Aug. 25, 1936. H. B. GREENWOOD 2,052,461

WEB CUT-OFF MECHANISM

Filed April 27, 1935 6 Sheets-Sheet 1

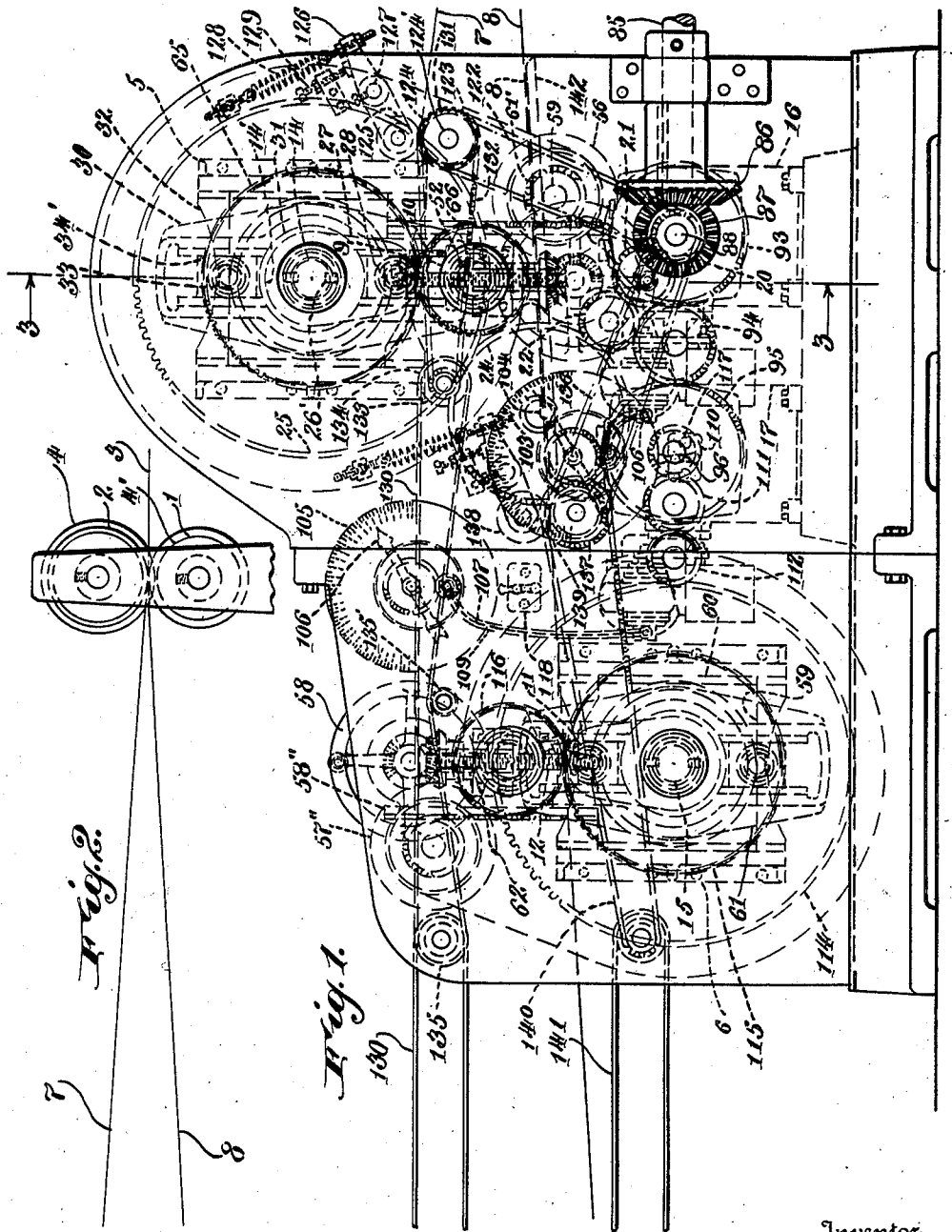


Fig. 2.

Fig. 1.

Witnesses

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Aug. 25, 1936. H. B. GREENWOOD 2,052,461

WEB CUT-OFF MECHANISM

Filed April 27, 1935 6 Sheets-Sheet 2

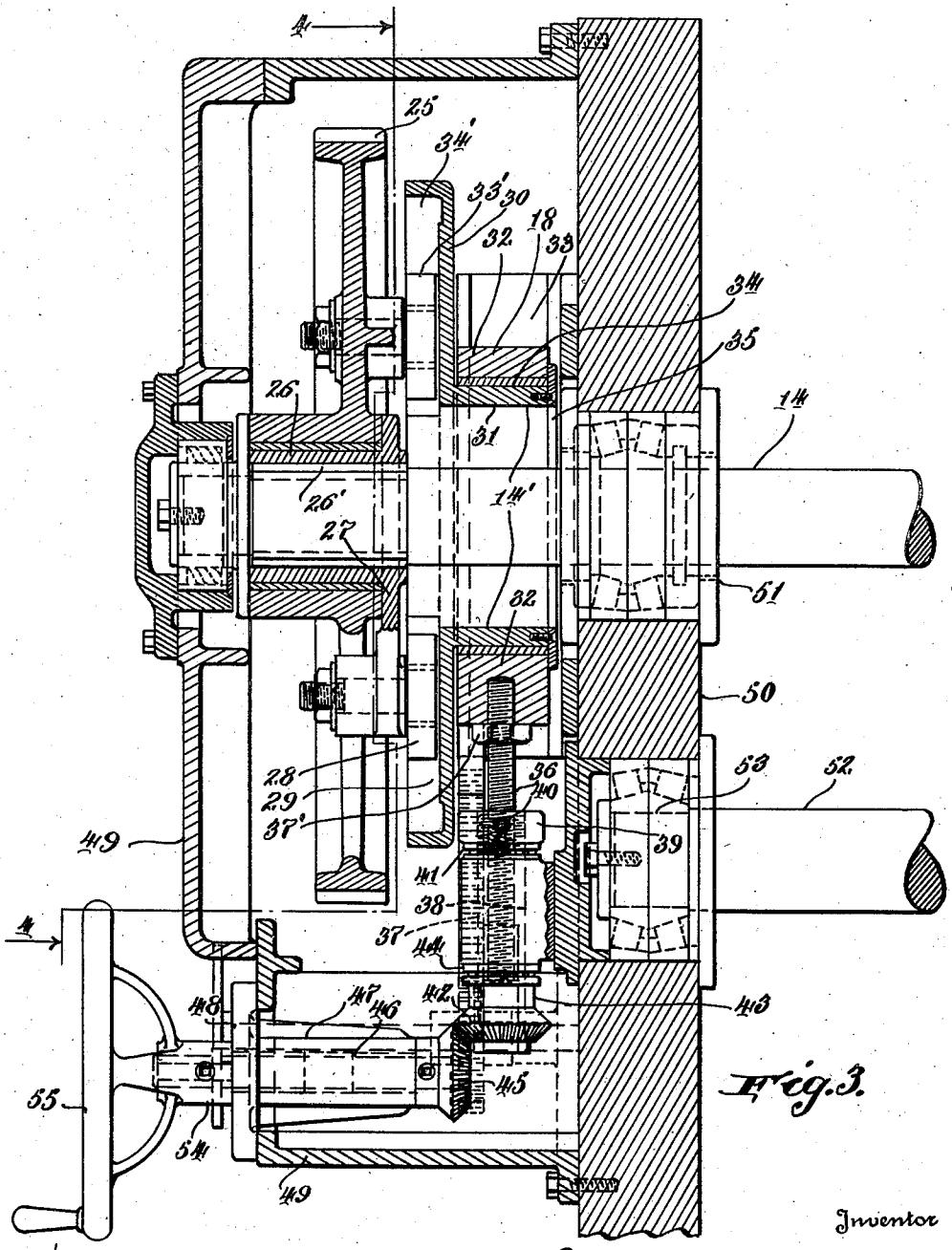


Fig. 3.

Witnesses:

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WEB CUT-OFF MECHANISM

Filed April 27, 1935 6 Sheets-Sheet 3

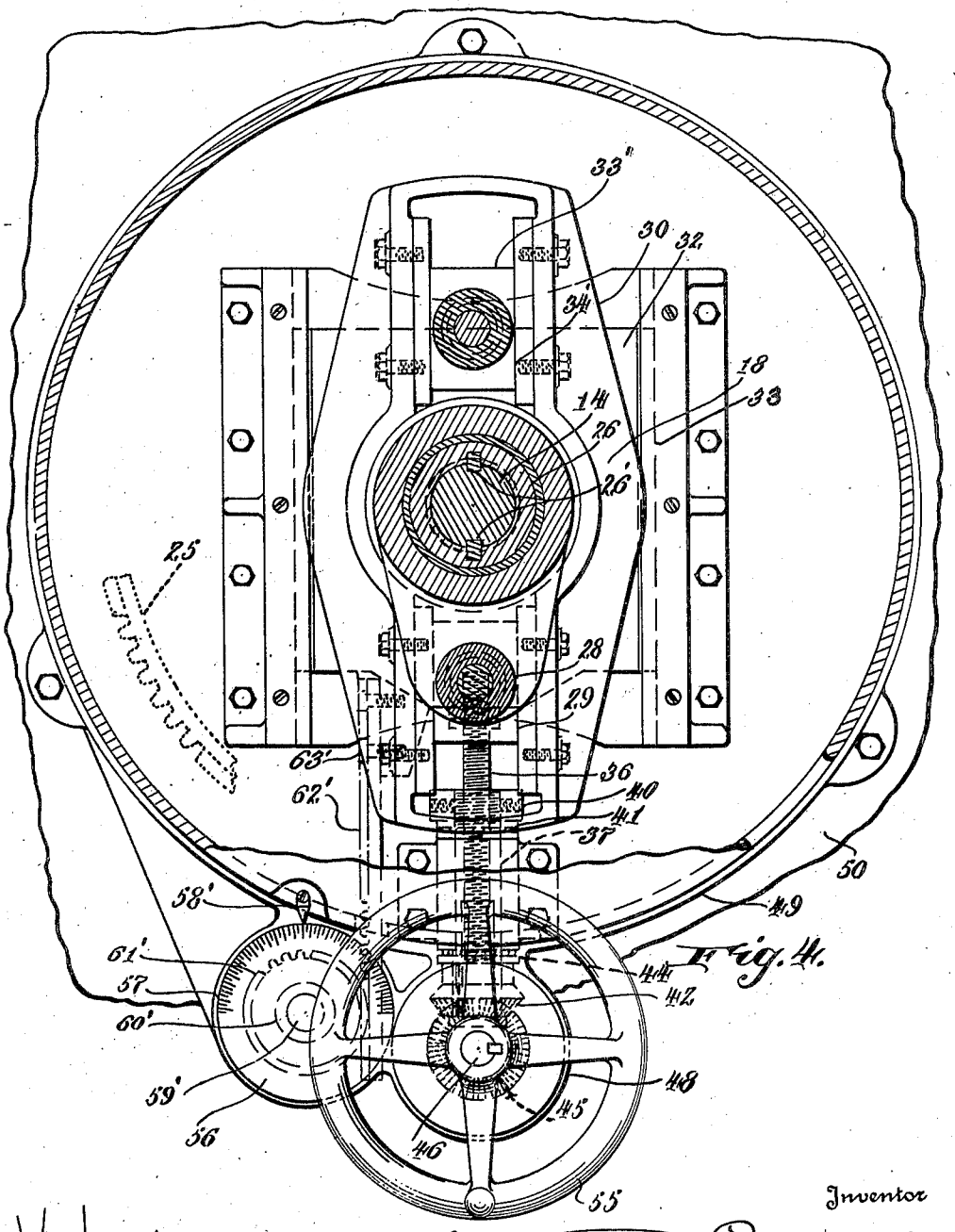


Fig. 4.

Witnesses

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Aug. 25, 1936. H. B. GREENWOOD 2,052,461

WEB CUT-OFF MECHANISM

Filed April 27, 1935 6 Sheets-Sheet 4

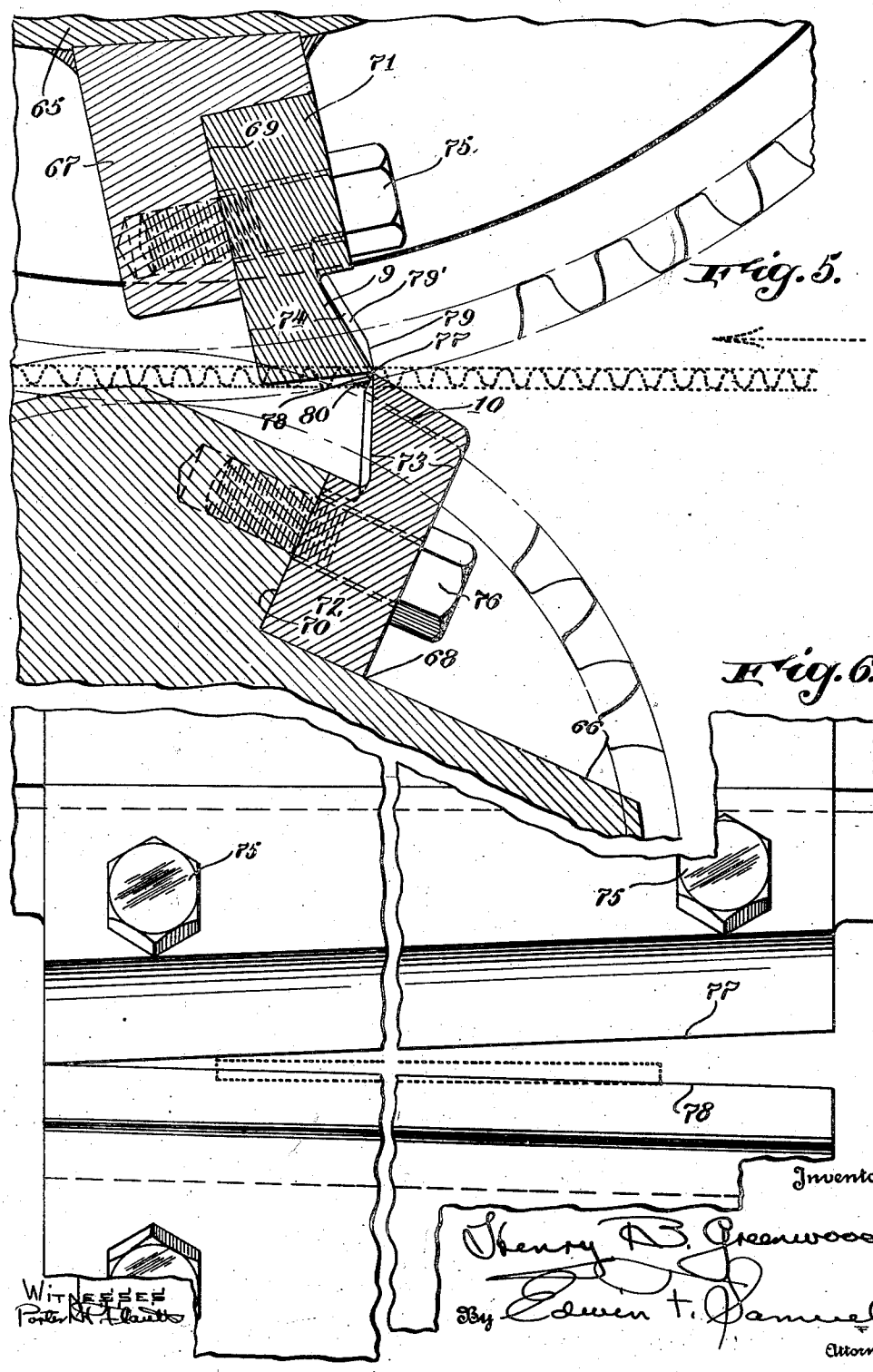


Fig. 5.

Fig. 6.

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WEB CUT-OFF MECHANISM

Filed April 27, 1935 6 Sheets-Sheet 5

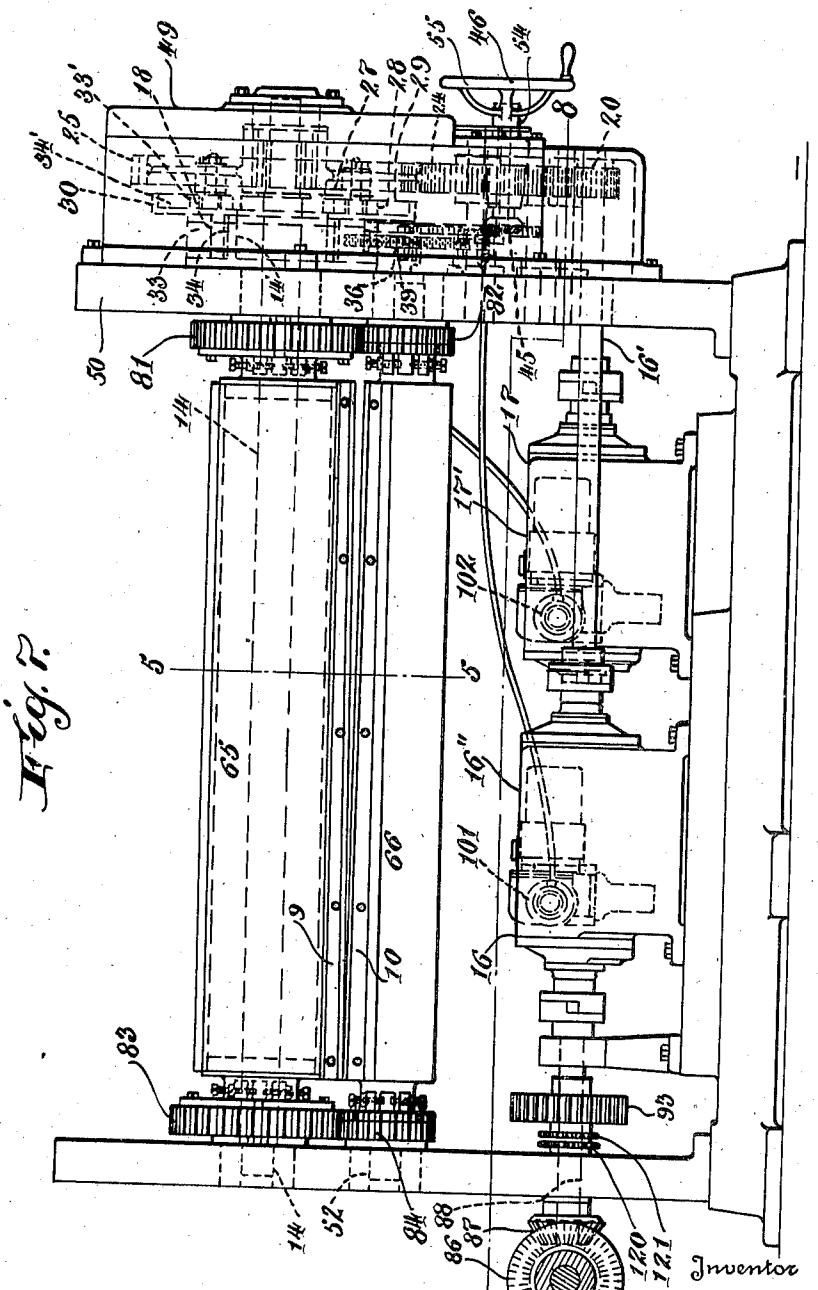


Fig. 5.

Witnesses:

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Aug. 25, 1936. H. B. GREENWOOD 2,052,461

WEB CUT-OFF MECHANISM

Filed April 27, 1935 6 Sheets-Sheet 6

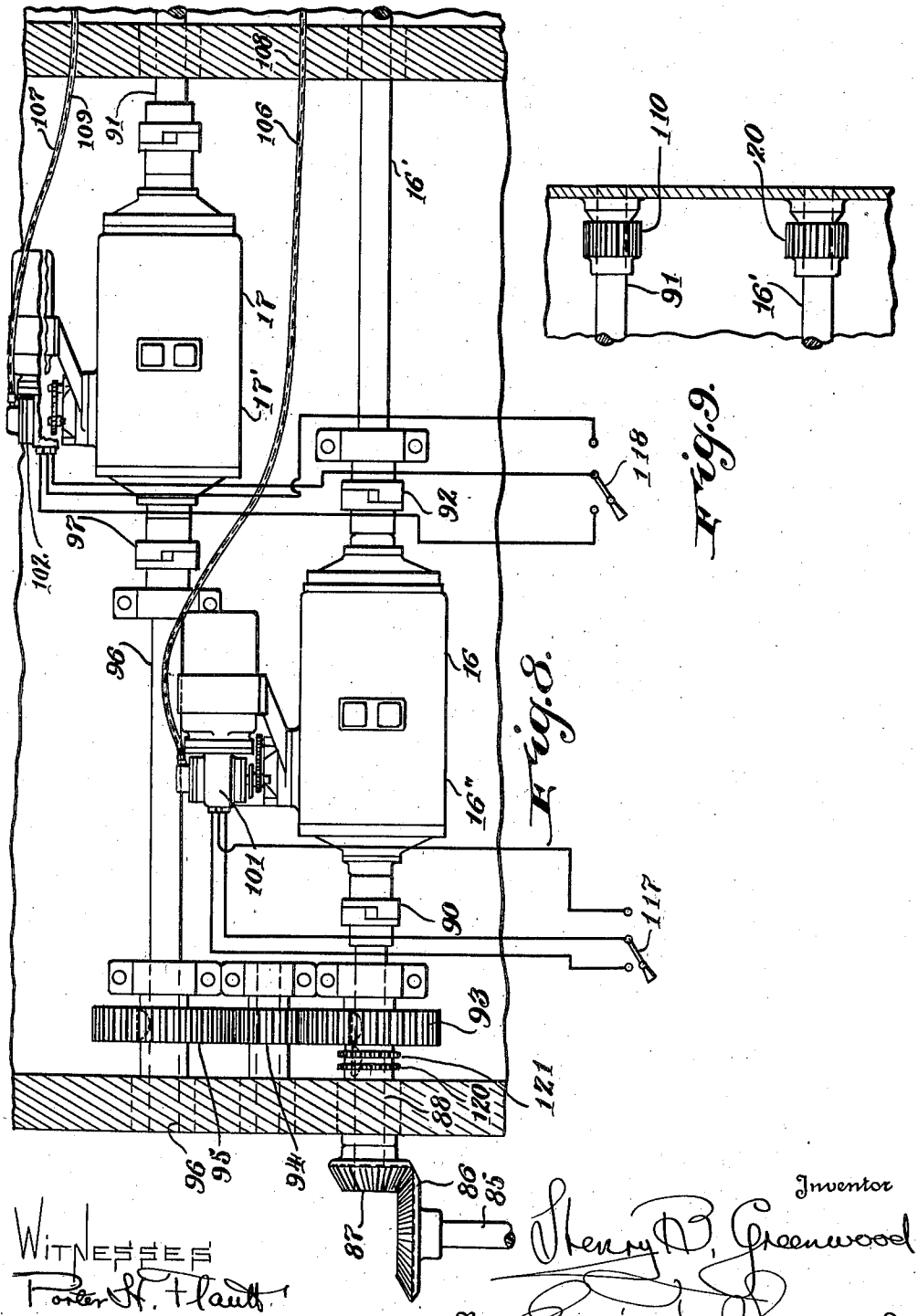


Fig. 9.

Fig. 8.

Witnesses
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Patented Aug. 25, 1936 2,052,461

UNITED STATES PATENT OFFICE

2,052,461

WEB CUT-OFF MECHANISM

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Application April 27, 1935, Serial No. 18,500

18 Claims. (Cl. 164—68)

The object of the invention is to provide an improved cutoff mechanism particularly adapted for use in cutting paper and making box blanks from a continuous web or for cutting sheets of uniform but adjustable lengths for any purpose from a continuous web of paper. The machine of the invention is equally usable in cutting sheets from any kind of relatively stiff paper or similar material including double faced corrugated board which may be fed to it.

The web may be fed from the machine on which it is made or from any suitable and convenient source. In the preferred form of the machine, although this is not essential to the use of various inventive features of the machine, there is cutting means at the feed end for slitting the web longitudinally into a plurality of relatively narrow webs which are led to the respective cutting heads, there being a cutting head for each of the webs into which the main web is separated by slitting. In order that blanks of any desired width may be cut, the cutters or knives may be of a length equal to the full width of the main or original web and the slitting knife or cutter is adjustable laterally for a sufficient distance to give any desired width of the resulting slit webs.

In the form of the invention shown the cutting heads are separately driven at speeds which are separately adjustable relatively to the feed so that the length of the blanks may be varied and for this purpose the machine of the invention in the preferred form is shown as provided with a change speed device in the form of a hydraulic drive, for each cutter head, the hydraulic drive providing a convenient and satisfactory adjustment of the speed, i. e., number of cuts per minute of each cutter head which adjustment can be operated either when the machine is standing idle or while it is running.

The machine of the invention also includes a drive for the cutter shaft of each cutter head having an eccentrically adjustable member which is driven from a circular gear with which it rotates coaxially for medium cuts, the eccentricity of the said member being adjustable in radial directions independently of the adjustment as to the length of cut, this adjustment being operable either while the machine is standing idle or while it is running. In this adjustment said member is moved in one direction from its coaxial position to increase the knife speed at the time of cutting and in the opposite direction from this position to decrease the knife speed at the time of cutting so the operator may obtain the desired relation of the speed of the cutter to the speed of the paper as the speed of the cutter head is changed relatively to the speed of the paper to change the length of cut.

An important advantage of the improved machine which may be referred to as an object of the invention is that both of the adjustments referred to, i. e., the number of rotations per minute to give the desired length of cut and the eccentricity, i. e., the knife speed at the time of cutting, are entirely independent and separately operated and may be effected either when the machine is standing idle or when it is running, and it is the purpose of the construction thus defined that the main adjustment of each be effected while the machine is standing idle, the minute final adjustment if further adjustment be desired, being performed while the machine is running.

The invention is of particular advantage in connection with the adjustment of the speed of the cutter heads which determines the length of the sheet or blank to be cut as it avoids the waste of paper incident to cutting a number of unusable sheets of sizes varying between the cut at the original and the cut at the final adjustment which is a necessary incident to performing the entire adjustment as to the size of the sheet while the machine is running, which is an essential of certain of the machines of the prior art.

The eccentric adjustment which is operable while the machine is standing idle and is intended to be so operated, particularly for the main adjustments, has the important advantage that for medium cuts there is no eccentricity at all, the knife moving smoothly at a uniform speed which is substantially equal to the feed, the eccentricity being changed from this intermediate point in one direction for the long blanks and in the opposite direction for the short blanks.

In this respect the eccentric of the present invention which is adjusted radially has an important advantage over the elliptic gears of existing mechanisms in relation to which the cutter is angularly adjusted, the change of speed at the ends of the elliptic gears giving an objectionable jar or jerky motion which is an unavoidable incident to the operation, whereas in the machine of the invention, there being no elliptic gears or any gears which are not circular, this objectionable feature is eliminated. The machine is, in fact, designed to cut medium lengths, of most frequent occurrence with no eccentricity or a slight eccentricity of the drive, the adjustment being on or near center. For relatively short and

long blanks the eccentricity is increased in opposite directions.

In making the adjustments referred to, the main adjustments both of the eccentric and the speed of the cutter head which in the preferred form has a hydraulic drive, are made while the machine is standing idle and before the machine is started. In this way the operator can come very close to the correct, if he does not achieve exactly the correct length of blank, and substantially the correct speed of the knife, after which slight adjustments of the speed of the cutter head and the speed of the knife at the point of cutting, i. e., the hydraulic drive and the eccentric adjustment may, if such adjustment is necessary, be made alternately and correctively each as to the other, until the desired adjustment is reached. An important advantage of this arrangement is that after the first or main adjustments made when the machine is standing, the machine being started, the blanks cut are usable, i. e., very close to the correct size so there is no waste of paper.

Another feature of the invention resides in the provision of a shearing cutter or shearing cutters or knives as they are termed herein. The edges of these knives are substantially straight but inclined to the axes of the respective shafts by which they are carried, the edges converging toward one end and being substantially in a plane parallel to a radial plane of the cutter shafts, the surface of the knives immediately back of the cutting edges referred to as shearing surfaces being so arranged that the edge of one knife slides in contact with the shearing surface of the other knife, giving a shearing action and a straight cut. As the cutting edges pass each other, the cutting progresses from one side of the material to the other as their shafts rotate, and the cut is straight because the knives advance as they rotate, the advance of the knives being substantially at the same speed as the speed of the paper.

In the accompanying drawings I have illustrated a cutoff mechanism embodying the features of the invention in the preferred form.

In the drawings:

Figure 1 is a front elevation showing the cutting heads and the paper feed.

Figure 2 is a corresponding view of the slitting knives which are in advance of the cutting gear in the direction of feed, i. e., to the right in Figure 1, the cut web being shown as extending toward and meeting the lines of the web where it terminates at the right in Figure 1.

Figure 3 is a section on the line **3**, **3** in Figure 1 showing the eccentric adjustment of the drive for the cutter shaft for one cutting head.

Figure 4 is a section on the line **4**, **4** in Figure 3 looking to the left.

Figure 5 is a detail of the cutting knives taken at right angles to the axis, i. e. on line **5**, **5** in Figure 7.

Figure 6 is a view of the cutting knives looking in the direction of the arrow in Figure 5.

Figure 7 is an elevation looking at the machine in the direction of feed, i. e., from the direction from which the material is fed to the machine, i. e., the right in Figure 1.

Figure 8 is a plan view of the hydraulic drive also showing the gearing and shaft by which these hydraulic drive units are driven and the shafts by which their motion is transmitted to the cutter heads looking from line **8**, **8**, Figure 7.

Figure 9 is a fragmentary elevation, showing the shafts driven by the hydraulic drive units, the said figure being an extension of Figure 8 to the right and also showing the gears on said shafts which gears are at one end of the train driving the cutter heads. It is taken on the same plane as is Figure 8.

Referring to the drawings by numerals and having particular reference to Figures 1 and 2, the construction shown comprises slitting mechanism including rollers **1** and **2**, to which the main web **3** of paper to be cut into blanks as described is fed in any suitable manner. The upper roll **2** is provided with a peripheral knife **4** and the lower roll **1** is peripherally grooved at **4'** to receive the knife. The rollers carrying the knife and groove aforesaid are laterally adjustable and capable of being secured to their respective shafts in any position of lateral adjustment to determine the width of the split webs **7** and **8**.

The machine in the preferred form further comprises two cutting heads indicated in a general way by reference characters **5** and **6**. The main web **3** being split or slitted by the knife **4**, forms two webs **7** and **8**, the web **7** being directed upwardly at a slight angle to the horizontal to the first cutting head **5** and the web **8**, being deflected downwardly also at a slight angle to the horizontal and led to the second cutting head **6**. The cutting head **5** is provided with a knife **9** and the cutting head **6** with a knife **11** and each cutting head is provided with the other cutting means opposed to the knife which may be a second knife or any other suitable means, other machines in the art being provided with a groove to be entered by the knife in cutting. In the present construction illustrated herein, the cutter head **5** is provided with a second knife **10** opposed to the knife **9** and the cutting head **6** is provided with a knife **12** opposed to the knife **11**.

The cutter head **5** has a transverse cutter shaft **14** and the cutter head **6** has a transverse cutter shaft **15**.

The illustration, Figure 8, also comprises a hydraulic or other adjustable speed drive **16** for the cutter head **5**, and **17** for the cutter head **6**, and each of the cutter heads comprises an eccentric adjustment indicated in a general way by reference character **18**, see Figures 3 and 4.

Referring again to Figure 8, the cutting head **5** is driven from the hydraulic drive shaft **16'** by means of a pinion **20** on said shaft which through intermediate gears **21**, **22**, drives the toothed gear **24** which in turn meshes with the large toothed gear **25** which rotates about the cutter shaft **14**, being mounted to rotate freely about the sleeve **26** which it keyed to rotate with the shaft **14** by keys **26'**. The sleeve **26** is driven by a radial arm **27** which carries a follower **28**. The follower **28** slides in a radial groove **29** in an eccentric plate **30** which has an axially projecting hub **31** near its center, the said hub encircling the shaft **14** but being spaced outwardly therefrom, the opening in the hub at **14'** being considerably larger than the shaft. This hub or boss **31**, as it may be called, projects through, rotates in and is carried by an eccentric carrier block **32** to be further described. It is also to be noted at this time that the gear **25** carries a follower **33'** which rides in a radial slot **34'** in the eccentric plate **30**, the slot being in the form shown diametrically opposite the slot **29** which engages the follower **28**.

It will thus be apparent that the gear **25** being driven from the hydraulic drive as described drives and rotates the eccentric plate **30** which in turn by way of the follower **28** drives collar **26**

which is keyed to the shaft 14 and drives the shaft.

Referring now to Figure 4, it will be noted that the carrier block 32, which has a bearing 34 enclosing the hub or boss 31 of eccentric plate 30, is mounted to slide vertically in ways 33 which are in turn mounted on a stationary portion of the machine, means to be further described being provided for moving the block up and down, changing the eccentricity of the plate 30 to the shaft 14 and its relation to the follower 33' and also changing the relation of the plate to the follower 28 by way of which it drives the collar or hub 26 and the shaft 14 whereby the relative speeds of the shaft at different points in its rotation are changed, changing the relative speeds of the knife in its cycle.

The boss or collar 31 is held against motion in the direction of its axis in relation to the carrier block 32 which moves in the guides 33 by means of a plate 35 secured to the end of said boss 31 and overlapping the surface of the carrier block.

It is of importance that the knife 9 is timed with the plate 30 to cut at the maximum and minimum speeds respectively, of the shaft 14, the knife being in the present instance for this purpose mounted in or near the radial plane of the slots 29 and 34' so that when the plate or member 30 is up, the speed at the time of cutting is the maximum speed in the knife cycle, and when it is down, the speed at the time of cutting is the minimum speed of the knife in its cycle. The knife 10 is timed to meet the knife 9 at the time of cutting as hereinafter described.

In order to move the carrier block 32 up and down effecting the adjustment referred to, I have provided in the form of the machine shown, which is understood may be widely varied as to these details, a carrier screw 36 secured at its upper end in the block 32 into which it is shown as threaded, being held stationary by means of a locknut 37', the lower end of the screw 36 is threaded into an internally threaded sleeve 37 which rotates in a stationary bearing and guide 38. This sleeve is supported in bearing 38 by a collar 39 encircling the upper end of the sleeve 37 and secured thereto by a set screw 40. This collar 39 is shown as resting on a thrust bearing 41 on the upper end of the guide bearing 38. The sleeve 37 projects downwardly from the bearing 38 having secured to its lower end a bevelled gear 42 and between the lower end of the bearing 38 and the hub 43 of the bevelled gear 42 there is a second thrust bearing 44. The bevelled gear 42 is in turn engaged by a bevelled gear 45 mounted on a hand wheel shaft 46, the axis of the gear 45 and the shaft 46 being shown as horizontal and at right angles to the axis of the gear 42. The hand wheel shaft 46 is mounted in a suitable stationary bearing 47 formed on the bracket 48 secured to the gear casing 49 which is in turn secured to the frame of the machine 50. This frame also carries a bearing 51 for the cutter shaft 14. The shaft 52 of the lower cutter or cutter roll to be described also has a bearing 53 in the frame 50.

The hand wheel shaft 46 projects to the left in Figure 3 from the bracket 48 toward the outside of the casing 49 and has secured to its projecting end portion the hub 54 of a suitable hand wheel 55 for adjusting the position of the eccentric plate 30 and the relative speeds of the cutter shaft at different points in its rotation by operation of bevelled gears 42 and 45, to rotate the sleeve 37, thus raising or lowering screw 36, carrier block 32, hub 31 and plate 30.

Figure 4 shows the mechanism just described in end elevation. Figure 4 also includes an indicator dial 56 with graduations 57 thereon and a stationary pointer 58' whereby the speed of the knife at the point of cutting may be indicated to the operator to assist him in adjusting the machine. This indicator dial 56 is mounted on a shaft 59' supported in a suitable bearing 60' on the casing. This shaft 59' has secured thereto a pinion 61' which meshes with a vertical rack 62' secured at its upper end to the carrier block 32 by means of screws 63' so that as the block moves up and down and the eccentricity of the plate 30 is changed and hence the relative speeds of the shaft 14 in its cycle are changed, this change is indicated by the graduations 57 on the dial 56, such indications being determined by means of the pointer 58'. The indicator may read in length of cut.

Figure 1 shows at the left a hand wheel 58 for operating the eccentric adjustment of the second cutter head 6 which is provided with a mechanism practically identical with that described in connection with cutting head 5 including the carrier block 59, ways 60, eccentric plate 61 and adjusting screw 62.

The operation of these parts having been described in connection with the first cutting head 5, a specific description of them is considered unnecessary, but it is noted in this connection that the relation of the parts is inverted, the hand wheel being at the top, the screw 62 being above the carrier block 59 and the cutter rolls to be further described being inverted with the small roll uppermost whereas the large roll is uppermost in the first cutting head 5. Cutting head 6 is driven from shaft 96 by gear 110 thereon which meshes with gear 111, which drives gear 112 which in turn drives large gear 114 which drives cutting head 6 as gear 25 drives cutting head 5. This head operates cutting rollers 115 and 116 carrying knives 11 and 12. Gear 114 drives plate 61, as gear 25 drives plate 30.

Referring now to Figures 5 and 6, which illustrate in detail the cutter knives and the manner of mounting them, having particular reference to the first cutter head 5, the two sets of knives being practically identical, in the form of the invention shown the knives 9 and 10, which extend the entire width of the main web, are mounted on cylindrical rollers illustrated fragmentarily in Figure 5 and in elevation in Figure 7 at 65 and 66. The roller 65 of cutter head 5, which is the upper and the larger roller, and preferably tubular, is mounted on the shaft 14, see Figures 3 and 7, and the lower roller 66 is mounted on the shaft 52 also shown in Figure 3. The roller 65 is provided with a cutter supporting bar 67 welded or otherwise secured to the roller and extending from one end to the other, and projecting outwardly from the roller. The roller 66 shown as solid has a right angular groove 68 for the knife 10 extending inwardly from the surface. Both knives 9 and 10 extend the entire length of the corresponding rollers which, in turn, comprise the entire width of the web as fed to the machine. The cutter bar 67 and radial surface 70 of groove 68 serve as supporting means for the respective knives 9, 10, each of which knives has a base or body portion 71, 72, from which blades 73 and 74 project outwardly from the bodies and from the rollers. The knife body 71 is secured in the rabbet 69 in the

bar 67 by means of set screws 75 and the knife body 72 is secured to radial surface 70 by means of set screws 76, resting at its end against the bottom of the groove 68. In this figure the feed is from the right, the upper roller rotating in right handed and the lower in left handed phase. The upper knife has a cutting edge 77 extending its entire length and the lower knife has a cutting edge 78 of similar length. Both the knives are of considerable thickness the exact shape of the blade backwardly from the cutting edge and the shearing surface to be described, being unimportant except that it is desirable to have it of considerable thickness and strength. Both knives are provided with shearing surfaces extending inwardly toward the respective centers of the corresponding rolls from the edges 77 and 78. The shearing surface 79 of the upper knife closely approaches the radial as to the roller 65, extending inwardly from the edge 77 in a plane which is substantially a radial plane of the knife, although this plane may be varied to give the shearing contact with edge 78 as described, and in accordance with the correspondence of the motion of the roller and the motion of the edge 78. Inwardly from the surface 79' the surface of the blade 74 is inclined in the direction of feed, i. e., to the left and toward the center of the roll 65. The blade 73 of knife 10 is also provided with a shearing surface 80 which closely approaches a radial plane, the portion of the surface inwardly from this shearing surface being inclined oppositely to the direction of the feed and toward the center of the roller 66 so that each cutting edge is in a radial plane of its axis. It will also be noted by reference to Figure 6 that the cutting edges 77, 78 instead of being parallel are inclined to the axes of the respective rollers so that in cutting position they converge toward the left in Figure 6 so that, as the rollers rotate in the direction stated, the knives moving to the left from the position shown in Figure 5, which may be referred to as the point of initial contact of the cutting edges, the contact point progresses to the right in Figure 6. It is also of importance that the surfaces 79, 80 are so formed that in the rotation of the rollers which are geared together, as shown in Figure 7, the edge 78 moves with a shearing action over the shearing surface 79 inwardly in relation to the cutter roll 65 and the cutting edge 77 of blade 74 moves inwardly over the shearing surface 80 of the blade 73 and inwardly of the roller 66. This action of the blades 73, 74 as to their edges 77, 78 is in a way very similar to the action of a pair of shears in that the point of cutting moves from one end toward the other and the cutting operation is essentially a shearing action, the contour of the surfaces 79, 80 as already pointed out, being such that the cutting edge of each knife slides inwardly over the corresponding surface of the opposed knife as cutting progresses, and as the paper is fed at a speed which closely coincides with the forward speed of the knives in the direction of feed, the point of cutting progresses in a straight line across the paper or the material being cut, giving a straight cut without the use of a helical cutting edge. The operation differs from that of an ordinary pair of shears in that there is no change of direction of the edges in their relation to the plane of cutting.

The straight cutting edges of the present construction have the advantage that they are cheaper to produce and easier to maintain in cutting condition than the helical edges in general use for this purpose, on account of the difficulty incident to accurately sharpening the irregular surfaces of a helical cutter, and the shearing cut is of increased efficiency.

Figure 7 shows the rollers 65 and 66 and shafts 14 and 52 thereof, geared together to rotate simultaneously to give equal speeds of the knife edges, the gears being indicated by reference characters 81, 82 at the right and 83, 84 at the left. These intermeshing gears are supplied at both ends to prevent twisting and disalignment and to maintain uniform contact of the knife edges.

Referring now to Figures 7 and 8, the hydraulic drive units indicated by reference characters 16 and 17 for the respective cutter heads 5 and 6, are shown in top plan in Figure 8 and in elevation in Figure 7. Each of these units comprises any suitable type of change gear mechanism. In the form shown each unit 16, 17 is of the hydraulic type comprising a rotating multicylinder pump and a rotating multicylinder motor driven by the hydraulic fluid under pressure from the pump, the pump and motor being placed in alignment with the driving and driven shafts projecting on opposite sides of the casing as shown. The details of the pump and motor are not part of the present invention being described in prior United States patents of which Patent No. 1,998,984, showing such a pump or motor, is an example. The drive employed is known as oil gear drive described in the catalogue of The Oil Gear Company. The hydraulic drive as used is of importance only as claimed in combination with other features of this machine.

The respective change speed drives or hydraulic drive units 16 and 17 are driven from any suitable source of power by way of the shaft 85 which may be connected to a machine which supplies paper to the cutter so that it has a direct speed ratio with the feed. This shaft carries a bevelled gear 86 which meshes with a bevelled gear 87 on a shaft 88 which carries the actuating member of the change speed unit or pump within the casing 16'', the pump and the hydraulic motor which it drives not being shown. Interposed in this shaft may be a coupling 90 which provides flexibility to take up any disalignment. Extending to the right from the unit 16 is the upper or first cutting head drive shaft 16' which is driven at adjustable speeds by the hydraulic drive unit 16. This shaft contains coupling 92 which provides flexibility and thus permits and provides for variation of alignment.

The shaft 88 carries secured thereto a toothed gear 93 which meshes with an idler 94 which meshes with and drives a toothed gear 95 which in turn drives the shaft 96 of the pump or power end of the second hydraulic unit or other change speed transmission 17. This shaft contains a coupling 97 to provide flexibility and take up disalignment. This unit 17, as does the unit 16 just described, includes a pump indicated in Figure 7 and a hydraulic motor driven by the fluid under pressure therefrom both the pump and the motor being of the rotary multicylinder type as shown in said patent. Other types of change speed mechanism may be used but the hydraulic drive has important advantages already pointed out. The hydraulic unit 17 drives the hydraulic drive shaft 91 which drives the lower or second cutting head.

In the form of the invention shown, each of the

hydraulic units is controlled as to its speed by an electric motor indicated at 101 as to the unit 16, and 102 as to the unit 17. This electric motor is connected to a valve located within each casing 16'', 17' not shown which valve controls the flow of fluid to the pump in each unit 16 and 17 as the valve is shifted by the motor in controlling the speed of the pump, the position of the valve being in turn indicated as to unit 16 by means of a dial 103 and pointer 104, and as to the unit 17 by dial 105 and pointer 106, the position of the valve being communicated to said dials as a function of the rotative position of the corresponding motors 101, 102 which is communicated to said dials by way of a Bowden wire shaft 106 as to unit 16, and 107 as to unit 17, the same being enclosed in tubes 108 and 109 shown in Figure 8, the respective shafts 106, 107 being suitably geared to the shafts of motors 101, 102 within the respective casings.

The drawing, Figure 8, also includes a lever switch 117 controlling motor 101 and a similar switch 118 for controlling motor 102 whereby the respective motors are operated to change the speed of the respective cutting heads 5 and 6 relative to the feed of the paper, thus changing the length of the sheets or blanks cut.

The material to be cut is fed in the form of a web 3 to the machine from any suitable source which may be a machine by which the material is made or any suitable feeding device. The shaft 85 which drives the cutting heads, see Figure 1, is driven from said machine or from any source of power which operates the feed. To feed the material through the machine any suitable mechanism is provided. In the machine shown the shaft 88, Figure 1, which is driven by bevelled gears 86, 87 from the shaft 85, carries secured thereto two sprockets 120, 121, Figure 7. The sprocket 120 drives a chain 122, Figure 1, which operates a feed roll 124 on shaft 124'. Roll 124 supports the web 7 as it enters the cutter head 5. Cooperating with this feed roll is a presser roll 125. This presser roll is of short length in the direction of its axis and serves to hold the material, i. e., center of the web, in contact with the center of the feed roller 124. The roller 125 is mounted on a lever 126 which is pivoted intermediately on a shaft 127 along which shaft the lever 126 and the roller 125 are adjustable in the direction of the axis of the shaft. The roller 125 is held in contact with the paper by a tension spring 128 which is connected at one end to the end of the lever 126 opposite to the roller 125 and at the other end to a stationary support. The lowermost position of the roller 125 is adjusted by means of a screw 129 which bears on the top of the lever 126 near the spring 128, preventing crushing of the paper.

From the rollers 124, 125 the web 7 is fed to the knives 9 and 10, and beyond the knives the cut sections of the web or blank are supported and carried forwardly out of the machine by the conveyor 130, the roller 124 or the shaft 124' thereof carries two sprockets, the sprocket 123 which is engaged by the chain 122 to drive the roller 124 and sprocket 131 which drives a chain 132 which extends forwardly. This chain 132 drives a sprocket 133 which in turn is secured to and operates a roller 134, which drives the conveyor 130 which is duly supported as shown by supporting roll 135 and tension roll 135'.

The second sprocket 121 on shaft 88 drives a chain 136 which operates a feed roller 137 for the second cutting head 6. Cooperating with this is a presser roller 138 similar to the roller 125 and similarly controlled, a sprocket 139 carried by the roller 137 or its shaft operates a chain 140 which in turn operates a conveyor 141 corresponding to the conveyor 130 whereby the cut blanks are carried forward from the second cutting head 6 and out of the machine.

In the operation of the machine the web 3 from any suitable source to which feed the drive shaft 85 is connected as aforesaid is fed to the slitting rolls 1, 2, carrying the slitting knife 4 by which the web 3 is split forming the separate webs 7 and 8, the web 7 being fed by roller 124, to the cutting head 5, particularly the knives 9 and 10 thereof, and the web 8 being fed over a chute or support 142 to the roller 137 whereby it is fed to the cutting head 6, particularly the knives 11, 12 thereof.

The length of the blanks as cut is determined by the ratio of the speed of rotation of the cutting heads to the feed of the paper, which latter bears a constant relation to the speed of the shaft 85 which as aforesaid is connected to the feeding source from which the paper is led to the machine. The feed rolls 124, 137 also operate at a speed which bears a constant relation to the speed of the feeding means for web 3, their surfaces moving at the speed of the paper. The speed of the cutting heads and the number of strokes or cutting cycles per minute of the knives 9, 10, 11, 12 is regulated in its relation to the paper feed at the will of the operator by the change speed unit 16 for the head 5 and 17 for the head 6, the change speed units being regulated by switches 117, 118 to give the desired ratio of the speed of the cutting heads to the speed of the paper feed and the desired length of cut or blanks.

This adjustment of the speed ratio is indicated in any unit which is satisfactory to the user of the machine which may, if desired, be readable in terms of the length of the cut blanks. The principal adjustment of the change speed drive for the cutting heads which in the form shown is a hydraulic drive is preferably made while the machine is idle, the dials 103 and 105 being thus utilized to determine the desired length of the blank, a close approximation of the length being obtained in this way so that when the machine is started, the blanks which are cut are usable. By this method of adjustment a considerable amount of paper is saved which would be wasted if the adjustment were made with the machine running, thus cutting a considerable number of useless blanks ranging in size from the length cut in the former adjustment to the length cut in the new adjustment.

While the machine is still idle, it is also adjusted as to the speed of advance of the knives in the direction of the feed at the time of cutting, which is performed by raising or lowering the carrier blocks 32, 59 and hence the centers of the eccentric plates 30, 61, the blocks being moved by the screws 36, 62, which are in turn operated by the hand wheels 55, 58. The dials 56 and 57'', connected to the respective carrier blocks, are graduated in units indicating the proper adjustment for the different lengths of blank.

As already pointed out, a sufficiently accurate adjustment of the machine to make usable blanks is obtained while the machine is stationary, the adjustment being set according to the dials. The machine being ordinarily empty at the end of the previous run, is then started, a further adjustment, if necessary, being obtained by operation of either or both adjustments until exactly the

desired length of cut and speed of the knife are obtained. It should be understood that after changing the speed of the hydraulic drive and the speed of the cutting head to change the length of cut, it may be necessary to change the position of the eccentric adjustment to adjust the speed of the cutter, there being in the preferred form of machine shown, no constant relation during adjustment between the hydraulic drive and the cutter speed at the point of cutting. These adjustments if both should be used while running, are used alternately and each correctly as to the other.

It is also of interest that the medium cuts comprising 80 to 85 per cent. of the sheets which ordinarily would be cut, can be obtained with a practically constant speed of the knife throughout its cycle, the speed of the knife being equal to the speed of the paper. In the preferred form of machine shown, the eccentrically adjustable member **30** is for this purpose on center or nearly on center with the cutter roll shaft **14** of the first cutter head **5** and **15** of the second cutter head **6**, the absence of any change of speed of the knife during its cycle giving a smoother operation of the cutters than can be obtained in any other way. The fact that at and near the medium or mean cut, all of the rotating parts, including the eccentric plate, are on center and substantially balanced, is of importance in giving smoothness of operation, and the fact that the eccentrically adjustable member **30** is adjustable from this position in one direction for reduced length of cuts and in the opposite direction for increased length of cuts gives the minimum of eccentricity as to the extreme adjustments.

Though the dimensions are unimportant, it is of interest that in the preferred form of the machine illustrated the mean cut being 60 inches, the path of the upper knife **9** in the first cutting head and the lower knife **11** of the second cutting head is 60 inches long, the circumferences of the large cutter rolls **65** and **115** being equal to the length of the medium blanks cut. Further, the angular velocity of the cutters is uniform at the medium cut, the surface speed of these rollers and the cutter speed being equal to the speed of the paper, and the adjustments essential to increasing and decreasing the length of cut are made in opposite directions from this medium adjustment, the variations in speed of the knife and carrier in their cycle essential to the longer and shorter cuts above and below the medium, are corresponding reduced as compared to the prior art machines having an eccentric adjustable in one direction only from on center position and the elliptical gear type of machine. The eccentric motion is an important advance over the elliptic gears of the prior art, it being an essential feature of the elliptic gears that they have an objectionable jerking motion which causes a harmful vibration of the parts under all cutting conditions.

A feature of the operation which is also of importance is that in the operation of the eccentric adjustment for cuts less than the medium, the cut takes place at the low speed point of the knife in its cycle, the adjustments being to one side of the on center position, and in making cuts greater than the medium cut, the cut takes place at the high speed position of the knife in its cycle, the adjustments being to the other side of the on center position of the eccentric.

It is also of interest as to the preferred form of the machine shown that all moving parts of the cutter head are in rotation on circular paths, the connection between the cutter roll and the gears being eccentrically adjustable on opposite sides of the center to be utilized in cutting at extreme fast or slow points of the cutting cycle, so that the operator may adjust the speed of the knife at variable cutting speeds, to the speed of the paper.

I have thus described specifically and in detail a cutoff mechanism for a paper or similar web, the description being specific and in detail in order that the manner of constructing, applying, operating and using the device may be fully 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 cutoff mechanism of the type described a rotary driving gear, a cutter, rotary means coaxial, with the gear, driving the cutter from the gear to move in successive cutting cycles, means for feeding a continuous web to the cutter which moves in the direction of feed at the instant of cutting, means for changing the speed of such gear relatively to the feed to change the length of cutting and means for adjusting the speed of the cutter at the instant of cutting to the speed of the paper, comprising an eccentrically adjustable rotating member eccentrically connected on one side of its axis to said gear and on the other side of its axis to said rotary means, said member rotating coaxially with the gear at medium cuts and being adjustable radially in opposite directions from said coaxial position, the adjustment in one direction serving to increase and in the other direction serving to decrease the speed of the cutter in its cycle at the instant of cutting.

2. The combination in a machine for cutting paper and similar materials supplied to the machine in the form of a continuous web, of a paper feed and a cutting head and a knife, means for operating the cutting head to move the knife in successive cutting cycles in which it moves in the direction of paper feed at the point of cutting, a change speed drive for the cutting head independent of the feed, for changing the speed of the cutting head relatively to the feed to determine the length of the cut, the same being operable while the machine is standing idle for main adjustments and while the machine is running for other adjustments, and means operable while the machine is standing idle for main adjustments and while the machine is running for other adjustments to change the speed of the knife in the direction of paper feed at the point of cutting, relatively to the speed of the cutting head, the two adjustments being separately and correctively operated each as to the other.

3. The combination in a machine for cutting paper and similar materials supplied to the machine in the form of a continuous web, of a paper feed, a cutting head and a knife, the cutting head operating to move the knife in successive cutting cycles in which it moves in the direction of feed at the point of cutting, a hydraulic drive for the cutting head having a change of speed independent of the feed for determining the length cut, the change of speed being operable while the machine is standing idle for main adjustments as to the length of the cut and operable while the machine is running for other adjustments, and means operable while the machine is standing for main adjustments and while the machine is running for

other adjustments to change the speed of the knife at the point of cutting relatively to the speed of the cutting head so that the speed of the knife may be adjusted to the speed of the paper for the different lengths of cuts.

4. In a machine for cutting material from a web to form blanks of lengths adjustable at the will of the operator, a knife, means for feeding the web thereto, circular gears to operate said knife to move in the direction of and at the speed of the material and transversely thereto to cut a predetermined medium length therefrom at a uniform angular velocity of said gears and said knife in their respective cycles, means for varying the velocity of said gears by increasing their speed relatively to the rate of feed from their speed at said medium cut to decrease the length of the material cut from the web and by decreasing their speed below the speed at medium cut to increase the length of cut, and means independent of said velocity varying means for changing the relation of the speed of the knife at the point of cutting to the angular speed of said circular gears, said means being adapted to decrease the speed of the knife relative to the speed of the circular gears from the ratio at medium cut in cutting shorter lengths of material, and to increase the speed of the knife at the point of cutting relatively to the speed of said gears from the ratio at medium cut in cutting longer lengths of material than said medium cut, and both said adjusting means being separately operated at the will of the operator either while the machine is standing or while it is running.

5. In a machine for cutting material from a web to form blanks of lengths adjustable at the will of the operator, a knife, means for feeding the web thereto, circular gears to operate said knife to move in the direction of and at the speed of the material and transversely thereto to cut a predetermined medium length therefrom at a uniform angular velocity of said gears and said knife in their respective cycles, means for varying the velocity of said gears by increasing their speed relatively to the rate of feed from their speed at said medium cut to decrease the length of the material cut from the web and by decreasing their speed below the speed at medium cut to increase the length of cut, and means for changing the relation of the speed of the knife at the point of cutting to the angular speed of said circular gears, said means being adapted to decrease the speed of the knife relative to the speed of the circular gears from the ratio at medium cut in cutting shorter lengths of material, and to increase the speed of the knife at the point of cutting relatively to the speed of said gears from the ratio at medium cut in cutting longer lengths of material than said medium cut.

6. In a machine for cutting material from a web to form blanks of lengths adjustable at the will of the operator comprising a knife, means for feeding the web thereto, circular gears to operate the knife in successive cutting cycles to move in the direction of the material at the point of cutting and at the speed of the material and transversely thereto to cut a predetermined medium length therefrom at a uniform angular velocity of said gears and said knife, means for varying the velocity of said gears by increasing or decreasing their speed relatively to their speed at said medium cut and relatively to the rate of feed, and an eccentrically adjustable member driving said knife from one of said gears for changing the speed of the knife at the point of cutting relatively to the angular speed of said circular gears and to its speed at other points in its cycle, and from the speed ratio between the knife and gears existing at medium cut, said eccentrically adjustable member being operable at different times to reduce or increase the speed of the knife at the point of cutting relatively to the speed of said gears and relatively to its speed in the remainder of its cycle, to cut lengths of the material shorter or longer respectively than said medium cut, the said member being mounted to rotate on center for said medium cut and having means whereby it is adjustable in opposite directions from on center position, for said shorter and longer cuts, respectively.

7. The combination in a machine for cutting paper and similar materials supplied to the machine in the form of a continuous web, of a paper feed, a cutting head having a knife, said cutting head operating to move the knife in successive cutting cycles in which it moves in the direction of feed at the point of cutting, a change speed hydraulic drive for the cutting head for determining the length of cut, the change speed being operable while the machine is standing idle for main adjustments, and while the machine is running to give final adjustments, an eccentrically adjustable member for changing the relative speeds of the knife at different points in its cycle to change the speed of the knife relatively to the speed of the cutting head at the point of cutting, said eccentric adjustment being operable for such changes of speed for main adjustments while the machine is idle and for final adjustments while the machine is running, the adjustment of the change speed drive and the eccentric being separate and independent and operable alternately to give a step by step final adjustment while the machine is running.

8. In a web cutting machine, a rotary driving gear, a cutter, rotary means coaxial with said gear driving the cutter from said gears to move in successive circular cutting cycles, means for feeding the web to the cutter which moves in the direction of feed at the instant of cutting, a change speed drive for the gear operable to change the speed of said gear relatively to the feed while the machine is standing or running to change the length of cut, means for adjusting the speed of the cutter in its cycle at the instant of cutting to the speed of the paper comprising an eccentrically adjustable member which at medium cuts with the knife operating at the speed of the paper, rotates concentrically with the axis of the gear, said member having a connection on one side of its axis to said gear and on the opposite side of its axis to said rotary means, and means for moving said member in opposite radial directions from said concentric position, changing its center of rotation relatively to both said connections to the gear and the rotary means, the knife being located near the radial plane of said connections and the point of cutting being near the plane of adjustment whereby the motion of said member in one direction causes an increase of the speed of the knife at the instant of cutting, and in the other direction a decrease of the speed of the knife at the instant of cutting, which cutting takes place at the fast and slow points of the knife cycle, respectively.

9. In a web cutting machine a rotary driving gear, a cutter driven therefrom to move in successive cutting cycles, means for feeding the web to the cutter which moves in the direction of feed at the instant of cutting, a change speed drive for

the gear operable to change the speed of said gear relatively to the feed while the machine is standing or running to change the length of cut, means for adjusting the speed of the cutter at the time of cutting to the speed of the paper comprising an eccentrically adjustable member which at medium cuts with the knife operating at the speed of the paper, rotates concentrically with the axis of the gear, said member having a connection on one side of its axis to said gear and a connection on the other side of its axis to the cutter, and means for moving said member in opposite radial directions from said concentric position, changing its center of rotation relatively to both said connections to the gear and the cutter, the motion of said member in one direction causing an increase of the speed of the knife at the instant of cutting, and in the other direction a decrease of the speed of the knife at the instant of cutting, the knife being located adjacent the axial plane of said eccentric adjustment.

10. The combination in a machine for cutting paper and similar materials supplied to the machine in the form of a continuous web of a paper feed, a cutting head having a knife, said cutting head operating to move the knife in successive cutting cycles in which it moves in the direction of feed at the point of cutting, a change speed hydraulic drive for the cutting head for determining the length of cut, the change speed being operable while the machine is standing idle for main adjustments, and while the machine is running to give final adjustments, an eccentrically adjustable member for changing the relative speeds of the knife at different points in its cycle to change the speed of the knife relatively to the speed of the cutting head at the point of cutting, said eccentric adjustment being operable for such changes of speed for main adjustments while the machine is idle and for final adjustments while the machine is running, the adjustment of the change speed drive and the eccentric being separate and independent and operable alternately to give a step by step final adjustment while the machine is running.

11. In a machine for cutting material from a web to form blanks of lengths adjustable at the will of the operator, a knife, means for feeding the web thereto, circular gears to operate said knife in successive cutting cycles to move in the direction of the material at the point of cutting and at the speed of the material to cut a predetermined medium length therefrom at a uniform angular velocity of said gears and said knife, means for varying the velocity of said gears at the will of the operator, said means being operable both to increase or decrease the speed of said gears relatively to their speed at said medium cut and relatively to the rate of feed to decrease or increase the length of material cut from the web, and an eccentrically adjustable rotary member operating the knife from said circular gears, said member rotating concentrically with one of said gears at medium cut and being adjustable in substantially opposite directions from its position of medium cut, the adjustment in one direction serving to increase and in the other direction serving to decrease the speed of the knife at the point of cutting in its relation to the angular speed of said circular gear, in order that the speed of the knife may be controlled by the operator to conform to the speed of the paper as the speed of the circular gears is changed.

12. In a machine for cutting material from a web to form blanks of lengths adjustable at the will of the operator, a knife, means for feeding the web thereto, a gear to operate said knife in successive cutting cycles to move in the direction of the material at the point of cutting and at the speed of the material to cut a predetermined medium length therefrom, means for varying the velocity of said gear at the will of the operator, to change the length of material cut from the web, and an eccentrically adjustable rotary member operating the knife from said gear, said member rotating concentrically with said gear at medium cut and being adjustable in substantially opposite directions from its position of medium cut, the adjustment in one direction serving to increase and in the other direction serving to decrease the speed of the knife at the point of cutting in its relation to the angular speed of said circular gear to adjust the knife to the speed of the paper, the knife being in alignment with the plane of adjustment at the point of cutting so that it cuts at said increased speed at the fast point of its cycle and at reduced speeds at the slow point of its cycle.

13. In a machine for cutting material from a web to form blanks of lengths adjustable at the will of the operator, a knife, means for feeding the web thereto, a gear, means driving the gear and means driving the knife from the gear to operate said knife in successive cutting cycles to move in the direction of the material at the point of cutting to cut a predetermined medium length therefrom, the path of the knife being substantially circular, means for varying the velocity of said gear at the will of the operator to decrease or increase the length of material cut from the web, said means comprising an eccentrically adjustable rotary member driving the knife from the rear, said member rotating concentrically with the knife cycle at medium cut and being adjustable in substantially opposite directions from its position of medium cut to increase by adjustment in one direction and to decrease by adjustment in the other direction, the speed of the knife at the point of cutting in its relation to the angular speed of the circular gear and in relation to the speed of the knife in the remainder of its cycle in order that the knife may be controlled by the operator to conform to the speed of the paper as the length of cut is either decreased or increased from the medium cut.

14. In a machine for cutting material from a web to form blanks of adjustable lengths comprising a knife, means for feeding the web thereto, a rotary gear, and a rotary carrier for the knife driven thereby, means for driving said gear to operate the knife in successive cutting cycles to move in the direction of the material at the point of cutting and at the speed of the material to cut a medium length blank therefrom at a uniform angular velocity of said gear and said knife, means for varying the velocity of said gear relatively to the feed to cut shorter or longer blanks and an eccentrically adjustable member driving said knife from said gear, said member being mounted to rotate coaxially with said gear and said carrier for said medium cut, means eccentrically located as to said gear for driving said member from the gear, the knife carrier having means eccentrically located as to its axis of rotation whereby it is connected to said member and means for moving said member on opposite sides of its coaxial position to change its relation to both said eccentrically located means, the movement of said member on one side of said coaxial position serving to increase, and on the

other side serving to decrease the speed of the knife at the point of cutting relatively to the speed of said circular gear.

15. In a machine for cutting material from a web to form blanks of adjustable lengths comprising a knife, means for feeding the web thereto, a circular gear, rotary means driven by said gear to operate the knife in successive cutting cycles, means for driving the circular gear to operate the knife to move in the direction of the material at the point of cutting at the speed of the material to cut a predetermined medium length blank therefrom at a uniform angular velocity of said gear and said knife, means for varying the velocity of said gear relatively to the feed by increasing or decreasing its speed relatively to its speed at said medium cut to cut shorter or longer blanks, and an eccentrically adjustable member driving said knife from said rotary means, said member being mounted to rotate coaxially with said gear for said medium cut, means eccentrically located as to said gear for driving said member from the gear, the said rotary means having means eccentrically located as to its axis of rotation whereby it is connected to said member to be driven thereby and means for moving said member on opposite sides of its coaxial position to change its relation to both said eccentrically located means, the movement of said member on one side of said coaxial position serving to increase and on the other side serving to decrease the speed of the knife at the point of cutting relatively to the speed of said circular gear, the knife being in alignment with both eccentrically located means and being in the line of eccentric adjustment at the time of cutting so that it has its minimum speed in its cycle at the instant of cutting blanks shorter than medium and its maximum speed in its cycle at the instant of cutting in cutting blanks longer than medium length.

16. In a machine for cutting corrugated paper board from a web, a pair of opposed knives, means for operating the knives to move in substantially circular paths, about substantially parallel axes which paths intersect along an arc corresponding to the period of cutting, means for feeding the material to the knives at said arc of intersection, at right angles to said axes the speed of the knives at the intersection being normally equal to the speed of the material, the relation of the respective knives to each other and to the feed being such that both knives move in the direction of the material at the said arc of intersection, each knife having a cutting edge which is located in a substantially radial plane of its axis, and elongated in the general direction of the axis, giving sufficient length to cut the desired width of web to be presented, one of the knives having a shearing surface extending inwardly from the edge at the initial point of intersection the said edges being arranged to converge toward one end in initial cutting position the knives being geared to operate in unison, causing the edges to contact at one end at the beginning of the intersection of the paths, the contact progressing along the respective edges toward the opposite end as the material and the knives advance and along said shearing surfaces and moving in the direction of the feed and at the rate of feed of the web.

17. In a machine for cutting corrugated paper board from a web, a pair of opposed knives, means for operating the knives to move in substantially circular paths about substantially parallel axes, which intersect along an arc corresponding to the depth of cut, means for feeding the material to the arc of intersection, at right angles to said axes the speed of the knives at the intersection being normally equal to the speed of the material, the phase of rotation of the respective knives and their relation to each other and to the feed being such that both knives move in the direction of the material at the said point of intersection, each knife having an edge which is elongated in a substantially radial plane of the axis, each said edge extending in the general direction of its axis, giving sufficient length to cut the desired width of web to be presented, the edges being arranged to converge toward one side in initial cutting position and the knives being geared to operate in unison, causing the edges to contact at one end at the beginning of the intersection of the paths, the contact progressing along the respective edges toward the opposite end, and in the direction of the feed of the web and at the speed of the web both of said knives having shearing surfaces extending inwardly from their edges toward their respective centers of rotation, one shearing surface being disposed forwardly in the direction of rotation and the other one being disposed rearwardly as to said direction, said surfaces being substantially radial as to the direction of rotation so that each knife edge slides over the shearing surface of the opposite knife with a shearing action as the cut progresses from one side of the material to the other, the relation between the speed of the knives and the paper serving to give a straight cut at right angles to the length of the web and the direction of feed.

18. In a machine for cutting stiff paper from a web, a pair of knives, means for operating the knives to move in substantially circular paths, about parallel axes which paths intersect, bringing the knife edges in contact along a cutting arc, means for feeding the web to said arc at a constant speed and at right angles to said axes, the speed of the knives in said arc being equal to the speed of the web and the relation of the knives to each other and to the feed being such that both knives move in the direction of the material through the arc, each knife having its cutting edge located in a radial plane of its axis and elongated in the direction of the axis, the said edges being arranged to converge in the plane of both axes, toward one end of the knives, said knives being geared together to operate in unison causing the edges to contact at one end at the beginning of the arc of intersection of these paths, the contact progressing along the two edges toward the opposite ends as the material and the knives advance and moving in the direction of feed at the rate of feed, giving a cut at right angles to the length of the web and the direction of the feed.

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