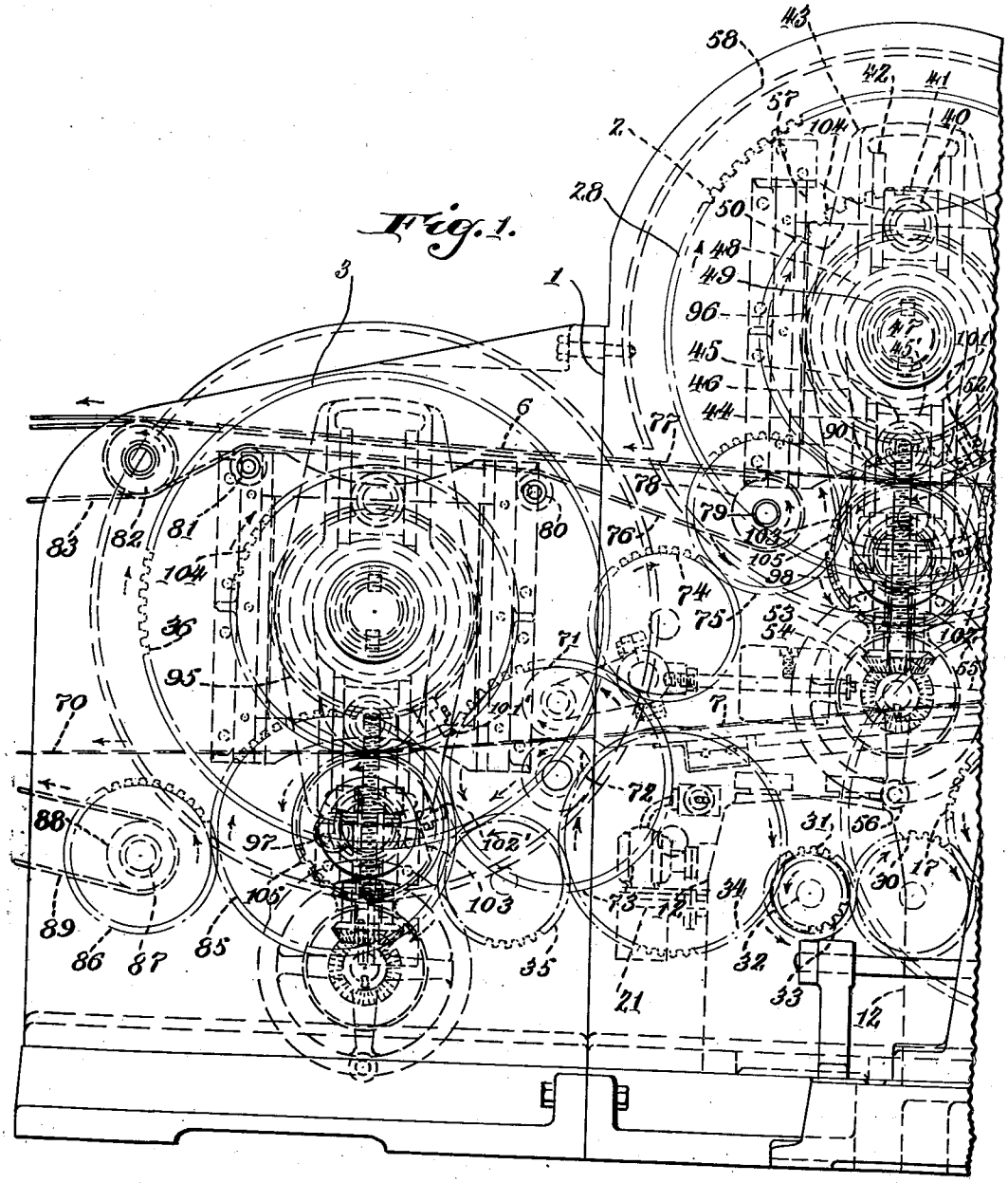
Dec. 26, 1939. H. B. GREENWOOD 2,184,522

WEB CUT-OFF

Original Filed Nov. 18, 1936 2 Sheets-Sheet 1

Fig. 1.



Witness

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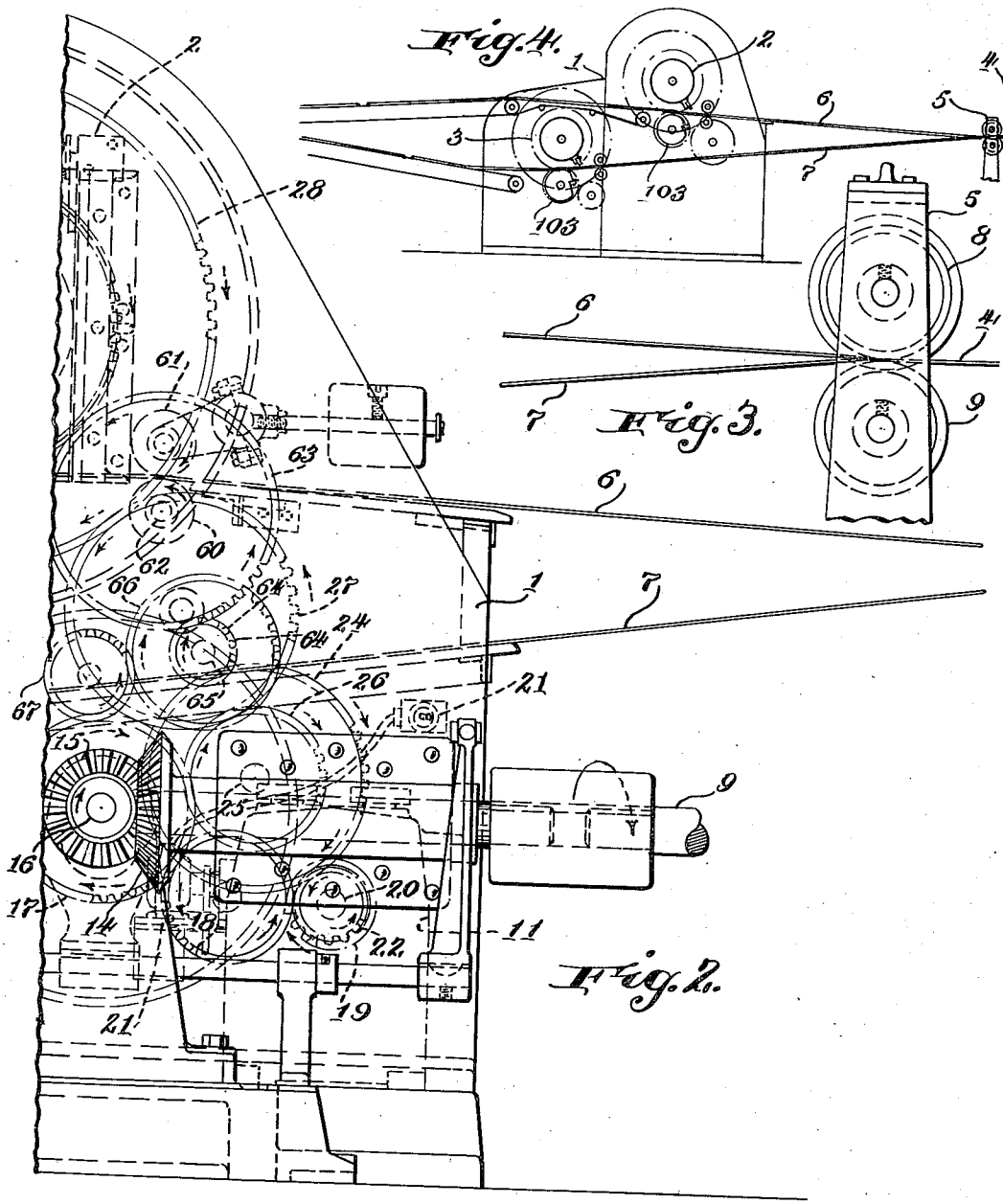


Fig. 2.

Fig. 3.

Fig. 4.

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UNITED STATES PATENT OFFICE

2,184,522

WEB CUT-OFF

Henry B. Greenwood, Glenarm, Md., assignor to F. X. Hooper Company, Inc., Glenarm, Md., a corporation of Maryland

Application November 18, 1936, Serial No. 111,395, Renewed June 3, 1939

8 Claims. (Cl. 164—68)

The invention relates to a machine for cutting sheets of adjustable lengths for any purpose from a continuous web, the object of the invention being to provide an improved cut-off mechanism for use in cutting sheets of adjustable lengths from a slitted web or from a plurality of webs. While the machine of the invention is operable with almost any material which may be presented in the form of a web, it is particularly adapted for use in cutting fiber board or corrugated paper board which comes directly to the cut-off mechanism from a fiber board machine or from a corrugator. At these corrugators and fiber board machines are most efficiently operated at a constant speed, the number of cutting cycles per unit of time is changed to determine the length of the sheets to be cut.

The machine of the invention being adapted for operation upon a plurality of webs is provided with a plurality of cutting heads and as these webs are generally in the existing practice formed by slitting a single main web they are fed at equal speeds in planes diverging from the point of slitting, and as it is often desirable to cut blanks of different lengths at the same time from the respective webs, these heads are driven at speeds which are independently adjusted as to the number of cutting cycles per minute, the width of the sheets being determined either by changing the width of the main web or the point at which it is slitted or both of these elements.

In accordance with the existing practice the cut-off mechanism is connected to the machine which produces the web to be driven in timed relation thereto and the elements of speed variation, i. e. variation of the number of cuts per minute, and the relative speed of the web determines the maximum and minimum cuts, i. e. the maximum and minimum lengths of the blanks to be cut. Between these lengths there is a medium cut which is so chosen that it may be said to represent the normal operation of the machine near which point the majority of cuts are made. In cutting this medium length blank the cutters move at constant speed throughout the cycle, the speed of the cutters being substantially equal to the speed of the web. When the length of the blank is changed to increase or decrease it from this medium cut the speed of the cutters may be changed within the cycle, to cause the cutting speed to conform substantially to the speed of the paper, as the number of cutting cycles per minute is changed to change the length of the blanks or the sheets being cut. In all these cutting operations the cutters and all other moving parts of the machine move in continuous rotation, the changes of speed when it is utilized being on one side or the other of a constant medium speed and therefore relatively slight. Further such changes are so gradual and uniform as to eliminate practically all vibration or shock which is incident to this cutting operation in the prior art machines.

A further object of the invention is to simplify the machine, reduce the number and complication of the parts, to synchronize the operation of the cutter heads, to increase the compactness of the machine both as to its longitudinal and upright dimensions and to make the cutter heads of substantially uniform construction and arrangement avoiding the production of right and left hand parts and making all parts of the respective heads interchangeable thus reducing the cost of production of the machine. It is of interest in this connection that the cutting heads which comprise large and small cutting cylinders are similarly arranged, i. e. both having the large cutters above, one cutting head having its small cutter between the two parts of the split web and the other cutting head which is immediately adjacent the first cutting head having its large cutter between the webs and its small cutter below the lower part of the split web, giving increased compactness and convenience of feed and delivery and greater simplicity of construction as compared to the previous machines.

A further object is to provide an efficient arrangement of the cutters between the divergent webs, the small radius cutter of one head being relatively near the point of slitting and the relatively large radius cutter of the other head also between the web and beyond the first said cutter in the direction of feed and of divergence, thus utilizing the space between the webs to the best advantage.

In the accompanying drawings, I have illustrated a multiple unit web cut-off mechanism for cutting a slitted web or a plurality of webs and embodying the features of the invention in the preferred form.

In the drawings:

Fig. 1 is a fragmentary side elevation of the cutting heads in operative relation.

Fig. 2 is a fragmentary elevation showing the infeed end of the machine looking in the same direction, the broken lines at the right in Fig. 1 and at the left in Fig. 2 being identically located in their relation to the elements of the machine.

Fig. 3 is a similar elevation of the slitting rolls at the right of Fig. 2 the broken line at the left

in Fig. 3 and at the right in Fig. 2 being identically located in their relation to the machine elements, and the webs being continuous through all three figures.

Fig. 4 is a side elevation on a reduced scale illustrating the general arrangement of the machine.

Referring to the drawings by numerals each of which is used to indicate the same or similar parts in the different figures, the machine as shown comprises side frames 1 on each side of the machine in which the cutter heads 2 and 3 and the other elements of the machine are mounted for operation as hereinafter described.

The main web 4 is fed from any convenient source which may be a fiber board machine or a corrugator or a machine for producing sheet metal or any other type of web or merely a feeding device for such a web. While the machine is adapted for cutting sheets or blanks of predetermined lengths from webs fed at a constant speed, it may also be used to cut similar sheets or blanks from a web fed at an adjustable speed. This web 4 may either be fed as a plurality of webs or in accordance with the prevailing practice, whereby a single main web 4 is fed to a slitting cutter 5 to be separated into two or more webs 6 and 7 which in the existing practice are of adjustable width, the slitting cutter 5 being movable or adjustable transversely of the web for this purpose.

In the form of machine shown, the slitting cutter 5 comprises upper and lower cooperating rotary cutters 8 and 9 the former being shown as grooved and the latter as entering the groove in the cutting operation.

As they leave the slitting cutter 5, the two webs 6 and 7 are separated and deflected, the one from the other, in diverging planes and led forwardly to the cut-off mechanism at any convenient and suitable angle dependent upon the vertical spacing of the bites of the cutter heads 2 and 3 and the spacing of the slitting cutter 5 from these heads. In accordance with the usual practice the cut-off mechanism is connected to the feeding source of the web to be driven therefrom and if the web is fed direct from a fiber board machine or a corrugator the main drive shaft 9 of the cut-off mechanism may be driven directly from such machine being connected to the driving mechanism for the delivery rolls of said machine or otherwise to give a constant speed ratio between the cut-off mechanism as a whole and the feed of the paper.

In the form of machine shown the cutter heads 2 and 3 are driven from the main shaft 9 through and by way of suitable change speed mechanism for which purpose in the machine illustrated a hydraulic drive is provided for each cutter head the hydraulic drive for the cutter head 2 being indicated by reference character 11 and the hydraulic drive for the cutter head 3 by reference character 12. The hydraulic drive 11 is driven at a constant determinable speed which is proportionate to the feed of the web 4 by any suitable connection to the shaft 9. As shown, this shaft is provided with a bevel gear 14 secured thereto and meshing with a bevel gear 15 on and secured to a transverse shaft 16 which is driven thereby. The shaft 16 carries secured thereto a toothed gear 17 which meshes with a gear 18, and this gear in turn meshes with and drives a toothed gear 19 secured to the drive shaft 20 of the hydraulic drive 11. The driven shaft of the hydraulic drive is in the form shown, in alignment with the drive shaft 20 and is driven at a speed which is varied in its relation to the speed of the shaft 20 by a suitable adjusting means 21 which may be a well known type of electric control for such a hydraulic drive. This driven shaft carries secured thereto a toothed gear 22. This gear 22 meshes with a toothed gear 24 secured to a shaft 25 which carries secured thereto a toothed gear 26 which meshes with a toothed gear 27 which in turn meshes with the large toothed gear 28 which operates the cutting head 2.

The cutting head 3 is driven in a similar manner from the hydraulic variable speed drive 12, this hydraulic drive or hydraulic gear 12 is driven from the gear 17 on the shaft 16 which meshes with a toothed gear 30 which in turn meshes with the gear 31 on the drive shaft 32 of the hydraulic gear. The driven shaft of the hydraulic gear which is in line with the shaft 32 carries a toothed pinion 33 which meshes with the gear 34 which meshes with pinion 35 which in turn engages and drives the drive gear 36 of the cutter head 3.

The change speed mechanism for changing the speed of the cutters within the cycle to cause the advance of the cutters to conform to the advance of the paper, such change being effected on each side of a predetermined medium speed at which the cutters rotate uniformly, is fully illustrated and described in U. S. Patent issued to this inventor August 25, 1936, #2,052,461. The details of the cutter heads being disclosed in this patent, and described and shown in more detail than herein, reference is had to the specification of said patent for such details.

The two cutter heads being identical in construction and operation, one only of these cutter heads need be described in detail. It may be of interest that in the form shown, the driving and driven gears of the hydraulic gear rotate in such relation that the speed of the driven gear is not only adjustable relatively to the driving gear but in the hydraulic gear 11 these gears rotate in opposite phase. As to the hydraulic gear 12, they rotate both in the same direction. The purpose of the hydraulic gear is one which is understood in this art, i. e., to change the number of cutting cycles per unit of time of the respective cutter heads which they operate, in order to determine the length of the sheets or blanks being cut.

The drive gear 28 of the cutting head 2 which is in all respects identical with the drive gear 36 of the cutting head 33 carries a roller or crank pin 40 which operates a sliding block 41 which engages radial way 42 in a rotary plate 43 and thus drives said plate in rotation. The plate 43 is provided with a second way or slot 44 shown in alignment with the way or slot 42. This way or slot 42 is engaged by sliding block 45' pivoted on a crank pin 45 carried by an arm 46 keyed to the upper cutter roll shaft 47 to operate the same. The plate 43 is provided with a hub or boss 48 having an opening 49 which is considerably larger than the shaft 47 which passes therethrough. This hub or boss 48 is encircled by a collar 50 which is adjusted vertically to change the center of the plate by means of a screw 52. On the shaft of this screw in the form shown there is a bevel gear 53 meshing with a bevel gear 54 which is secured to and operated by a hand wheel 55 having a handle or hand crank 56. In this connection it may be noted that the collar 50 is shown as of rectangular external

outline being mounted to slide in ways 57 suitably secured to the guard 58 or other portion of the frame.

In the operation of each cutting head for a medium cut the cutters move at a constant speed throughout each cutting cycle the plate rotating concentrically with shaft 47 but in the cutting of blanks or sheets which vary considerably from the medium cut in either direction, it is found advisable to increase the speed of the cutter at the point of cutting for relatively long cuts and to decrease its speed at this point for the relatively short cuts. This is accomplished in the form shown the bite of the cutter rolls being below the shaft 47, by shifting the center of the plate 43 upwardly from the middle position in which the cutter moves at a constant speed for the long cuts, and downwardly from this middle constant speed position for the relatively short cuts. It should be understood in this connection that in the normal or medium operation all the parts rotate about their centers at uniform speeds and when it is found desirable to shift the center of the plate from medium position the change of speed is relatively slight because of this medium constant speed position from which the adjustments are made in both directions, i. e. in one direction to increase the cutting speed and in the other direction to decrease it.

The upper long radius roll 96 carries a knife 101 which cooperates with a knife 102 on the lower short radius roll 98. In the second head 3 there is an upper long radius roll or cylinder 95 provided with knife 101' and a lower short radius cutter roll or cylinder 97 with a knife 102'. The cutting cylinders of each head are connected to operate in fixed and timed relation by intermeshing toothed gears 104 and 105 secured to the respective cutters or cutter rolls or cylinders.

The feed of the web 6 to the cutter head 2 is controlled by feed rollers 60 and 61 in Fig. 2 which rollers are operated at a speed which bears a constant ratio to the drive shaft 9 and the speed of the web 4. The lower roller 60 is mounted on a shaft 62 to which is secured a toothed gear 63 which is driven from a pinion 64 secured to a shaft 65 which also carries secured thereto a gear 66 meshing with a pinion 67 which is in turn engaged and driven by the gear 17 on the shaft 16 which is driven from shaft 9 as explained.

The cutting head 3 is provided with upper and lower feed rollers 71 and 72 engaging the lower web 7 and feeding it forwardly and presenting it to the cutting head 3. The lower roller 72 is driven from a toothed gear 73 secured to said roller or the shaft thereof and driven by a gear 74 which is in turn driven by a gear 75. The gear 75 is driven from a gear 99 meshing therewith, which gear in turn meshes with the gear 63 on the shaft 62 previously described as driven from shaft 9. Gear 75 operates delivery belts 76 which deliver the cut material 77 from the cutting head 2. These belts operate over pulleys 78 secured to the shaft 79 of the gear 75 and over supporting or guide pulleys 80 and 81. At their forward ends they pass about pulleys 82 which drive a second conveyor 83 to which the material is passed from the belts 76 to be carried forwardly to a point of final delivery.

The gear 73 also drives a gear 85 which meshes with and drives a gear 86 the shaft 87 of which carries pulleys 88 which drive conveyor belts 89 by which the cut material 78 is delivered from the cutting head 3 being dropped thereon after each cut, the operation being similar to the operation of belt 77 which receives the blanks from the cutting head 2.

It is of advantage that the cutting heads 2 and 3 are identical in form and arrangement and as to all their parts, all corresponding parts of the two heads being thus made interchangeable. It is also of advantage that the two cutting heads are arranged with the long radius cutter of each head above and the short radius cutter of each head below, the long radius cutting cylinder 95 of the cutting head 3 and the short radius cutting cylinder 98 of the head 2 being between the webs 6 and 7 with the short radius cutter 98 nearest the slitter 5 from which the webs 6 and 7 diverge so that the space between the webs is utilized to best advantage. In this arrangement both long radius cutters or cylinders 95 and 96 are above the webs 6 and 7 on which they operate, both the small cutting cylinders 97 and 98 being below the respective webs 6 and 7 on which they operate. It will also be noted that the angle between the webs 6 and 7 is determined by the spacing of the slitting cutter 5 from the cutting heads and may be fixed in accordance with the nature of the material to be cut.

It is further to be noted that this arrangement of the cutters or cutting heads is economical both as to vertical and horizontal dimensions and space consumed and that as thus arranged the machine is relatively simple of construction. The substantially uniform rotation of the parts in cutting with the smooth operation and lack of vibration gives an extremely long life to the machine and no interference whatever with the comfort of those working in the vicinity of the machine.

The uniform symmetrical arrangement of the cutting heads also has the advantage that all adjustments for the same purpose, i. e. to give similar changes of the cuts, are performed as to both heads in the same direction avoiding any tendency to confusion on the part of the operator in adjusting the machine.

I have thus described specifically and in detail a cut-off mechanism for operating on a slitted web or two webs fed at uniform speeds for cutting blanks of uniform and variable lengths from the two webs simultaneously, the description being specific and in detail in order that the manner of constructing, applying and using the invention may be understood, however, the specific terms herein are used descriptively rather than in a limiting sense, the scope of the invention being defined in the claims.

What I claim as new and desire to secure by Letters Patent is:

1. In a cut-off mechanism for cutting sheets of independently adjustable lengths from a plurality of webs, means for feeding the webs in divergent planes at a constant speed, a cutting head for each web each cutting head comprising a plurality of rotary cutters of different radii means for operating the cutters and changing the number of cutting cycles per unit of time relatively to the feed, the cutting heads being spaced in the direction of feed and having the relatively short radius cutter of one head and the relatively long radius cutter of the other head between the webs.

2. In a cut-off mechanism for cutting sheets of independently adjustable lengths from a plurality of webs, means for feeding the webs in divergent planes at a constant speed, a cutting head for each web each cutting head comprising rotary cutters of different radii, means for operating the

cutters, the cutting heads being spaced in the direction of feed and having the relatively short radius cutter of one head and the relatively long radius cutter of the other head between the webs, the long radius cutter of each head being above the web on which it operates.

3. In a cut-off mechanism for cutting sheets of independently adjustable lengths from a plurality of webs having means for feeding the webs in divergent planes at a constant speed, a cutting head for each web each cutting head comprising two rotary cutters of different radii, and driving means, a train of all circular gears connecting the driving means to the cutters for operating the cutters and means for changing the number of cutting cycles per unit of time relatively to the feed, means for adjusting the speed of the cutters at the time of cutting, to the speed of the web, including means for shifting the centers of some of said circular gears, the cutting heads being spaced in the direction of feed and having the relatively short radius cutter of one head and the relatively long radius cutter of the other head between the webs, the long radius cutter of each head being above the web on which it operates and above the short radius cutter of the same head.

4. In a cut-off mechanism for a plurality of webs, for cutting sheets of independently adjustable lengths from the respective webs, means for feeding the webs in different planes at a constant speed a plurality of cutting heads one for each web each head comprising two rotary cutters of relatively short and long radii respectively means for driving the cutting heads means for adjusting the speed of the cutting heads at the time of cutting to the speed of the web, and means for varying the number of cutting cycles of each head per unit of time relatively to the feed, thereby varying the speed of each head above and below a mean speed at which the cutters move at uniform speed throughout the cutting cycle, the long radius cutter of one head and the short radius cutter of the other head being between the webs.

5. In a cut-off mechanism for a plurality of webs for cutting sheets of independently adjustable lengths from the respective webs, means for feeding the webs in planes diverging from a point of slitting said feed being constant, a plurality of cutting heads one for each web, the heads being arranged in the direction of feed and each head comprising two rotary cutters of relatively short and long radii respectively means consisting entirely of circular gears for driving the cutting heads, means for adjusting the speed of the cutters at the time of cutting to the speed of the web and means for varying the number of cutting cycles of each head per unit of time relatively to the feed thereby varying speed of each head above and below a mean speed at which the cutters move at uniform speed throughout the cutting cycle, the long radius cutter of one head and the short radius cutter of the other head being between the webs, the long radius cutter of each head being above the short radius cutter of that head and the head having its short radius cutter between the webs being nearest the point of slitting.

6. In a cut-off mechanism for a plurality of webs for cutting sheets of independently adjustable lengths from the respective webs, means for feeding the webs at a constant speed in planes diverging in the direction of feed from a point of slitting, a plurality of cutting heads one for each web each head comprising two rotary cutters of relatively short and long radii respectively, means for driving the cutting heads, means for adjusting the speed of the cutting heads at the time of cutting to the speed of the web and means for varying the number of cutting cycles of each head per unit of time relatively to the feed, thereby varying speed of each head above and below a mean speed at which the cutters move at uniform speed throughout the cutting cycle, the long radius cutter of one head and the short radius cutter of the other head being between the webs, the long radius cutter of each head being above the short radius cutter of that head, and above the web on which it operates and the head having its short radius cutter between the webs being nearest said point of slitting.

7. In a cut-off mechanism for a plurality of webs for cutting sheets of independently adjustable lengths from the respective webs means for feeding the webs at a constant speed in different planes a plurality of cutting heads one for each web each head comprising two rotary cutters of relatively short and long radii respectively, means for driving the cutting heads, means for changing the speed of the cutters at the instrument of cutting to conform to the speed of the web and means for varying the number of cutting cycles of each head per unit of time relatively to the feed, thereby varying speed of each head above and below a mean speed at which the cutters move at uniform speed throughout the cutting cycle, the cutting heads being arranged in the direction of feed and closely adjacent each other, the long radius cutter of one head and the short radius cutter of the other head being between the webs, means for slitting a main web to form said plurality of webs, the cutting head having its small radius cutter between the webs being nearest said slitting means.

8. A cut-off mechanism for cutting sheets of independently adjustable lengths, means for feeding a web at a constant speed, means for slitting the web forming a plurality of slit webs, means for leading the slit webs from the point of slitting in divergent planes, a cutting head for each slit web each cutting head comprising two rotary cutters of different radii, means for operating the cutters, and means for changing the speed of the cutters relatively to the speed of the web, to change the length of the cut, and means for changing the speed of the cutters at the time of cutting to cause them to conform to the speed of the web, said operating means consisting entirely of circular gears, the cutting heads being arranged in the direction of feed and having the relatively short radius cutter of one head and the relatively long radius cutter of the other head between the webs, the head which has the short radius cutter between the webs being nearest the point of slitting.

HENRY B. GREENWOOD.