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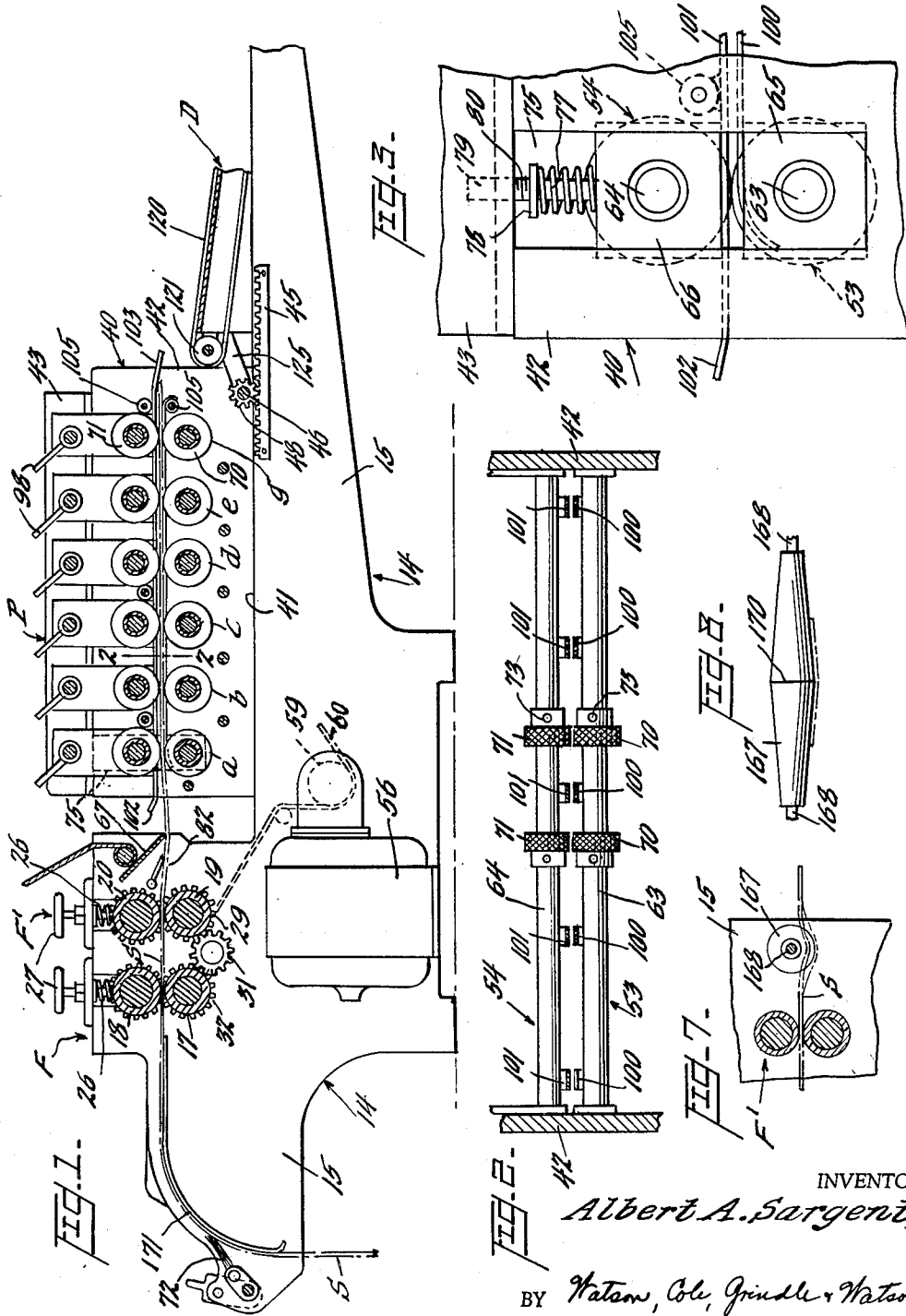
A. A. SARGENT

3,135,446

STRIP SEVERING MACHINES

Filed Jan. 21, 1963

2 Sheets-Sheet 1



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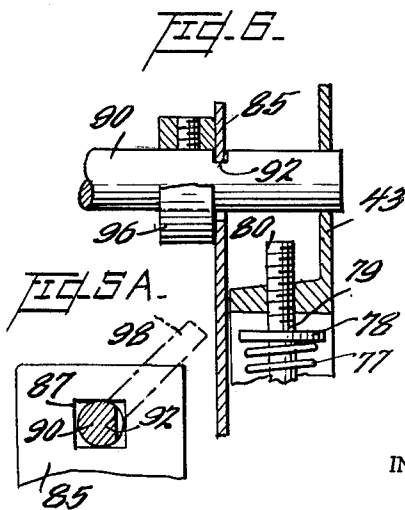
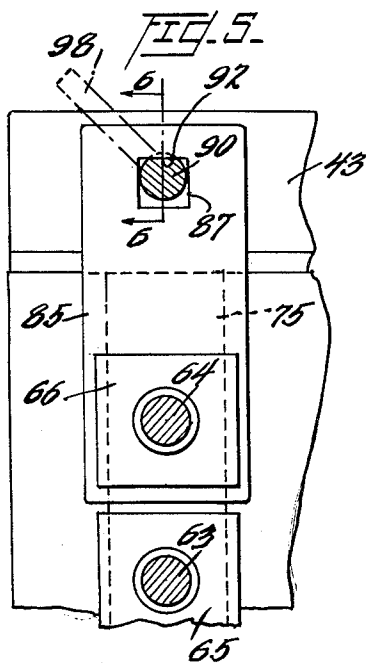
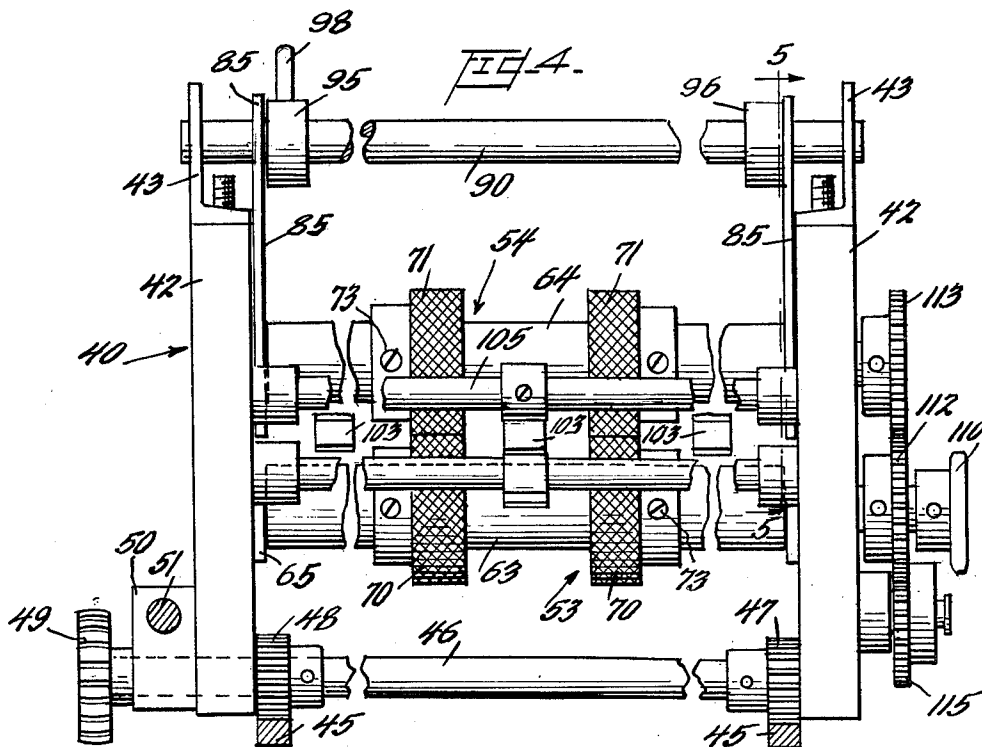
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STRIP SEVERING MACHINES

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This invention relates to web feeding and severing machines by which webs or strips of paper or similar material may be severed into units consisting of sheets or units of predetermined length.

Machines of this general type have been produced and used before this time, and have been variously denominated strip severing devices, sheet detachers, sheet bursters, and other designations. Devices of this character have been most commonly used in connection with feeding, imprinting, separating, and collating manifold or record strips of various kinds and have greatly facilitated the separation of such strips or webs—usually in multifold assemblies—into individual units, the strips usually being severed along pre-formed transverse longitudinally spaced lines of perforations. Examples of prior machines of this basic type are shown and described in United States Patent 2,513,093, granted June 27, 1950, to Louis F. Hageman, and United States Patent 2,778,424, granted January 22, 1957 to Louis F. Hageman and Carl R. Mabon.

The general object of the present invention is to provide a strip severing machine which is constructed and operated under the same broad principles as those disclosed in the above mentioned patents, but which embodies novel and improved features which increase the versatility of the device and among other improvements adapts the machine admirably to the efficient and safe handling of paper strips and webs of tissue, or other light-weight papers, or of webs of ordinary weight but running at higher speeds than usual.

In the operation of the continuous forms detachers which are the subjects of the above mentioned patents, feeding devices including a set of feeding and restraining rollers serves to feed the successive leading edges of a strip beneath a breaker blade, and then up an inclined slide to a second set of rollers which are driven at a speed substantially faster than that of the first set of feed rollers. When the lead edge of the strip enters the bite of the high speed snatch rollers the strip is pulled taut against the restraint offered by the first set or sets of feed rollers and brought sharply up against a severing blade, whereupon the end form or sheet is severed, usually along a prepared line of cross perforations.

The mechanisms of these patents are quite effective for most purposes where cardboard or paper of average weight is involved or when exceptionally high speeds of operation are not demanded. However, these arrangements require that the single set of high-speed pull or snatch rollers be adjusted so as to be spaced from the breaker blade a distance approximately equal to the required form depth. For a three inch form the high speed roller frame is positioned quite close to the breaker blade. For the very commonly used eleven inch form depth, the high speed roller frame is moved away from the breaker blade and the lead edge of the strip is pushed up the inclined slide surface approximately eleven inches before it is grasped by the pull roller.

To accomplish this object and other results which may appear as the description proceeds, the invention in its preferred embodiment contemplates the provision, instead of the single set of high speed snatch rollers, of a bank of several sets of high speed rollers positioned fairly close together with means for selectively adjusting the clearance between the upper and lower rollers of the sets

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from relative positions affording a very slight spacing, where the rollers are just out of contact, to positions where they are in positive feeding or pulling contact.

This arrangement has at least two advantageous results.

First, and possibly of lesser importance, the necessity for sliding adjustment of the pull or snatch rollers along the frame of the detacher may be of less frequent occurrence. If a short form is to be detached, one of the pairs of rollers nearer the detacher blade is set for positive contact and the other pairs are adjusted for just-out-of-contact arrangement, or in what is referred to in the industry as "kissing contact" with the form strip or sheets. If a strip of longer forms is being run, the near sets of rollers are positioned just out of pulling contact and one of the more remote pairs of rollers are brought into positive contact.

Another and probably more significant and important advantage lies in the guidance and protection of thin strips, or of any weight of paper under extraordinarily high speeds of operation, which is afforded by the invention. As mentioned above, the sets of rollers nearest the breaker blade are quite close to the latter, and in cases where the more remote rollers are in positive contact settings the intervening lengths of the strips are supported and guided by the preceding rollers. These rollers, set for mere kissing contact, do not exert sufficient pressure to pull or tear the form strip, but only a slight feeding action and an effective supporting and guiding action afforded by light frictional contact with the strip. This establishes a definite guide whereby the possibility of flutter of the leading end of the web, or of the leading end flying upward under the influence of air draft, is eliminated. It also makes unnecessary the inclined guide plate previously employed upon which the leading edge of the strip might "stumble" or buckle.

Other objects and features of novelty will be apparent from the following specification when read in connection with the accompanying drawings in which one embodiment of the invention is illustrated by way of example.

In the drawings:

FIGURE 1 is a somewhat diagrammatic view in longitudinal vertical section through a sheet detaching machine embodying the principles of the invention;

FIGURE 2 is a fragmentary transverse vertical sectional view taken on line 2—2 of FIGURE 1;

FIGURE 3 is a fragmentary view in side elevation upon an enlarged scale of the first unit of pull rolls in the bank of such rolls illustrated in FIGURE 1;

FIGURE 4 is an end view of the bank of pull rolls as viewed from the right-hand side of FIGURE 1;

FIGURE 5 is a vertical sectional detail view taken substantially on line 5—5 of FIGURE 4;

FIGURE 5A is a fragmentary view similar to the upper portion of FIGURE 5 but showing the manually operated roll-lifting mechanism in shifted position;

FIGURE 6 is a fragmentary sectional view taken on line 6—6 of FIGURE 5;

FIGURE 7 is a fragmentary view in vertical section showing an alternative embodiment of the device wherein a double-coned or crown roller is used instead of the cutting blade shown in FIGURE 1; and

FIGURE 8 is a fragmentary side view of the double-coned roller of FIGURE 7.

For a more detailed disclosure of the basic framework and operating means of this general type of detacher device, reference is made to the two patents mentioned above, but certain portions of the basic machine will be recognized in the present drawings wherein the general framework of the machine is designated by the numeral 14 and the individual side frames by 15. These side

frames are rigidly connected by certain transverse tie rods which are not shown in the present drawings.

The strip to be severed into individual components such as business forms, is designated S and is led into the machine from a suitable source of supply or from another operating unit over the curved strip guide member 171, the strip being guided and smoothed by means of bristle brushes 72 or other suitable means. The strip may be led directly to the feeding or restraining rolls of the present machine or more positively fed by a tractor pin device such as illustrated in Patent 2,778,424. At any rate, the strip S passes between the sets of feeding-in and restraining rolls indicated at F and F'. The forward pair of feed rolls comprises the lower roll 17 and the upper roll 18 and the more advanced pair comprises the lower roll 19 and upper roll 20. The shafts of the lower rolls 17 and 19 rotate in the side frames 15 and each carries at one of its ends a gear such as suggested at 29 and 32, these gears being operatively connected by an idler 31. On the opposite end of the shaft of roll 19 from the gear 29 is a driving sprocket (not shown but coincidental with the gear 29) which is driven by a drive chain 60 which also serves to drive other portions of the detacher and is itself driven by the sprocket 59 actuated by the electric motor 56 carried in the lower portion of the frame 14.

The adjusting hand wheels 27 serve to regulate the pressure of the upper feed rolls 18 and 20 to properly grip the strip S and feed it forwardly toward the breaker portions of the machine. The bearings of the upper roll shafts are urged yieldingly toward their operative positions by means of the springs 26, the pressure being regulated by the adjusting wheels or handles 27.

As fully explained in Patent 2,513,093 the cooperating feed rolls are provided with suitable facings to facilitate the gripping of the strips, the two lower feed rolls having continuous uninterrupted strip gripping surfaces throughout. However, the strip gripping surfaces of the upper feed rolls 18 and 20 are interrupted for non-registering circumferential areas for purposes fully described in the patent referred to. Thus, there will always be a feeding and restraining grip on the strip by one or the other, or both of the cooperating feed roll units.

Next in the line of travel of the strip S occurs the breaker or burster blade 67 which extends transversely of the path of strip feed and is carried in adjustably fixed position with respect to the frame. The blade is of angular construction as fully described in the patents mentioned so that the strip or web is brought against the angled blade with a tearing action preferably effected along lines of transverse perforations in the strip. Bristle-brush guides as shown at 82 may be provided to deflect the forward ends of the strips downward slightly as disclosed in Patent 2,513,093, if desired.

In the devices disclosed in the patents mentioned above the faster running snatch or pull rolls, of which there were provided only one pair, serve to draw the forward end of the strip S forward abruptly and bring the strip suddenly and forcibly against the severing blade 67 thus effecting the separation of the leading unit or form. This pair of snatch or pull rolls was adjustable through quite a range on the framework for different sizes of severable units and in order to guide a leading edge of the strip to the bite of these pull rolls an inclined guide plate or platform was provided. This proved quite adequate for the feeding of strips of form material of average weight and at limited speeds of operation.

However, they were found not to be suitable for the handling of extremely thin papers nor for running any weight of ordinary paper strips at greatly increased speeds of operation. Thus, by means of the present invention there has been provided a bank of a plurality of pull rolls such as indicated generally at P in the drawings.

This bank of rolls is provided with a sub-frame 40 which is mounted for sliding adjustment along the ledges 41 of the side frames 15 of the main frame 14. The sub-

frame 40 includes side frame members 42 upon each of which are mounted the upwardly extending angle frames 43.

The means of support of the sub-frame 40 upon the main frame 14 also include the racks 45 as best shown in FIGURES 1 and 4, and a pinion shaft 46 extends across the pull roll sub-frame 40 and carries adjacent its opposite ends the pinions 47 and 48 which rest upon and mesh with the racks 45. The shaft 46 extends beyond one of the side frames 42 and may be provided with a hand wheel as suggested at 49. A split clamping block 50 surrounds an end of the shaft 46, is fixed to one of the side frames 42, and is provided with a threaded operating screw 51 which causes it to grip the shaft 46 tightly and hold it in an adjusted position. This gripping means may be of any suitable type, for example, as suggested by the means illustrated in FIGURE 6 of the Patent 2,778,424. When the gripping arrangement 50, 51 is loosened, the shaft may be rotated by means of the hand wheel 49 and the pinions 47 and 48 rolled down the racks 45 in order to effect a micro adjustment of the position of the particular pull rolls selected for operative functioning.

The several pairs of pull rolls in the unit P are designated a, b, c, d, e, and g and they comprise in each case the lower roll sets 53 and the upper roll sets 54. Although within the purview of the present invention various types of gripping and feeding rollers may be employed, it has been found that those illustrated herein operate quite satisfactorily, each set of upper and lower rolls 53 and 54 comprising elongated transverse shafts 63 and 64 having their ends mounted in suitable bearing blocks 65 and 66, and carrying at intervals along their length the knurled rollers properly designated 70 and 71, these rollers being fixed at properly registering points along the shafts 63 and 64 as by means of the set screws 73.

As indicated at 75 in FIGURES 1, 3 and 5 the bearings 65 and 66 are mounted in vertical slots formed in portions of the side frames 42, which provides ease of installation and removal of the lower bearings 65 and also for the required vertical adjustment of the upper bearings 66 of the upper pull rolls 54.

The lower roll sets 53 are installed at the proper level with respect to the cutting blade 67 and need not be subject to vertical adjustment. However, the upper roll sets 54 which bear downwardly upon the lower rolls 53 to grip and pull the forward ends of the strip S are vertically adjustable within the slots 75. Normally the upper bearing blocks 66 are urged downwardly, so that the upper rolls 54 serve to cooperate with the lower rolls 53 to grip the strip, by means of the coil springs 77 which are seated between the bearing blocks 66 and the shoulder 78 on the vertical adjusting shaft 79, the upper end of the shaft being adjustably threaded at 80 into a similarly threaded opening in the bottom flange of the upper framing 43.

The means for raising selected upper pull rolls 54 from operative pinching or gripping contact with the lower rolls 53 will now be described. Adjacent each end of the roll shafts are the thin plate-like lifting elements 85, the lower portions being provided with squared openings adapted to receive the upper bearing blocks 66 and the upper portions having smaller squared openings 87 through which the eccentric lifting rock shaft 90 extends. Each shaft 90 is notched out as at 92 along a chordal line which gives that portion of the shaft an eccentric characteristic, the upper margin of the opening 87 in the lifter element 85 being aligned with the notch 92 and resting within the notch, as shown in FIGURES 5 and 6, when the upper roller 54 is in operative contact with the lower set of rollers 53.

The rock shaft 90 is provided with the fixed collars 95 and 96 positioned just inside of the lifting plates 85, the collar 95 having a handle 98 fixed thereto whereby the shaft 90 may be rocked from the operative position shown in FIGURES 5 and 6 to the position shown in FIGURE

5A where the upper surface of the opening 87 in the lifting plate 85 rests upon the fully cylindrical portion of the shaft 90 and thus the bearings, roll shaft, and upper rolls 54 are raised from gripping contact with the lower rolls 53 to the extent of the depth of the notch 92 which will relieve the strip S from gripping or pulling seizure and merely guide the strip through the series of pull rolls of like adjustment with light frictional contact only and thus exerting a supporting and guiding action on thin papers rather than a pulling action.

Of course, one of the sets of pull rolls *a, b, c, d, e* or *g* is adjusted for gripping contact depending upon the length of the form or severable unit desired. For example, for the maximum length of form to be detached from a thin paper strip or web S, the set of rolls *g* would be lowered by manipulation of the appropriate handle 98 to form gripping contact with the lower roll and all the other sets *a, b, c, d,* and *e* would be adjusted for only "kissing" contact for merely lending support to the sheet or web as it passes along to the ultimate pull roll set *g*. Of course, for varying shorter lengths of form units to be severed any selected one of the roll sets *a, b, c, d,* and *e* can be positioned for gripping contact and the remaining rolls exerting only a supporting and light frictional forwarding function. Even for extremely short lengths of severable units with the set of pull rolls *a* in gripping action the relieved sets *b, c, d, e* and *g* would serve as a guiding and frictionally forwarding means for the severed sheets.

To aid in maintaining the forms in proper alignment during the passage through the bank P of roll banks, further guiding means are provided in the form of the transversely spaced mating strips 100 and 101. The upper strips 101 may have bent lead-in ends as shown at 102 in FIGURES 1 and 3 and also downwardly bent delivery ends suggested at 103 in FIGURE 1. These guide strips 100 and 101 are secured to transverse supporting rods 105 extending from one of the side frames 42 to the other.

Suitable means are provided for driving the upper and lower rolls 53 and 54 of the pull roll series. Upon one of the roll shafts, for example, the lower roll shaft of the pair designated *a* there may be mounted a sprocket 110 as indicated in FIGURE 4 of the drawings and just inwardly of this sprocket can be pinned a gear 112 which meshes with a gear 113 pinned to the shaft 64 of the corresponding upper roll set 54. Between each of the sets of pull rolls *a—g* inclusive there are provided idler gears as indicated at 115 in FIGURE 4, these gears being mounted on stub shafts secured in one of the side frames 42. Thus the chain of driving action is carried along the pull roll installation P from one set to the other. The chain 60 of course as it leaves the sprocket carried by the shaft of the lower feed roll 19 may be led to the sprocket 110 therefrom.

The amount of lift given the upper rolls and their gears is not sufficient to draw the latter out of mesh with the corresponding lower roll gears.

At the delivery end of the pull roll bank P the sheets may be discharged upon any sort of delivery arrangement, such as might be afforded by the belt conveyor designated D, this installation being supported in any suitable way from the main pull roll frame 14 and including tapes 120 trained around rollers such as shown at 121. Preferably the receiving end of the delivery frame D should be positioned adjacent the discharge of the pull roll bank P and for this purpose the delivery unit D may be suspended from the shaft 46 of the unit 40 as by means of the brackets 125.

An alternative means for bursting or severing the sheets from the web is suggested in FIGURES 7 and 8 of the drawings where a double-coned or crown roller 167 is employed. This roller may be carried on a shaft 168 mounted in the side frames 15 immediately beyond the second set of feed rolls F' and the strip or web S is brought into contact with the double conical surface of the roller 167 by the appropriately set pull rolls in the

bank P, the tear being precipitated by the ridge 170 formed at the junction of the bases of the two conical sections of the roller 167. One or more of the rollers 167 may be provided.

It is understood that various changes and modifications may be made in the embodiments illustrated and described herein without departing from the scope of the invention as determined by the following claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In a sheet severing machine of the class described, combination: a supporting frame; at least one pair of cooperating strip feeding and restraining rolls on the frame between which a strip is fed; means for driving said rolls at a predetermined speed; a plurality of pairs of cooperating pull rolls disposed serially on the frame beyond said first named feeding and restraining rolls and between the rolls of which successive pairs the strip passes from said feeding and restraining rolls; means for driving all of said pull rolls at a speed greater than that of said feeding and restraining rolls; means for mounting the pull rolls of said respective pairs for relative movement between positive gripping positions with respect to leading portions of a strip and separated non-gripping positions; and means for selectively, individually and independently adjusting at will the mountings of said rolls of respective selected pairs of pull rolls to effect the positive gripping by such selected pairs of pull rolls spaced at different respective distances from said feeding and restraining rolls.

2. In a sheet severing machine of the class described, in combination: a supporting frame; at least one pair of cooperating strip feeding and restraining rolls on the frame between which a strip is fed; means for driving said rolls at a predetermined speed; a plurality of pairs of cooperating pull rolls disposed serially on the frame beyond said first named feeding and restraining rolls and between the rolls of which successive pairs the strip passes from said feeding and restraining rolls; means for driving all of said pull rolls at a speed greater than that of said feeding and restraining rolls; means for mounting the pull rolls of said respective pairs for relative movement between positive gripping positions with respect to leading portions of a strip, and positions wherein said rolls are very slightly spaced apart; means for selectively, individually and independently adjusting at will the mountings of said pull rolls of the selected pair to vary the bites between said rolls between positive gripping position and said slightly spaced-apart positions, whereby a selected pair of pull rolls grips the sheet at its proper distance from the feeding and restraining rolls while the remaining pull rolls exert merely a slight frictional brushing supporting contact with the strip.

3. The sheet severing machine as set forth in claim 2 in which the said pairs of pull rolls are mounted as a unit on the frame and means are provided for adjusting such unitary bank of pull rolls along said frame to effect further adjustment in accordance with the length of the sheet to be severed from the strip, in addition to the adjustment effected by the selection of the pair of pull rolls which are to grip the strip.

4. The sheet severing machine as set forth in claim 2 in which said pairs of pull rolls are mounted in a sub-frame supported upon said machine frame beyond said feeding and restraining rolls, the lower roll of each pair of pull rolls being rotatably mounted in a relatively fixed position on the frame, the upper rolls of each pair having axial shafts, vertically depending lifter elements having their lower ends operatively connected with respective shafts, and manually operated means for actuating said lifter elements to selectively raise and lower said upper rolls from and to gripping contact with a strip passing between them and the associated lower rolls.

5. The sheet severing machine as set forth in claim 4

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in which said lifter elements are provided with loops at their upper ends which surround the eccentric portion of a rock shaft rotatably mounted in the frame, handle elements on said rock shaft for rotating the shaft through an angle to cause the eccentrically formed portions thereof to raise said lifter elements and thus the upper rolls of the pairs of pull rolls, and spring means for urging said upper roll shafts and their rolls down into gripping contact with respect to the lower rolls, the upward urging

of the lifter members being in opposition to the influence of said spring means.

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