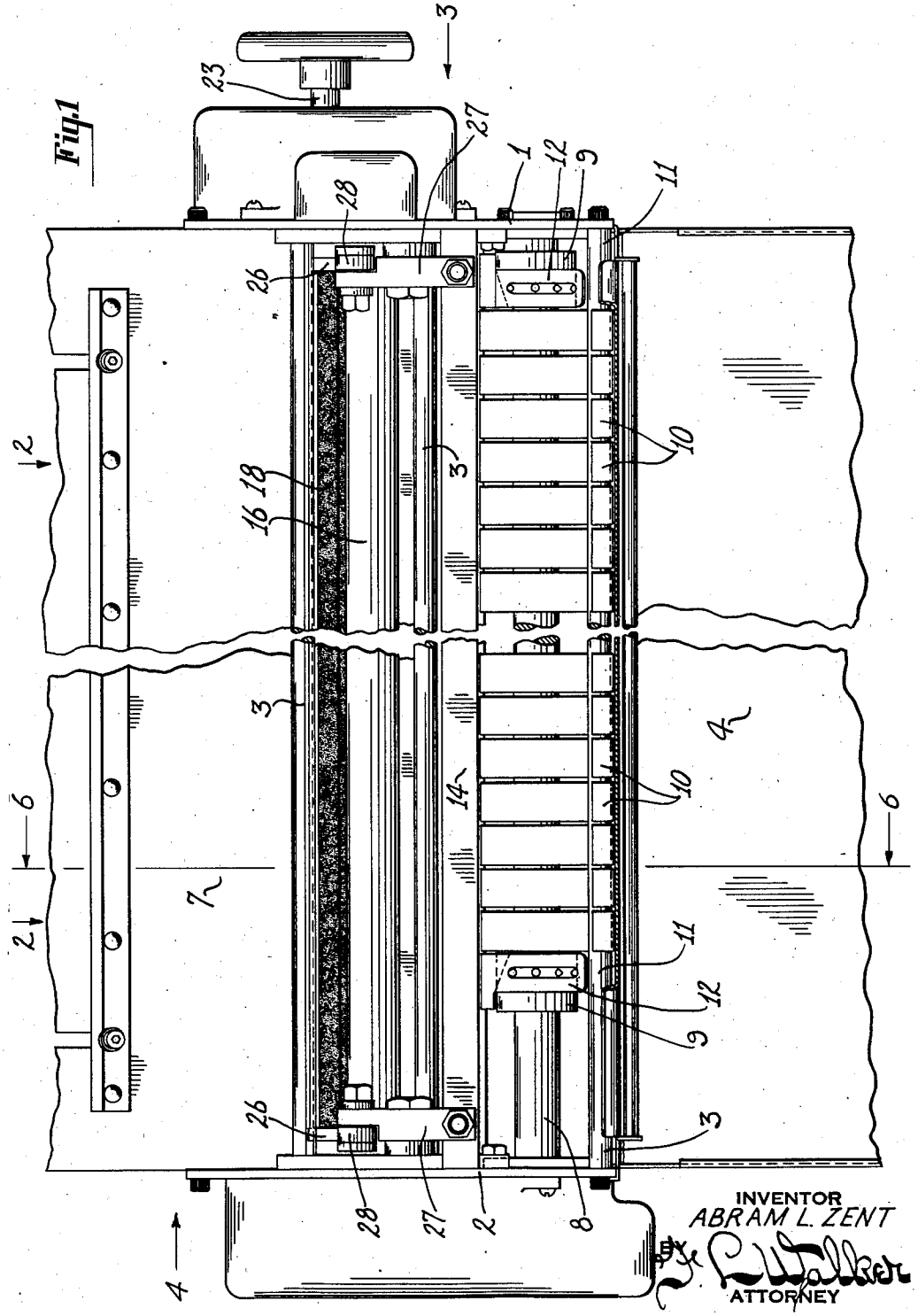
Aug. 15, 1944. A. L. ZENT 2,355,690

STRIP FEEDING AND BURSTING DEVICE

Filed Aug. 20, 1942 5 Sheets-Sheet 1

Fig. 1



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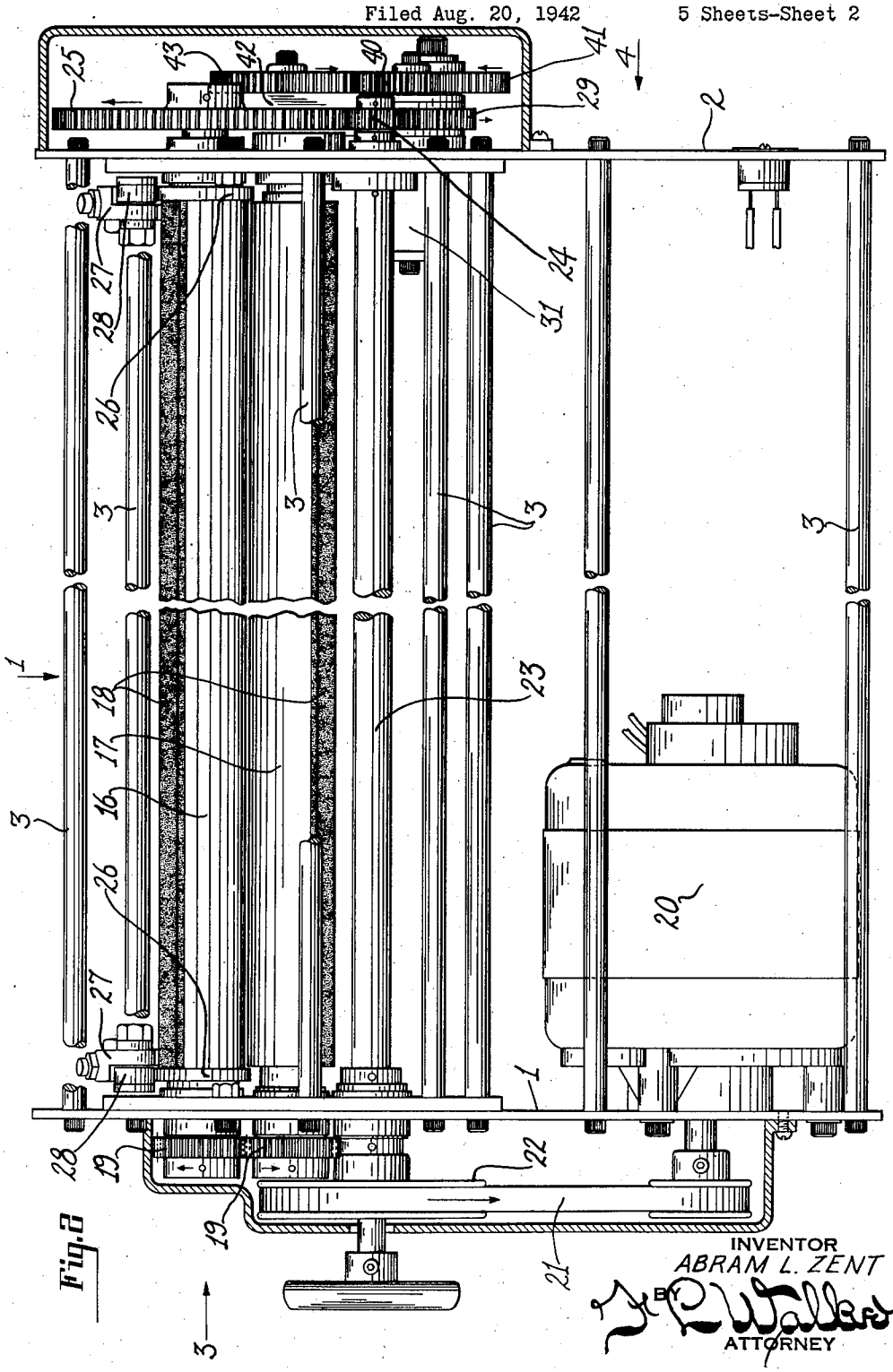

Fig. 2

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Fig. 3

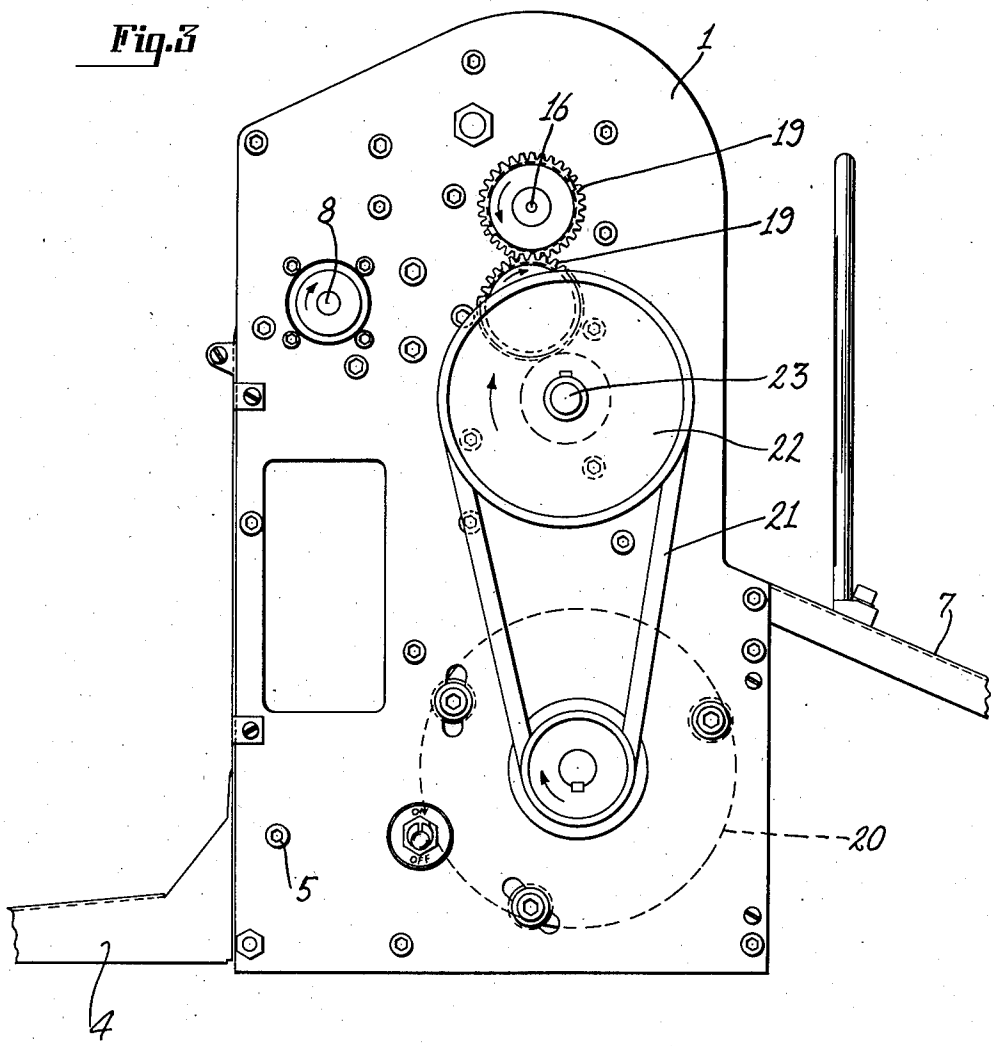

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Fig. 4

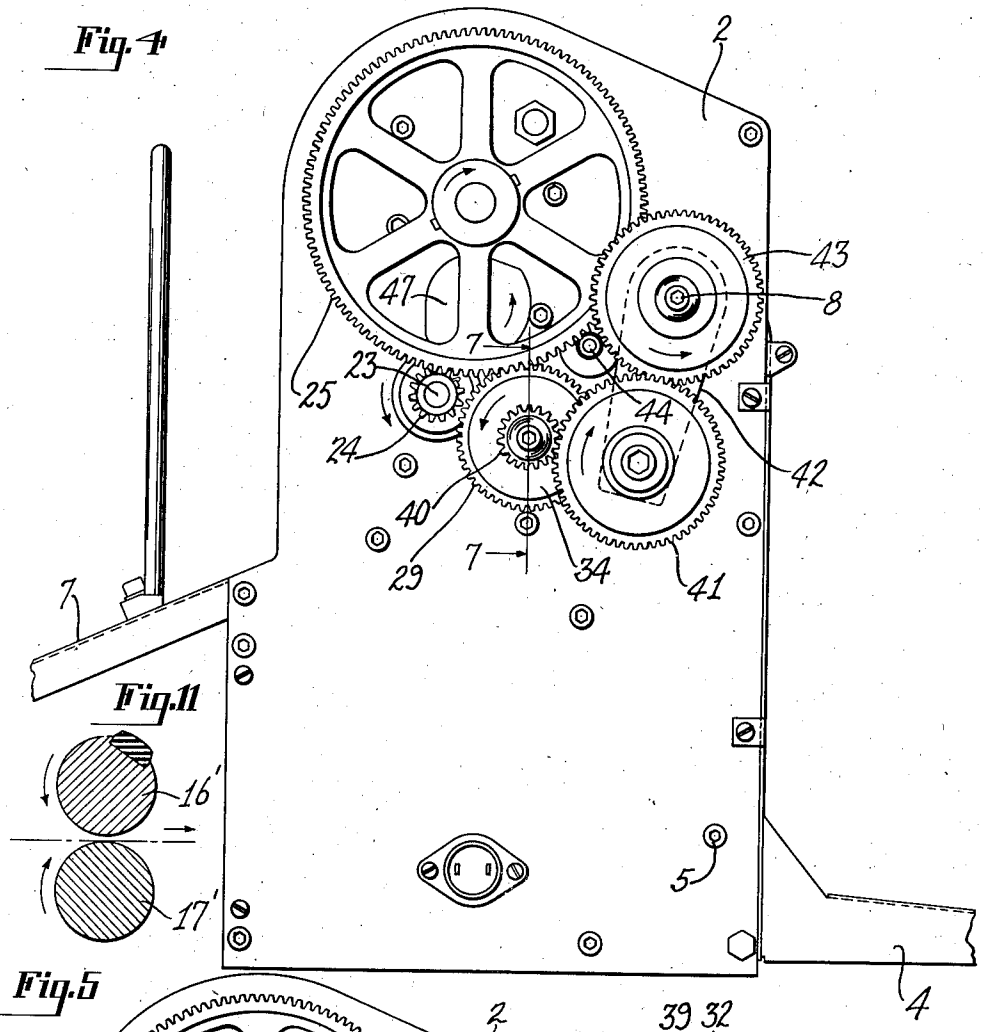

Fig. 11

Fig. 5

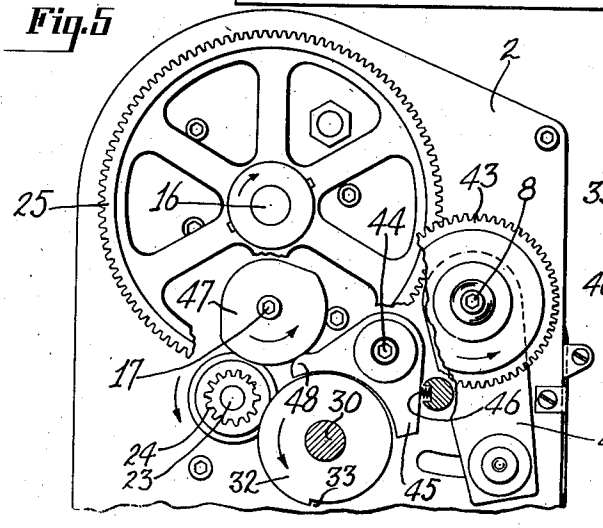

Fig. 7

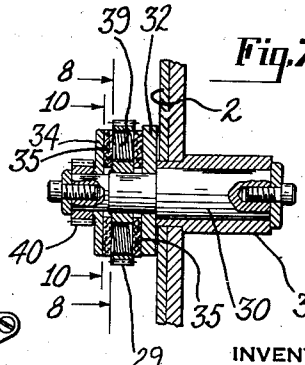

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Fig.6

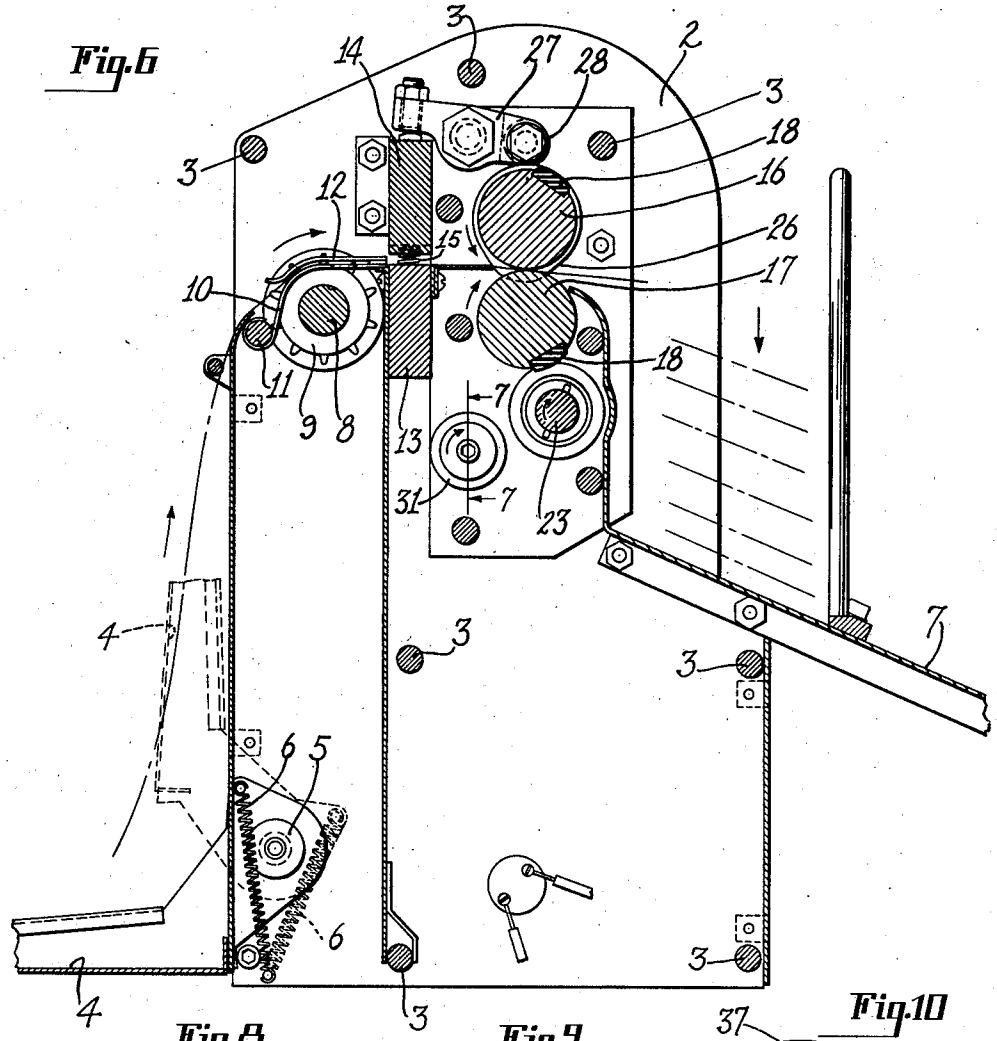


Fig.8

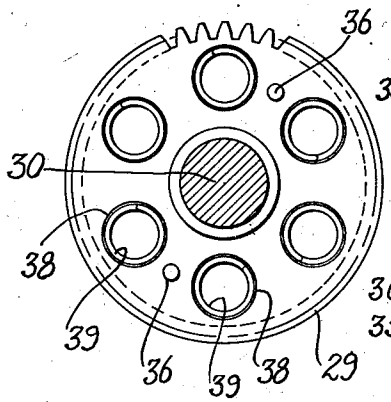


Fig.9

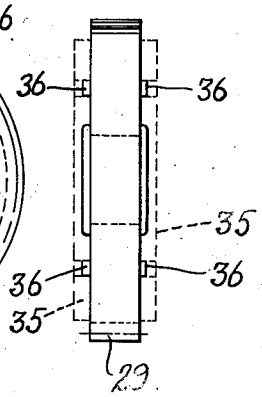
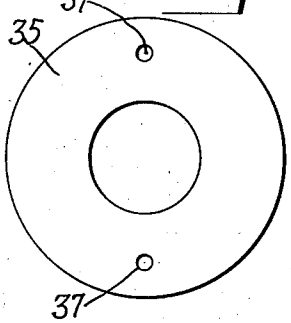


Fig.10



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Patented Aug. 15, 1944 2,355,690

UNITED STATES PATENT OFFICE

2,355,690

STRIP FEEDING AND BURSTING DEVICE

Abram L. Zent, Dayton, Ohio, assignor to The Standard Register Company, Dayton, Ohio, a corporation of Ohio

Application August 20, 1942, Serial No. 455,461

22 Claims. (Cl. 164—84.5)

This invention pertains to strip feeding and severing devices, and more particularly to an automatic bursting machine for progressively advancing a continuous strip of material past a severing position and successively dividing the strip transversely into individual sheets.

In the operation of modern business transaction, recording and billing machines, and other writing, imprinting and addressing apparatus, it is quite common practice to produce successions of legends, imprints, or messages at longitudinally spaced intervals upon continuous strips of stationery, and subsequently divide the strips into individual sheets, each bearing imprinted or written matter. For convenience in dividing the strips into sheets of uniform length, the strips are usually provided with longitudinally spaced transverse, scored or weakened division lines at uniformly spaced intervals.

The present apparatus is designed to automatically divide such strips at the prescribed intervals at a very rapid rate, by momentarily subjecting advanced portions of the strip to tensioning strain in excess of the tensile strength of a transverse weakened division line within the tensioned area, thus causing the strip to separate on such line.

The object of the invention is to improve the construction, as well as the means and mode of operation of strip feeding and severing mechanisms, whereby they may not only be economically manufactured and operated, but will be more efficient in use, automatic in operation, uniform in action, having relatively few operating parts, and be unlikely to get out of repair.

A further object of the invention is to provide a strip feeding and severing apparatus, which is of compact form, relatively small in size, and rapid in operation.

A further object of the invention is to provide an improved form of feeding means, by which the strip to be severed is intermittently advanced in timed sequence with the severing operation.

A further object of the invention is to provide an improved strip tensioning device and actuating means therefor.

A further object of the invention is to provide a strip feeding and severing machine having the advantageous structural features and inherent meritorious characteristics, and the mode of operation herein set forth.

With the above primary and other incidental objects in view as will more fully appear in the specification, the invention intended to be protected by Letters Patent consists of the features of construction, the parts and combinations thereof, and the mode of operation, or their equivalents, as hereinafter described or illustrated in the accompanying drawings.

In the accompanying drawings, wherein is shown the preferred but obviously not necessarily the only form of embodiment of the invention,

Fig. 1 is a top plan view of an assembled strip feeding and severing machine embodying the present invention.

Fig. 2 is a side elevation thereof viewed from the top of Fig. 1.

Fig. 3 is a side elevation from the left of Fig. 2.

Fig. 4 is an end elevation from the right of Fig. 2.

Fig. 5 is a detail view partly broken away of the gear driving train shown in Fig. 4.

Fig. 6 is a vertical sectional view.

Fig. 7 is a detail sectional view of the frictional drive clutch for the strip feeding means.

Figs. 8, 9 and 10 are details of the frictional clutch assembly shown in Fig. 7.

Fig. 11 is a detail view of a modification of the tensioning rollers.

Like parts are indicated by similar characters of reference throughout the several views.

Referring to the drawings, the frame of the machine comprises a pair of relatively spaced vertical end plates 1 and 2 rigidly interconnected with each other by transverse tie rods 3—3. At the front of the machine (right of Fig. 4 and left of Fig. 6) is a hinged tray 4 to receive a supply packet of strip material to be severed. The tray 4 is pivoted at 5 and provided with a helical tractile spring 6, the connection of which is movable to and fro past dead center position to hold the tray alternately in extended and retracted positions. At the opposite side of the machine is an inclined table 7 upon which are collected the individual sheets into which the strip is divided. Journaled in the end plates adjacent the front of the machine is a revoluble feed shaft 8, preferably, but not necessarily, carrying a pair of axially adjustable pin wheels 9 for engagement in marginaly punched holes in the strip to be severed.

While positive feeding of the strip is quite desirable, it is not essential and the shaft 8 may be provided with a friction feed roller or other strip engaging means. Intermediate the pin wheels 9 are a series of curved, flat guide fingers 10 mounted on a supporting shaft 11 in parallel offset relation with the pin wheel shaft 8. The guide fingers support the advancing strip intermediate the pin

wheels. Overlying each pin wheel is a slotted guide finger 12 by which the punched margins of the strip are held in engaging relation with the feeding pins.

Adjacent to the pin wheels 9 is a pair of vertically arranged clamp bars 13 and 14, between which the strip of stationery is progressively advanced by the pin wheels. The lower bar 13 is fixed in the frame with its top surface substantially coincident with the tangential plane of the pin wheels. The upper clamp bar 14 is mounted in vertical guides on the end frames for alternating motion toward and from the fixed clamp bar 13. Helical springs 15 intermediate the bars tend to elevate the upper bar 14 after each depression thereof. In spaced relation rearwardly of the clamp bars 13—14 is a pair of coacting cam rollers 16—17, each having a segmental resilient tenacious pad 18 of rubber or other analogous material.

The pads 18 project peripherally beyond the peripheries of the rollers through limited registering portions thereof and comprise interengaging cam faces. The rollers are interconnected by a pair of intermeshing gears 19 (at left of Fig. 2 and shown in Fig. 3) for unison rotation so that the pads 18 oppose each other with the strip of material interposed therebetween during a portion of each revolution. The relation of the rollers 16 and 17 is such that during a portion of their rotation their peripheries are separated sufficiently to permit the end of the strip material to be advanced freely therebetween simultaneously with its advancement relative to the separated clamp bars 13—14 by rotation of the pin wheels 9. Upon continued rotation of the rollers 16—17 the advanced portion of the strip is gripped in advance of a transverse division line between the tenacious pads 18. The clamp bar 14 is simultaneously depressed into gripping engagement with the strip back of the transverse weakened division line to momentarily snub the strip while the roller pads continue to exert pulling tension thereon. During this tensioning period, the strip feeding pin wheels 9 are momentarily arrested. The tension exerted upon the strip by the gripping segments 18 of the rollers against the resistance of the clamp bars 13—14 exceeds the tensile strength of the transverse weakened division line, then positioned intermediate the clamp bars and rollers, and the strip fails and separates along the preformed weakened division line.

The several cooperating parts are actuated in timed sequence by a driving motor 20 located in the bottom of the frame (Fig. 2) connected by a drive belt 21 with a pulley 22 on a driven shaft 23 journaled in the end frames and extending across the machine below the rollers 16—17. The drive shaft 23 carries at its right hand extremity, Fig. 2, a small gear pinion 24 which meshes with a large gear wheel 25 upon the shaft of the upper roller 17, to drive the roller at increased speed. (See Fig. 4.) The two rollers 16 and 17 are interconnected for unison rotation by the gears 19 at their left extremities, as viewed in Fig. 2, and as appears in Fig. 3. The upper roller 16 carries at each end for unison rotation therewith a rotary cam 26, which at each revolution engages one end of a medially pivoted rocker 27 mounted on the end frame. One end of the rocker is provided with a roller 28 with which the actuating cam engages. The opposite end of the rocker overhangs and bears upon the depressible clamp bar 14. The rocker 27 operates to depress the clamp bar 14 against the yielding resistance of its elevating springs 15 in timed relation with each rotation of the rollers. The depressed clamp bar grips the interposed portion of the strip to resist the tensioning influence of the rollers 16—17 as the pads 18 thereof engage the strip and tend to advance it against the resistance of the clamp bars.

The strip material is advanced step by step between the clamp bars and thence between the rollers intermediate the severing engagement thereof with the strip during succeeding cycles. The driving train for the feed shaft 8 derives its power from the large gear 25 on the upper tension roll shaft, which meshes with a gear pinion 29 loosely journaled on a revoluble stub shaft 30 journaled in a hub 31 which projects inwardly from the end frame 2. Fast upon the stub shaft 30 at the inner side of the gear 29 for unison rotation is a notched disc 32, having therein a peripheral notch 33. The gear 29 is operatively connected with the revoluble stub shaft 30 by a friction slip clutch of any suitable construction. For illustrative purpose, but without limiting the invention to the particular form of friction drive assembly illustrated, there is shown keyed upon the rotary stub shaft 30 at the outer side of the loose gear 29 a second disc 34. Interposed between the loose gear 29 and the respective discs 32 and 34 are friction discs 35, keyed to the gear for unison rotation by studs 36 on the gear which engages holes 37 in the friction discs 35. The gear 29 has therein a series of spaced holes 38, as shown in Fig. 8, in each of which is a helical expansion spring 39 which exerts its influence in opposite directions against the interposed friction discs 35 and thence against the discs 32 and 34 fast upon the shaft 30. The construction is such that the rotation of the gear 29 produces rotation of the stub shaft 30 so long as the latter is free to turn. However, upon arrest of the shaft 30 the gear 29 continues to rotate by slipping the friction discs upon the spaced discs 32 and 34.

Secured on the end of the stub shaft 30 for unison rotation is a small change gear pinion 40 with which meshes a gear member 41 carried by a swinging arm 42 pivoted concentric with the drive shaft 8. By swinging adjustment of the arm 42, the gear 41 may be intermeshed with interchangeable gears 40 of different size. The gear 41 meshes with a corresponding gear 43 upon the end of the feed shaft 8. By interchanging the gear 40 for others of different size, the speed of the feed shaft 8 and pin wheels 9 may be varied through a wide range to effect advancement of the strip through greater or less distance between succeeding severing operations.

To effect intermittent feeding operation and momentarily arrest the strip during succeeding tensioning and bursting periods, there is pivoted at 44 a bifurcated detent pawl 45, one arm of which extends in proximity to the periphery of the rotary disc 32, toward which it is pressed by a spring 46. The detent pawl 45 engages in the notch 33 to stop the rotation of the disc, and with it the stub shaft 30 and the feed shaft driving train. The detent is oscillated out of its engagement in the notch 33 to permit operation of the feed shaft driving train by a cam 47 on the lower tensioning roll shaft, as shown in Fig. 5. During each rotation of the tensioning roll 17 the cam 47 engages the detent arm 48 to disengage the locking pawl from the disc 32 and hold it disengaged during approximately half the cycle of operation, during which time the feed shaft and pin wheels are in motion and operate to ad-

vance the strip a distance determined by the ratio of the gears 40 and 43.

Instead of providing both rollers 16 and 17 with radially extended peripheral pads, either of the rollers may be uniformly circular, and the other roll only may be cammed sufficiently to periodically coact with the uniform cylindrical surface of the mating roller to grip the strip therebetween, as shown at 16' and 17' in Fig. 11.

From the above description it will be apparent that there is thus provided a device of the character described possessing the particular features of advantage before enumerated as desirable, but which obviously is susceptible of modification in its form, proportions, detail construction and arrangement of parts without departing from the principle involved or sacrificing any of its advantages.

While in order to comply with the statute the invention has been described in language more or less specific as to structural features, it is to be understood that the invention is not limited to the specific features shown, but that the means and construction herein disclosed comprise the preferred form of several modes of putting the invention into effect, and the invention is therefore claimed in any of its forms or modifications within the legitimate and valid scope of the appended claims.

Having thus described my invention, I claim:

1. A strip feeding and severing apparatus, wherein a continuous strip of material having a series of longitudinally spaced transverse division lines is advanced past a severing position at which succeeding portions thereof are subjected to pulling tension in excess of the tensile strength of a weakened division line within the tensioned area of the strip, including a continuous driving member, an intermittently operative strip feeding device, actuating means therefor, including a friction clutch, a locking detent for temporarily maintaining the strip feeding device idle while the driving member effects slipping of the frictional clutch, a pair of relatively movable clamp bars between which the terminal portion of the strip is advanced by the strip feeding device during periodic operation thereof, a pair of continuously rotating rollers beyond the clamp bars between which the terminal portion of the strip is advanced by the strip feeding device and brought to rest by the arrest of the feeding device, at least one of the rollers having a cam face cooperative with the other roller to grip the strip therebetween and tension the terminal portion thereof against the resistance of the clamping action of the clamp bars, a cam rotating in unison with the rollers, a rocker member actuated thereby, one end of which has operative engagement with one of the clamp bars to effect strip gripping action thereof to resist the tensioning influence of the rollers beyond the tensile strength of a weakened division line within the tensioned area of the strip, and tripping means operating in unison with the rotation of the rollers for disengaging the strip feeding detent to permit further operative action of the strip feeding device in synchronism with the rotation of the rollers and relative movement of the clamp bars.

2. A strip feeding and severing apparatus, wherein a continuous strip of material having longitudinally spaced transverse weakened division lines is advanced past a severing position and intermittently subjected to tensioning strain in excess of the tensile strength of a transverse division line thereof, intermittently operative strip feeding means for advancing the strip through successive step by step movements, a pair of relatively movable clamp bars between which the terminal portion of the strip is successively advanced, a pair of rollers located in the path of the strip beyond the clamp bars, the adjacent faces of the rollers being separated during a portion of their rotation to freely receive therebetween the advanced terminal of the strip, a cam area on at least one of the rollers cooperative with the other roller to grip the interposed portion of the strip during a portion of the rotation of the rollers to subject the strip to pulling tension which is resisted by the engagement of the clamp bars with the strip, and actuating means for operating the clamp bars in timed sequence with the rotation of the rollers.

3. A strip feeding and severing apparatus, wherein a continuous strip of material is progressively divided into individual sheets upon preformed longitudinally spaced transverse weakened division lines by subjecting succeeding portions of the strip to pulling tension in excess of the tensile strength of a transverse weakened line within the tensioned area, including an intermittently operative strip feeding device, intermittently operative strip clamping means for immovably gripping a portion of the strip advanced by the strip feeding device, and a pair of tensioning rollers beyond the clamping means, between which the terminal portion of the strip is advanced, a cam face on at least one of the rollers cooperative with the other roller to grip the interposed portion of the strip and subject it to pulling tension against the resistance of the clamping means, a continuously operating driving member common to the strip feeding device, the clamping means and the tensioning rollers, and means for effecting operation of the said parts in timed sequence.

4. A strip feeding and severing apparatus, wherein a continuous strip of material is progressively divided into individual sheets upon preformed longitudinally spaced transverse weakened division lines by subjecting succeeding portions of the strip to pulling tension in excess of the tensile strength of a transverse weakened line within the tensioned area, an intermittently operable strip feeding device, a clamp means additional to the strip feeding device intermittently engageable with the strip alternately with the operation of the strip feeding device, and a pair of tensioning rollers intermittently engageable with an advanced portion of the strip during the period of strip engagement of the clamping means and exerting tensioning influence thereon against the resistance of the clamping means in excess of the tensile strength of a division line within the tensioned area, and means for effecting strip feeding, clamping and tensioning action in predetermined sequence.

5. A strip feeding and tensioning apparatus, including a strip feeding device, a reciprocatory clamping member, a tensioning roller, a rocker member oscillated by rotation of the tensioning roller to effect reciprocation of the clamping member into engagement with the strip to resist tensioning influence of the roller, and a detent for temporarily arresting the strip feeding device in timed sequence with the clamping and tensioning operations.

6. A strip feeding and severing apparatus, including a strip feeding device, actuating means therefor, strip tensioning devices, for intermit-

tently tensioning a portion of a strip of material advanced by the strip feeding device beyond the tensile strength of the tensioned area of the strip, and an arresting device for the strip feeding device automatically controlled in synchronism with the strip tensioning devices for temporarily arresting the strip feeding device and subsequently releasing the same in alternation with the operation of the strip tensioning devices.

7. A strip feeding and severing apparatus, including a strip feeding device, actuating means therefor, power transmitting means, including a friction clutch, strip tensioning devices, arresting means for the strip feeding device, controlled by the strip tensioning devices for effecting operation of the strip feeding device alternately with the operation of the strip tensioning devices, the friction clutch being adapted to slip during periods of non-operation of the strip feeding device.

8. A strip feeding and severing apparatus, including a strip feeding device, a strip clamping member intermittently engageable with the strip, a strip tensioning roller operative against the resistance of the clamping member to tension an intermediate portion of the strip beyond the tensile strength thereof, and a rocker member controlled by the rotation of the roller to actuate the clamping member into engagement with the strip.

9. A strip feeding and severing apparatus, including a strip feeding device, a strip clamping member intermittently engageable with the strip, a strip tensioning roller operative against the resistance of the clamping member to tension an intermediate portion of the strip beyond the tensile strength thereof, a medially pivoted lever, a cam rotating in unison with the roller engageable with one end of the lever, the opposite end of which is pressed into engagement with the strip clamping member to actuate the clamping member into engagement with the strip.

10. A strip feeding and severing apparatus, including a strip feeding device, a strip clamping member intermittently engageable with the strip, a strip tensioning roller operative against the resistance of the clamping member to tension an intermediate portion of the strip beyond the tensile strength thereof, and a detent for the strip feeding device movable into and out of operative relation therewith in timed relation with the rotation of the tensioning roller, the construction and arrangement being such that the strip feeding device and the strip clamping and tensioning members are alternatively operative.

11. A strip feeding apparatus, wherein a continuous strip of material is advanced through successive step by step movements, a strip feeding device, actuating means therefor, including a revoluble shaft, a driving member loosely mounted thereon for independent rotation, friction clutch elements normally connecting the shaft and driving member for unison rotation but enabling independent rotation of the driving element when the shaft is held against rotation, a notched disc connected with the shaft for unison rotation and a detent engageable with the notched disc for temporarily arresting the rotation of the shaft.

12. A strip feeding and severing apparatus, wherein a continuous strip of material is advanced through successive step by step movements past a severing position, strip severing devices, a strip feeding device, actuating means for the strip severing device including a frictional slip connection adapted to normally drive the strip feeding device, a detent operable to arrest the strip feeding device, and control means therefor under influence of the strip severing devices for automatically engaging and disengaging the detent to effect operation of the strip feeding device alternately with operation of the strip severing devices.

13. A strip feeding and severing apparatus, wherein a continuous strip of material is advanced past a severing position at which it is tensioned beyond the tensile strength of the material, including a strip feeding device, a gripper engaging the strip to resist its advancement alternately with periodic advancement thereof by the strip feeding device, and a roller having areas of different radial extent relative to which the strip is advanced by the strip feeding device, the area of greater radial extent of which is engageable with the strip during the period of engagement thereof by the gripper to subject the portion of the strip intermediate the gripper and the roller to tension in excess of the tensile strength thereof.

14. A strip feeding and severing apparatus, wherein a continuous strip of material is divided into individual sheets by being successively tensioned beyond the tensile strength of the tensioned areas thereof, including a strip feeding device, strip tensioning means including a reciprocatory clamp bar, and a cam roller in relatively spaced relation along the path of travel of the strip relative to which the strip is advanced by the strip feeding device, and motion transmitting means for transmitting motion from the roller to the reciprocatory bar in timed relation with the advancement of the strip by the strip feeding device.

15. A strip feeding and severing apparatus, wherein a continuous strip of material is divided into individual sheets by being successively tensioned beyond the tensile strength of the tensioned areas thereof, including a strip feeding device, a reciprocatory clamp bar, and a rotary tensioning roller having faces of different radial extent, and common actuating means therefor and motion transmitting means for intermittently operating the strip feeding device to advance the strip through successive step by step movements, and for transmitting continuous rotary motion to the tensioning roller and intermittent strip engaging motion to the reciprocatory clamp bar alternately with the actuation of the strip feeding device, the faces of greater and less radius of the roller being positioned to engage the strip and subject it to pulling tension only during the period that the strip is engaged by the clamp bar and the strip feeding device is idle.

16. A strip feeding and severing apparatus, including an intermittently operable strip feeding device for advancing a strip through successive step by step movements, a strip tensioning device having intermittent engagement with the advanced terminal portion of the strip alternately with the operation of the strip feeding device and a clamping device engageable with the strip intermediate the points of engagement of the feeding and tensioning devices during the engagement of the strip tensioning device, the construction and arrangement being such that the advancement of the strip is arrested while being tensioned beyond the tensile resistance of a transverse weakened line in the portion of the

strip intermediate the tensioning and clamping devices.

17. A strip feeding and severing apparatus, an intermittently operable strip feeding device for advancing a continuous strip of material having longitudinally spaced transverse weakened lines through a step by step movement, a pair of rotary rollers having a peripheral speed greater than the speed of advancement of the strip by the feeding device, between which the terminal portion of the strip is advanced by the strip feeding device, at least one of the rollers having a segmental face coacting with the other roller to momentarily grasp the intermediate terminal portion of the strip and impart thereto an accelerated advance feeding impulse, and a vibratory clamp bar operated in timed relation with the rotation of the rollers to grip the strip and resist the accelerated feeding influence of the rollers thereon to tension an intermediate portion of the strip beyond the tensile strength of a transverse weakened line within the tensioned area of the strip.

18. A strip feeding and severing apparatus, including strip feeding device for advancing past a severing position a continuous strip of material having longitudinally spaced transverse weakened lines, a pair of spaced rollers operating at a peripheral speed greater than the lineal speed of the strip between which the terminal portion of the strip is freely advanced, at least one of the rollers having a segmental portion coacting with the other roller to grasp the intermediate portion of the strip and impart thereto an advance feeding impulse at an accelerated speed, a pressure bar intermittently engageable with the strip to momentarily resist acceleration of the speed thereof, and a cam rotating in unison with one of the rollers for actuating the pressure bar in one direction, and spring tension means for retracting the bar, the bar and rollers being effective to tension an intermediate portion of the strip beyond the tensile resistance of a weakened division line therein.

19. A strip feeding and severing apparatus, including an intermittently operative strip feeding device, a strip tensioning device operable alternately with the operative periods of the feeding device, a strip snubbing device disposed in advance spaced relation with the feeding devices and operable synchronously with the tensioning device to protect the feeding device from pulling influence of the tensioning device while an intermediate portion of the strip is tensioned beyond the tensile strength of a transverse weakened line included in the tensioned area, and actuating means for operating the strip feeding and tensioning devices in alternating sequence.

20. A strip feeding and severing apparatus, including a strip feeding device, a strip tensioning device operative alternately with periods of operation of the strip feeding device, a separate strip snubbing device disposed intermediate the strip feeding and strip tensioning devices operable in timed relation with the strip tensioning device to intermittently tension an intermediate portion of the strip beyond the tensile strength of a transverse weakened line within the tensioned area thereof, driving means for the several devices and interrupter means for periodically rendering the driving means ineffective to drive the strip feeding device.

21. A strip feeding and severing apparatus, including a strip feeding device, a strip severing device in spaced relation therewith and a pair of clamp bars disposed intermediate the feeding and tensioning devices and operative in timed sequence therewith to momentarily grip the strip and resist pulling influence of the tensioning device while a portion of the strip intermediate the clamp bars and the tension device is tensioned beyond the tensile strength of a transverse weakened line within the tensioned area thereof.

22. A strip feeding and severing apparatus, including a strip feeding device, a strip tensioning device and a vibratory clamp bar interposed between the feeding and tensioning devices for momentarily gripping a passing strip in timed sequence with the operation of the feeding and tensioning to protect the strip feeding device from the pulling influence of the tensioning device while a portion of the strip intermediate the clamp bar and tensioning device is tensioned beyond the tensile strength of a transverse weakened line within such area.

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