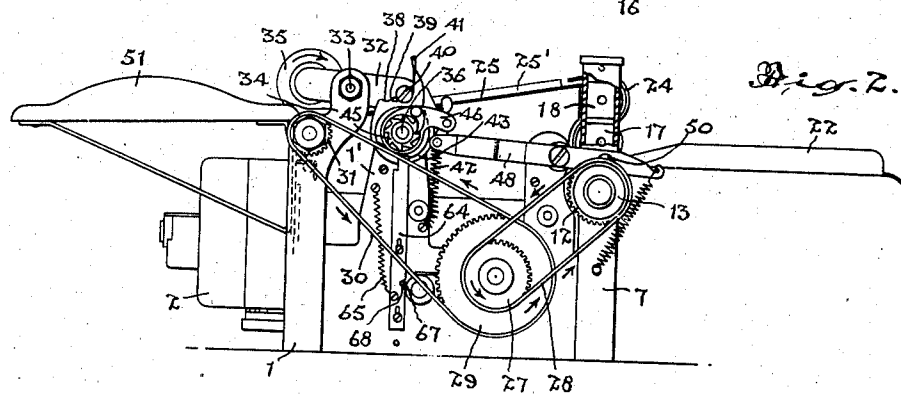
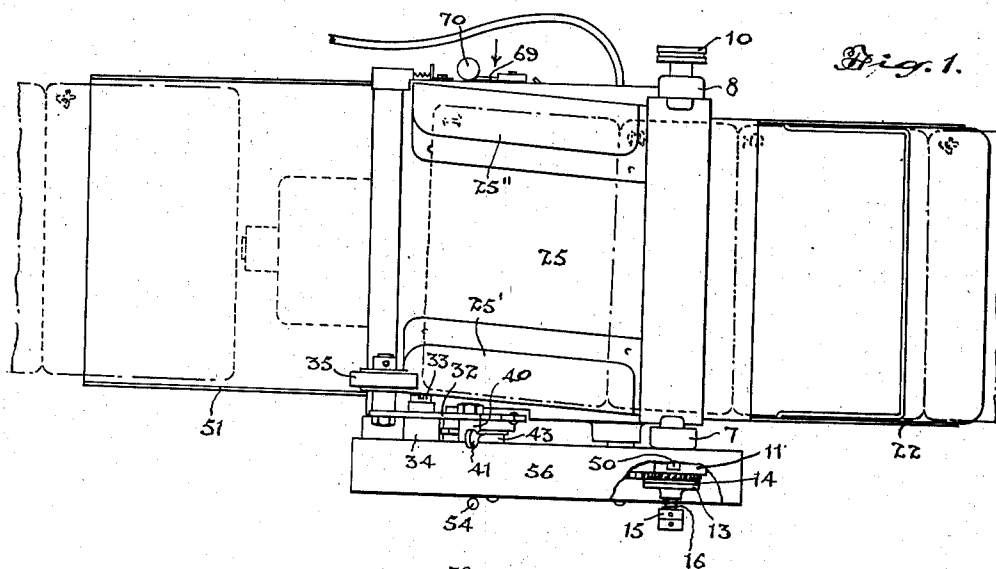
R. J. COPELAND ET AL

2,268,190

SHEET SEPARATING DEVICE

Filed March 11, 1940

2 Sheets-Sheet 1



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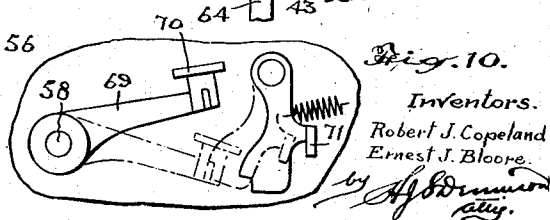
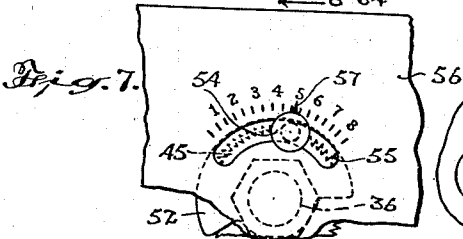
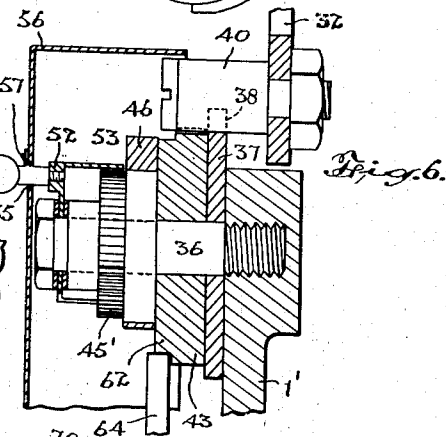
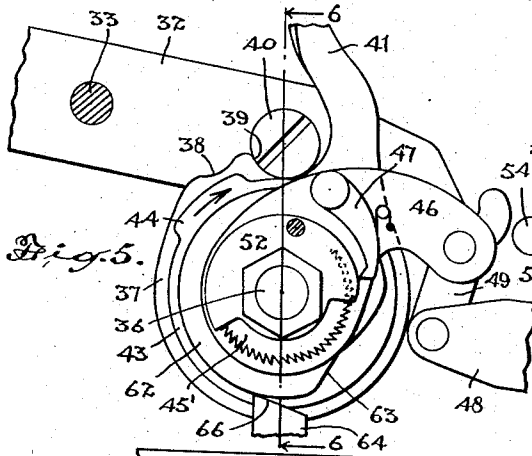
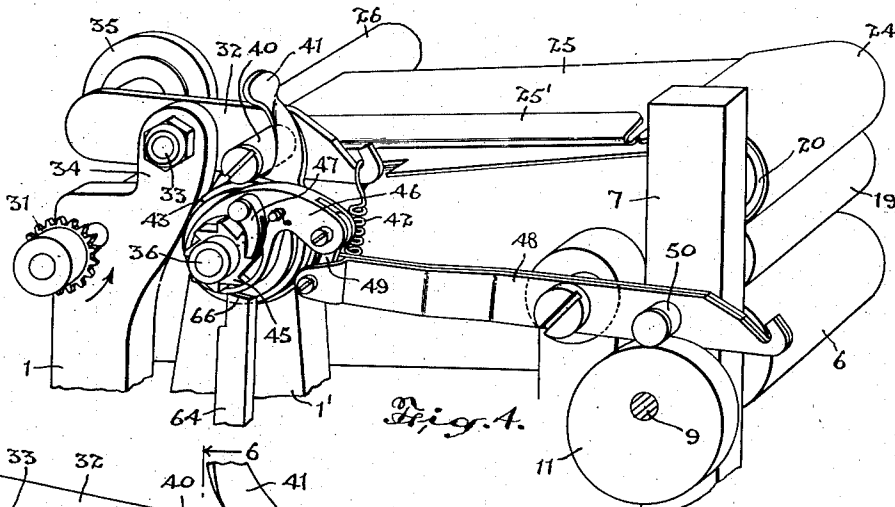
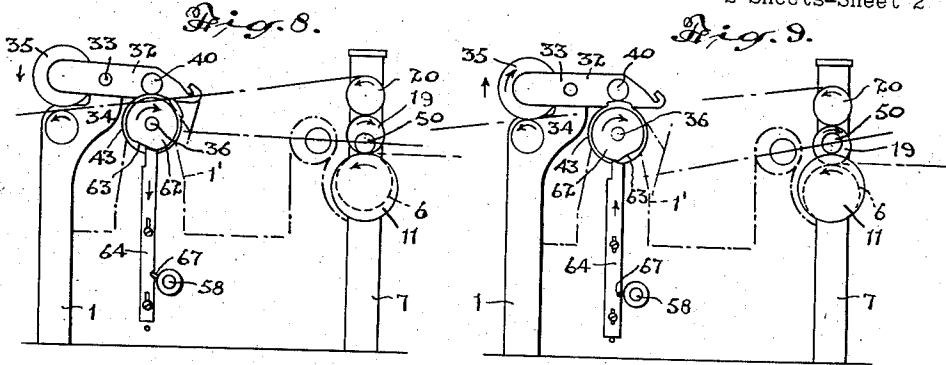
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2,268,190

SHEET SEPARATING DEVICE

Filed March 11, 1940

2 Sheets-Sheet 2



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2,268,190

SHEET SEPARATING DEVICE

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Application March 11, 1940, Serial No. 323,402

19 Claims. (Cl. 164—845)

This invention relates to the separation of sheets, forms or the like of the continuous strip type into individual sheets or groups of two or more, and the principal object of this invention is to provide a mechanism to which the continuous strip of transversely perforated form sheets are directed and which will function to automatically effect the separation or subdivision of the strip into required individual or grouped form.

A further and important object is to provide a mechanism for this purpose which will operate efficiently and will effect a considerable saving in time over the present tedious hand method of separation.

A still further and important object is to provide a control mechanism for the separating means which may be quickly adjusted to adapt the machine either to the separation of the continuous strip into individual sheets or into groups of two, three, four or more attached sheets in accordance with departmental requirements and to enable the machine to be operated either continuously or for predetermined periods.

The principal feature of the invention resides in the novel construction and arrangement of parts whereby the form sheets in continuous strip form are directed by feed rollers to separating rollers arranged therebeyond at least one of which is driven at a faster rate than the feed rollers, the second-mentioned rollers being arranged to be periodically brought into active gripping relation with a predetermined form sheet to grip the same with an accelerating action to detach the same from the successive sheets.

A further and important feature resides in the arrangement of special guide means between the feed rollers and separating rollers arranged at an angle to the perpendicular of the feed rolls to exert a pre-separating influence, whereby the separating rollers are facilitated in their separating function.

In the drawings Figure 1 is a plan view of a device constructed in accordance with the present invention.

Figure 2 is a side elevational view.

Figure 3 is a longitudinal mid-sectional view.

Figure 4 is an enlarged perspective view showing the feeding and separating rollers and the co-operatively interposed control means.

Figure 5 is an enlarged end elevational view of a modified form of adjustable ratchet control means.

Figure 6 is a section taken on the line 6—6 of

Figure 5 with the drive-enclosing casing in place.

Figure 7 is a fragmentary view of the drive-enclosing casing showing an indicating arrangement in conjunction with the adjustable ratchet means.

Figure 8 is a diagrammatic part structural view showing a form sheet being advanced between the space-separating rollers.

Figure 9 is a view similar to Figure 8 but showing the control means moved to the position where the separating rollers frictionally grip the sheets to be detached.

Figure 10 is a side elevational view of the manual control for the automatic switch means looking in the direction indicated by the arrow in Figure 1.

In the use of the continuous type of form sheet for duplicating purposes, in which the sheets are passed through a duplicating machine such as set forth in our co-pending United States application 302,800, filed November 4, 1939, it has been the custom to separate the continuous form strip into single or multiple units before it is passed through the duplicator, with the result that the work is slowed down considerably below the productive capacity of the duplicating mechanism.

The present invention has been devised to eliminate this difficulty in an otherwise efficient invoicing and accounting system, and to enable the automatic separation of the continuous form strip repeatedly into individual sheets or units of a predetermined number of sheets.

Referring in detail to the form of construction illustrated for carrying the present invention into effect, a frame 1 has mounted therein a drive motor 2 connected through a worm 3 and worm-wheel 4 with a main drive shaft 5 suitably journaled in the frame.

A feed roller 6 is rotatably journaled between the spaced frame uprights 7 and 8 and is provided with a shaft extension 9 at one end and a hand wheel 10 at the other end.

A cam 11, having a drive sprocket 12 secured thereto, is rotatably mounted on the shaft extension 9, the sprocket and cam assembly being frictionally connected with the roller shaft extension by means of a disc 13 slidably and non-rotatably mounted on said shaft and having a frictional facing 14 for engagement with the side face of the sprocket. The pressure of the frictional drive engagement may be varied by means of collars 15 threaded on the shaft extension and maintaining a compression spring 16 in variable pressure contact with the disc 13.

The upper portion of the standards 7 and 8 are preferably of channel formation and accommodate journal blocks 17 and 18 in a slidable manner, feed rollers 19 and 20 being journaled in these blocks so that they are guided in a vertical floating manner to rest on each other and on the main feed roller 6.

A supporting bracket 21 supports a feed tray 22 in alignment with the upper periphery of the feed roll 6 for directing the continuous strip of form sheets between the rolls 6 and 19, and a curved plate 23, supported in an extension of the bracket 21, is adapted to receive the advance edge of the continuous strip and directs the same between the rolls 19 and 20, a second curved plate directing member 24 being arranged in embracing relation to the upper roll 20 to receive the strip and guide the same around the roll 20 so that the strip is advanced over a downwardly sloping plate 25.

Mounted transversely of the frame 1 at the forward edge of the plate 25 is a sheet-separating roller 26 over which the continuous strip is adapted to pass.

The main drive shaft 5 is here shown provided with a drive sprocket 27 connected by chain drive 28 with the sprocket 12 of the feed roller, and a larger sprocket wheel 29 is connected by chain drive 30 with a considerably smaller sprocket 31 mounted on the shaft of the sheet-separating roller 26, so that the latter will be driven at a considerably greater speed than the speed or operation of the feed roller 6, for a purpose which will be hereinafter readily apparent.

An arm 32 is pivotally mounted intermediate of its length at 33 in a frame extension 34 and carries a resilient frictional roller 35 which is adapted to be moved toward and away from the separating roller 26 by pivotal motion of the arm 32, as will hereinafter appear.

Rigidly secured in an upright 1' of the frame is a stub shaft 36 on which is rotatably mounted a disc 37 having cam-like notches 38 and 39 of respectively different depths adapted to co-operate with a roller extension 40 on the arm 32 for a purpose hereinafter defined, the disc having a manually operable lever extension 41.

A tension spring 42 resiliently urges the arm 32 in a direction to move the frictional roller 35 away from the roller 26.

Rotatably mounted on the stub shaft 36 is a cam member 43 adapted to co-operate with the cam roller 40 when the latter is accommodated in the deeper notch 39 of the disc 37, as illustrated in Figures 2 and 5, and the cam carries a raised portion 44 which is adapted to periodically engage the cam roller 40 and swing the arm 32 to bring the friction roller 35 into pressure association with the roller 26.

A ratchet wheel 45 (Figures 2 and 4) is fixed to the cam 43 and a ratchet arm 46 rotatably encircles a hub portion of the cam and carries a spring-pressed pawl 47, which is adapted to engage the ratchet teeth when the arm 46 is oscillating in order to effect rotation of the cam 43 at a desired rate.

Pivotally mounted intermediate of its length in the frame is an arm 48 having an operating link connection 49 with the ratchet arm 46, a roller extension 50 being provided on the arm co-operatively engaging the cam 11 carried by the feed roller shaft extension, so that as the feed roller is driven the arm 48 will be oscillated, which in turn will oscillate the ratchet arm 46 at a rate

directly proportional to the rate of operation of the feed roller 6.

This oscillation rotates the cam 43 until the raised cam portion 44 engages the arm roller 40, causing the friction wheel 35 to bear downwardly against the particular sheet, which at the time is passing over the rapidly revolving roller 26, so that an instantaneous acceleration is imparted to the sheet by a force applied at one edge thereof, so that the sheet is instantly separated or subdivided from the next successive sheet of the continuous strip which is being advanced at a slower rate by the operation of the feed roller 6 and associated rolls.

In order to enhance this separating action guideways 25' and 25'' are here shown mounted on the plate 25 in acute angular relation to the direction of travel of the continuous strip as it leaves the upper feed roll 20, so that the sheets as they advance will be directed edgewise which will tend to initiate the separating action along the lines of perforation dividing the various sheets, thereby facilitating the separating action of the rolls 26 and 35.

A tray 51 is preferably arranged to receive the separated sheets or group of sheets and guide the same to the duplicating machine.

If it is desired to separate each individual sheet from the continuous strip as it is advanced between the rolls 26 and 35 it is simply necessary to swing the disc 37 manually to the position where the shallow notch 38 engages the arm roller 40 so that the rollers 26 and 35 will be continually held in frictional gripping relation to each sheet as the strip is advanced by the feed rollers.

However in most instances two, three, four or even more duplicate forms are required for transmission to the various operating departments and the ratchet drive means for the cam 43, together with the cam drive 11, may be so selected or coordinated that the required number of sheets or forms will pass between the frictional separating rollers 26 and 35 before the cam 43 has been rotated sufficiently to move the frictional roller 35 downwardly against the final sheet of the series to be separated from the strip.

The presence of the frictional drive in connection with the feed roller 6 enables the advance end of the continuous strip to be accurately adjusted or positioned in relation to the period of operation of the roller 35, the feed roller 6 being readily rotatable to the required initial position by manipulation of the hand wheel 10.

If the machine is to be used only for separating a group of say, three sheets at each operation, then a fixed drive ratio may be employed between the feed roller cam 11 and the separator operating cam 43. If, however the machine is required to operate under more versatile conditions in which say, two copies may be required at one time and at another time, say three, four, or even more copies at other times, then provision must be made for providing a variable ratio drive between the operating cam 11 of the feed roller and the separation-controlling cam 43, so that the required number of sheets will be allowed to pass in a grouped arrangement between the rolls 26 and 35 before these are brought into frictional separating relation to the last sheet of the group.

In Figures 5, 6 and 7 I have shown an adjustable form of ratchet drive for this purpose. In this modification the ratchet wheel 45' carries ratchet teeth of a comparatively fine character, and mounted on the stub shaft 36 or on the boss of the ratchet wheel 45 for adjustable rotation

concentrically thereof, is a disc-like member 52 having a semi-circular flange 53 which overlaps the toothed periphery of the ratchet wheel 45', and over which the ratchet pawl 47 is adapted to ride for a distance determined by the rotatable setting of the semi-circular flange 53 in relation to the range of travel of the ratchet pawl 47.

Thus if the minimum number of copies are required to be separated from the strip at each operation, say for instance, each successive sheet, then by adjusting the ratchet control member 52 in a counter-clockwise direction the ratchet teeth will be cleared for maximum drive cooperation with the pawl 47 to quickly turn the cam 43 to the sheet detaching position as each successive sheet passes between the rolls 26 and 35. If it is desired to separate the form sheets in groups of say, two, three, four or more, it is simply necessary to rotatably adjust the ratchet control member 52 in proportionate degrees in a clockwise direction so that the ratchet pawl 47 will ride up on the semi-circular flange 52, thereby proportionately decreasing the effective operating range so that the required number of sheets will be allowed to pass between the separating rollers 26—35 before operation of the roller 35.

With this form of adjustment a control knob 54 may advantageously be carried out through an arcuate slot 55 in the drive casing 56 and the latter may be provided with graduations and numbers designating the number of copies to be retained intact in each separated group so that when the pointer 57 is arranged opposite a number corresponding to the number of form sheets required in the group the continuous strip will be separated with this designated grouping.

With the ratchet control mechanism shown in Figures 5 and 6 the hand control disc 37 may be eliminated if desired, but it may be found particularly advantageous when extremely short form sheets are required to be individually separated successively from the continuous strip.

It is desirable to provide for the stopping of the machine immediately following each separating operation and this may be accomplished in a very simple manner as follows.

A rocker shaft 58 is mounted for oscillation in the frame 1 and carries a mercury tube switch 59 disposed in series with the lead 60 of the motor supply circuit, which lead also preferably includes a manual control switch 61.

The cam 43 is provided with an offset concentric portion 62 and having a notch 63 in the periphery. A bar 64 is mounted in the frame 1 for sliding displacement radially of the cam axis toward which it is biased by the spring 65 with its end 66 riding on the periphery of the cam 62. The notch 63 is so placed in relation to the raised cam portion 44 that the end 66 of the bar enters the notch immediately after the cam portion 44 has swung the arm 32 into sheet-detaching position, as illustrated in Figure 9.

The bar 64 is operatively connected with the shaft 58 in any suitable manner, here shown by means of a radial pin 67 engaging a notch 68 in the bar. Upward movement of the bar thus locks the shaft and tilts the mercury tube switch to break the motor circuit.

In order to again initiate operation of the machine a small lever 69 (Figure 10) is secured to the end of the rock shaft 58 so that by temporarily pressing on a button end 70 the motor circuit will be closed and further rotation of the cam 62 will carry the notch 63 out of alignment with the bar end 66 so that the machine will

continue to operate until the notch 63 again registers with the end 66.

In certain cases it may be desired to operate the machine continuously without stoppage at the end of each operation and for this purpose a finger latch 71 is arranged to be swung into interlocking relation to the lever 69 to retain the same depressed.

A mechanism such as described will function rapidly with precision and will eliminate the tedious time-consuming task of separating the continuous form strip into sheet or multiple sheet form. Moreover there will be no danger of the operator being injured by contact with the feed rollers due to the presence of the slip clutch drive and the fact that the upper rollers simply rest lightly on the main feed roller.

It will be readily appreciated that while we have shown a specific form of mechanism for carrying out the separating operation, many structural variations may be resorted to within the essential spirit of the invention.

What we claim as our invention is:

1. In a device of the class described for co-operation with a continuous strip of forms separable the one from the other and having means for advancing said continuous strip, means arranged in the path of travel of said strip at one edge portion only for imparting an accelerated rate of travel to an advance portion of said strip as the adjacent rearward portion of said strip is advanced at a normal rate to effect the detachment of said advance portion, and means for continuously advancing the rearward portion of said strip during the entire sheet-separating operation to provide for continuous uninterrupted operation.

2. In a device of the class described for co-operation with a continuous strip of forms separable the one from the other, means automatically operable to separate said strip repeatedly into units of one or more sheets, said means including means dependent on the advance movement of said strip for applying pressure edgewise on the advance sheet or sheets to first impart an initial separating influence, means for continuously advancing said strip of forms to the separating zone, and means for completing said separation during the uninterrupted advance of said strip.

3. Mechanism as claimed in claim 2 in which the means for imparting said initial separating influence comprises stationary guide means engageable with the side edge of an advance portion of the strip for deflecting the same edgewise out of alignment with the rearwardly disposed portion as the strip is advanced to commence separation at the edge.

4. In a device of the class described for co-operation with a continuous strip of forms separable the one from the other and having means for advancing same means operable to selectively separate said strip repeatedly into units of one or more sheets as the strip is advanced, including rotary separating means frictionally engageable with the continuous strip, means for driving said rotary separating means at such a rate as to impart an accelerated separating influence on the engaged portion of the strip relative to the rate of advance of said strip, and means for continuously advancing said strip in a continuous uninterrupted manner during the separating operation.

5. In a device of the class described for co-operation with a continuous strip of forms sep-

arable the one from the other, means automatically operable to separate said strip repeatedly into units of one or more sheets, including rotary separating means frictionally engageable with the continuous strip, means for driving said rotary separating means at such a rate as to impart an accelerated separating influence to the engaged portion of the strip, and means for controlling said rotary separating means to predetermine the separating of said continuous strip into units of one or more sheets.

6. In a device of the class described for cooperation with a continuous strip of forms separable the one from the other, means for advancing said continuous strip, and means arranged in the path of travel of said strip for automatically detaching units of one or more sheets from the advance end of the strip as the latter is in motion, including frictional separating rollers at least one of which is driven with a peripheral speed faster than the lineal rate of advance of said strip and between which said strip is adapted to pass, means mounting one of said rollers for displacement toward and away from the other roller to effect frictional gripping relation with the strip, and means operating in timed relation to the rate of advance of said strip for effecting the displacement of said roller at predetermined intervals.

7. Mechanism as claimed in claim 6 in which manually controlled means is provided for retaining said displaceable roller in pressure relation to the other roller to effect separation of each successive sheet from the strip.

8. In a device of the class described for cooperation with a continuous strip of forms separable the one from the other, means for advancing said continuous strip, and means arranged in the path of travel of said strip for automatically detaching units of one or more sheets from the advance end of the strip as the latter is in motion, including frictional separating rollers at least one of which is driven with a peripheral speed faster than the lineal rate of advance of said strip and between which said strip is adapted to pass, means mounting one of said rollers for displacement toward and away from the other roller to effect frictional gripping relation with the strip, means for controlling said roller-mounting means to predetermine the separating of said continuous strip into units of one or more sheets selectively, including cam means co-operatively associated with said roller-mounting means, a motion-transmitting means co-operatively interposed between said strip-advancing means and said cam for causing same to periodically displace said roller-supporting means to move the roller into sheet-separating relation to the strip and the said other roller, and means for continuously advancing said strip during the entire sheet-separating operation to provide for continuous uninterrupted operation.

9. In a device of the class described for cooperation with a continuous strip of forms separable the one from the other, means for advancing said continuous strip, and means arranged in the path of travel of said strip for automatically detaching units of one or more sheets from the advance end of the strip as the latter is in motion, including frictional separating rollers at least one of which is driven with a peripheral speed faster than the lineal rate of advance of said strip and between which said strip is adapted to pass, means for continuously advancing said strip during the entire sheet-sep-

arating operation to provide for continuous uninterrupted operation, means mounting one of said rollers for displacement toward and away from the other roller to effect frictional gripping relation with the strip, means for controlling said roller-mounting means to predetermine the separating of said continuous strip into units of one or more sheets selectively, including a rotary cam having a cam portion to engage the roller mounting and displace the roller into engagement with the strip, and ratchet drive means interposed between said cam and the said strip-advancing means for operating the cam in accurately timed relation to the latter.

10. In a device of the class described for cooperation with a continuous strip of forms separable the one from the other, means for advancing said continuous strip with a continuous uniform motion, and means arranged in the path of travel of said strip for automatically detaching units of predetermined length from the advance end of said strip, including ratchet drive means operatively connected with and actuated by said strip-advancing means, and means for controlling the rate of operation of said ratchet drive means to variably delay the operation of said detaching means independent of the rate of operation of the said strip-advancing means to control the length of the portion separated from the strip.

11. In a device of the class described for cooperation with a continuous strip of forms separable the one from the other, means for advancing said continuous strip with a continuous uniform motion, and means arranged in the path of travel of said strip for automatically detaching units of predetermined length from the advance end of said strip, including ratchet drive means operatively connected with and actuated by said strip-advancing means, said ratchet drive means including an oscillatable arm actuated by said strip-advancing means, a toothed wheel, a pawl on the arm engageable with the toothed wheel means actuated by said toothed wheel for controlling said detaching means, and adjustable means co-operative with said pawl to vary its effective range of travel.

12. In a mechanism of the class described, an electric drive motor, roller drive means for advancing a continuous strip of separable forms, a drive connection between said motor and roller drive means, means operatively connected with and actuated by said roller drive means for repeatedly separating said sheets from the continuous strip in units of predetermined length, and means co-operatively associated with said sheet-separating means for breaking the current supply to said electric drive motor immediately after a separating operation, said latter means including a member manually operable in one direction independent of said sheet-separating means to re-direct current to said motor to initiate operation of the machine.

13. In a sheet-separating mechanism for continuous strip, a main driven roller, a pair of rollers resting on said main roller, and about which the strip is adapted to be passed in substantial S formation above but contacting the upper surface of the main roller, and guide plates of semi-cylindrical form embracing said second-mentioned rollers and arranged to automatically direct the advance edge of the continuous strip in an S-shaped path thereabout, a guide plate extending from the upper periphery of the upper roller, and a tangential-like extension from the

guide member of the upper roller overlapping said guide plate to direct the continuous strip thereover.

14. In a device of the class described for co-operation with a continuous strip of forms separable the one from the other, of means for advancing said continuous strip, and means arranged in the path of travel of said strip for automatically detaching units of one or more sheets from the advance end of the strip as the latter is in motion, including frictional separating rollers at least one of which is driven with a peripheral speed faster than the lineal rate of advance of said strip and between which said strip is adapted to pass, means mounting one of said rollers for displacement toward and away from the other roller to effect frictional gripping relation with the strip, a rotary cam having a cam portion to engage the roller mounting and displace the roller into engagement with the strip, ratchet drive means interposed between said cam and the said strip-advancing means for operating the cam in accurately timed relation to the latter, said roller-mounting comprising a rocker arm carrying the roller and having a contact portion arranged for engagement with the cam, and a manually rotatable disc having notches to selectively register with said contact portion, one of said notches being deeper than the other to permit operative engagement of said contact portion with the cam and the other notch being adapted to accommodate said contact member to hold said arm with the roller in sheet-separating relation to the other roller whereby each sheet will be detached from the strip separately.

15. In a device of the class described for co-operation with a continuous strip of forms separable the one from the other along regularly spaced weakening lines disposed between and defining the lengths of the individual forms, means for advancing said continuous strip, means operable during the advance movement of said strip to selectively separate said strip along said weakening lines repeatedly into units of one or a consecutive series of more than one sheet including pre-selecting means manually setttable to cause said latter means to automatically and repeatedly separate a plurality of equally numbered units consecutively at each setting along predetermined ones of said weakening lines.

16. In a device of the class described for co-operation with a continuous strip of forms tearable the one from the other and having means for advancing said continuous strip, and means

arranged in the path of travel of said strip for automatically tearing single sheet units from the advance end of the strip as the latter is in motion, the combination therewith of manually setttable pre-selecting control means co-operatively associated with said last-mentioned means for withholding the normal operation thereof for predetermined periods to effect tearing of said strip automatically and repeatedly into a plurality of units each of more than one sheet at each setting during the normal advance movement of the said strip.

17. In a device of the class described for co-operation with a continuous strip of forms separable the one from the other, said device having means for advancing said strip, and means arranged in the path of advance of said strip for imparting a main separating influence to the advance form sheets, channel-shaped guide plates angularly disposed in a direction from edge-to-edge of the main portion of the strip to receive and engage the side edge of the strip and deflect the advance sheets edgewise as they are advanced toward the means for imparting the main separating influence to facilitate the latter in its separating function.

18. A device as claimed in claim 14 in which means is provided for indicating the adjustment of said adjustable means in terms representative of the number of sheets in the portion of the continuous strip to be detached.

19. In a mechanism of the class described, an electric drive motor, roller drive means for advancing a continuous strip of separable forms, a drive connection between said motor and roller drive means, means operatively connected with said roller drive means for repeatedly separating said sheets from the continuous strip in units of predetermined length, means for breaking the current supply to said electric drive motor immediately after each separating operation, means for manually re-directing current to said motor to initiate operation of the machine, said means for breaking the motor supply circuit including a rock shaft having a mercury tube switch thereon, a cam actuated in timed relation to said roller drive means, means operatively connected with the rock shaft and operatively engaging said cam, means for manually rocking said shaft independent of the cam operation, and means for latching said shaft in switch-closing position for continuous operation.

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