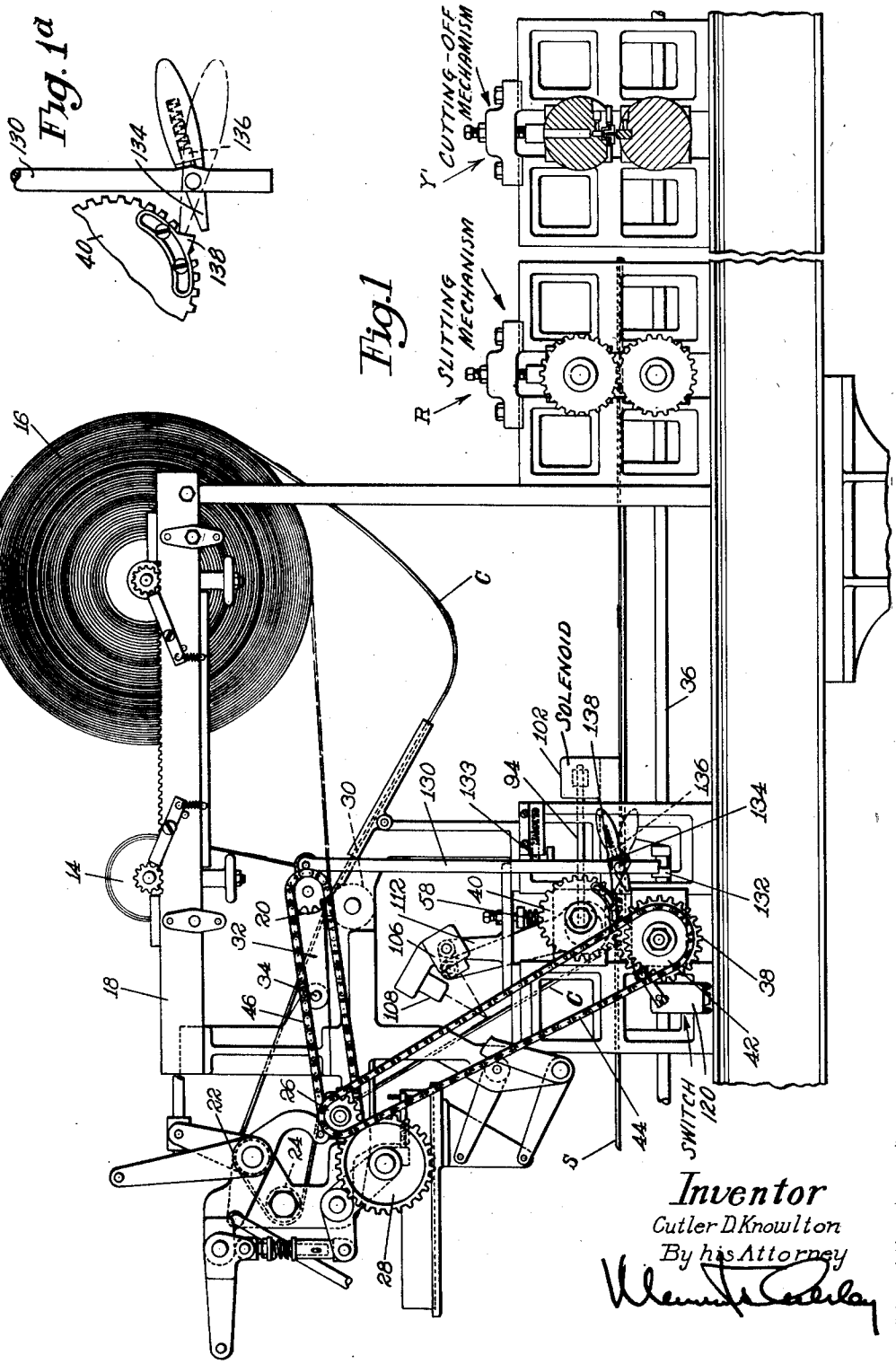
May 12, 1953 C. D. KNOWLTON 2,638,037

APPARATUS FOR FEEDING WEBS

Filed Aug. 29, 1947 4 Sheets-Sheet 1



Inventor

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By his Attorney

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APPARATUS FOR FEEDING WEBS

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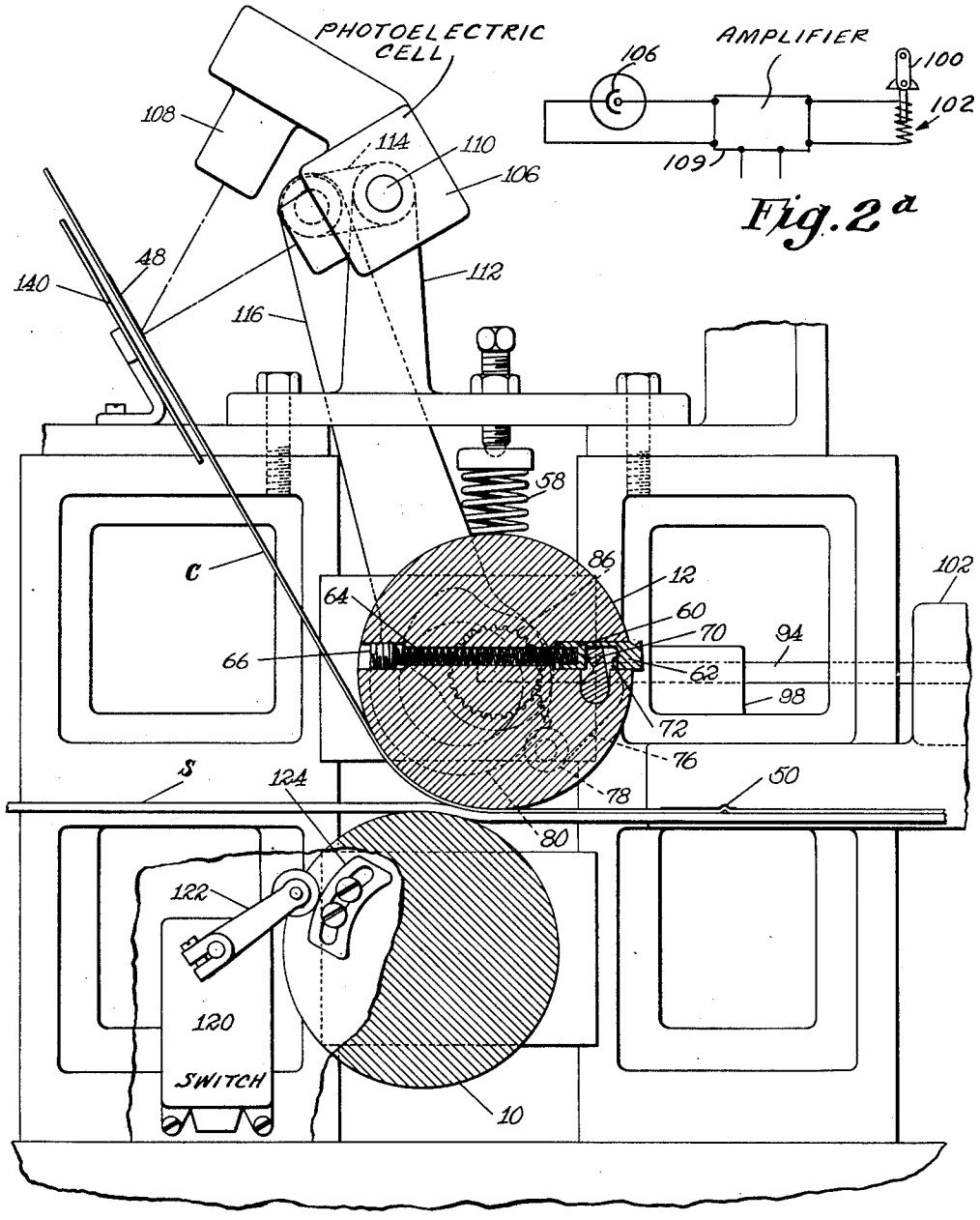


Fig. 2

Fig. 2a

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APPARATUS FOR FEEDING WEBS

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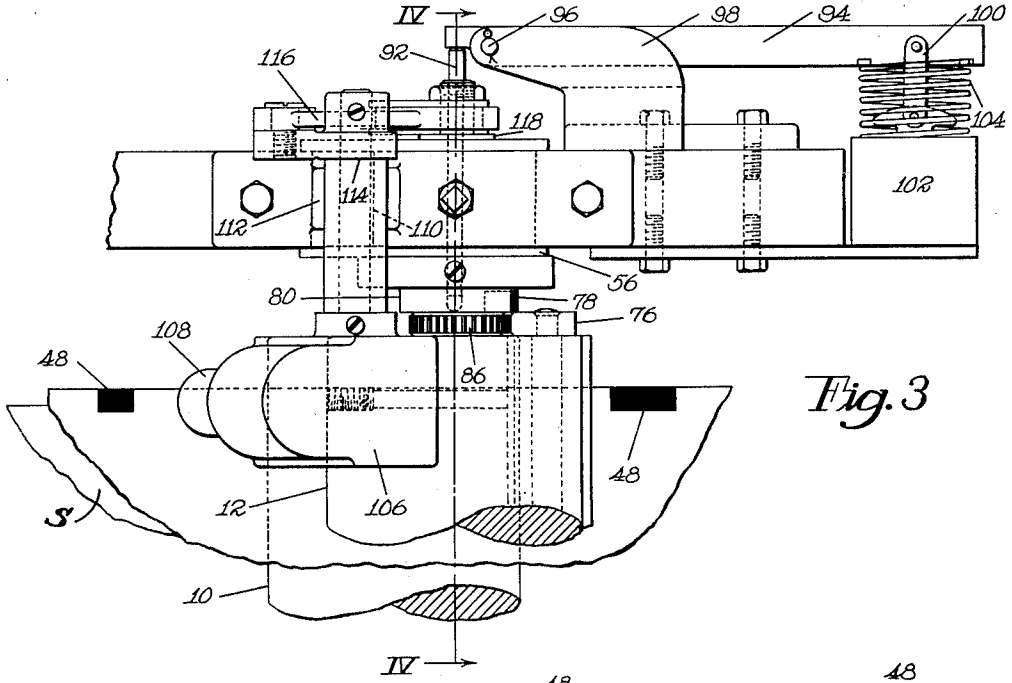


Fig. 3

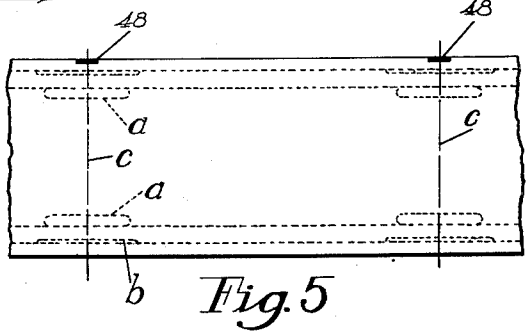


Fig. 5

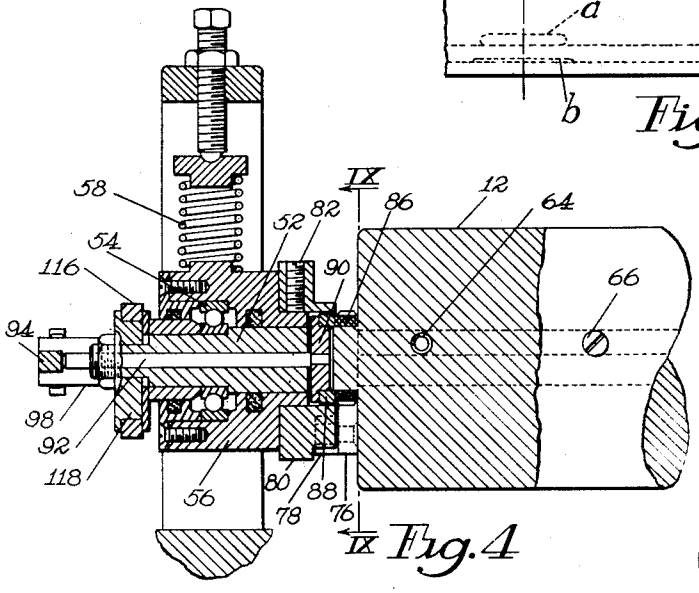


Fig. 4

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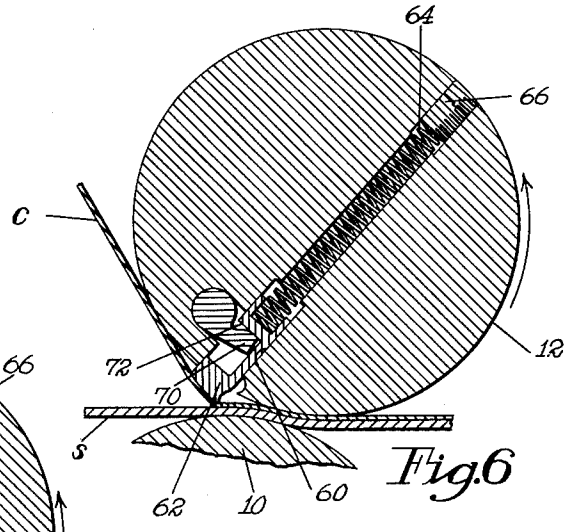


Fig.6

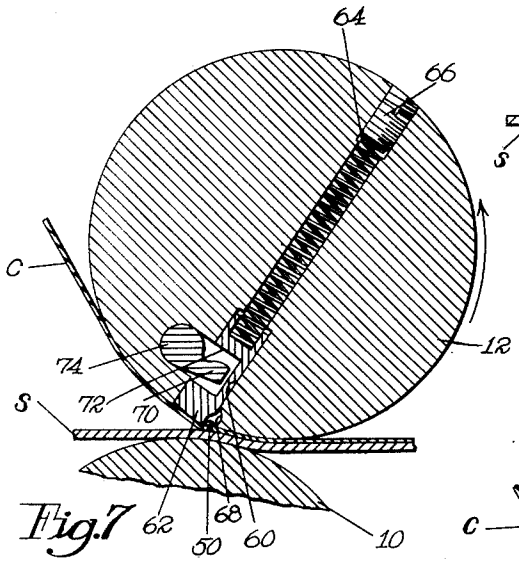


Fig.7

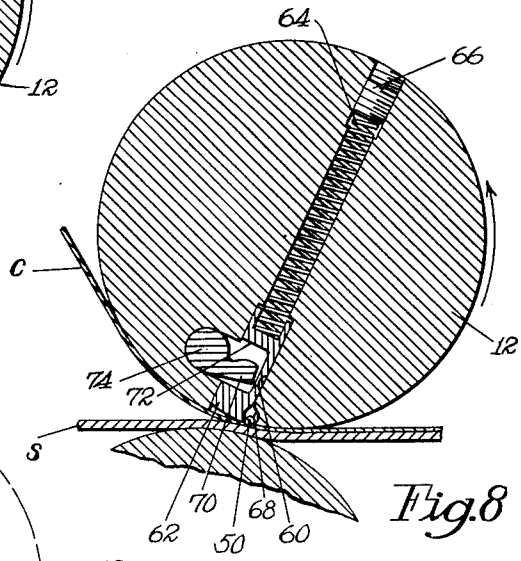


Fig.8

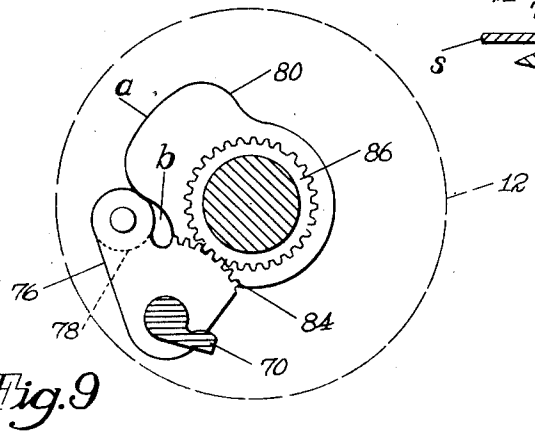


Fig.9

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2,638,037

APPARATUS FOR FEEDING WEBS

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Application August 29, 1947, Serial No. 771,283

11 Claims. (Cl. 93—36.6)

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This invention relates to web-feeding apparatus and more particularly to apparatus for feeding a web of material provided with recurrent printing, decorations, or both, which are hereinafter termed "designs," in such manner that each design is properly registered in a machine which is to operate upon the web. The invention is illustrated herein as embodied in a machine for making box blanks of the type illustrated and described in Letters Patent of the United States No. 1,988,451, granted January 22, 1935, on an application filed in my name, although it will be understood that in its broader aspects the invention is not thus limited in its applicability.

In the manufacture of preprinted box blanks, a web of cover paper is provided with recurrent designs at predetermined intervals along the length of the web. During the printing of the web, successive sections thereof are each provided with a design, the design occupying the same location in each section of the web. However, the lengths of these sections may increase or decrease subsequently to the printing operation due to changing conditions of temperature, humidity etc. If the paper is subsequently cut into lengths equal to the lengths of the original sections without making any compensation for shrinkage or stretching of the paper the printed designs will occupy different positions in each section and many sections will have portions of two recurring designs appearing thereon with the result that the attractiveness of the completed boxes or whatever the paper is to be ultimately used for is entirely ruined.

If the paper is originally printed in successive sections of slightly greater length than that required in the completed article each successive section may then be gathered locally along the line at which it is to be severed, into a plait, after the paper is withdrawn from the web, and by controlling the amount of paper that is gathered into the plait, in accordance with the degree of shrinking or stretching that has taken place since the paper was printed, adequate compensation for the shrinkage or stretching can be made so that each section of the web in the completed product will have its design properly located thereon. By originally printing the web in sections slightly greater in length than is desired in the finished product allowance is made for any expected degree in shrinking that may take place so that the lengths of sections of the web will not decrease below that required in the finished product and no subsequent stretching

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of the paper will be necessary. By forming the plaits along the lines where the paper is to be cut they do not detract from the appearance of the finished product, particularly when the paper is to be combined with a web of shell material in the manufacture of box blanks.

In view of the foregoing it is an object of the present invention to provide improved apparatus for registering successive sections of a web of material having recurring designs thereon in a predetermined manner in a machine arranged to operate on the web, so that each design will occupy the same relative position with respect to the operating instrumentalities of the machine.

In accordance with a feature of the invention the web of material is fed into the machine by a roll with which is associated means for gathering portions of the web into plaits thus shortening successive sections of the web in a manner to obtain proper registration of the designs upon the web with the machine. As illustrated herein there is associated with the upper assembly roll of a blanking machine a plaiting finger movable inwardly of the roll and pressed outwardly thereof by springs to a position determined by the amount of material to be gathered in each section of the web. An adjustable stop limits the outward protrusion of the finger with respect to the roll while permitting the finger to be moved inwardly as the finger moves into the bite between the two assembly rolls of the machine. The position of the stop is determined upon each rotation of the assembly roll in accordance with the amount of material to be gathered into a plait or in other words in accordance with the amount of stretching or shrinking which has taken place in the particular section of the web to be operated upon. The web is provided along one margin with recurring blackened portions located in predetermined positions with respect to the designs upon the web for controlling the action of a photoelectric means which in turn controls the stop in accordance with the distance between these blackened portions of the web during the combining operation.

The above and other features of the invention including various details of construction and novel combinations of parts will now be described by reference to the drawings and pointed out in the claims.

In the drawings,

Fig. 1 is a side elevation of one form of apparatus in which the invention is embodied;

Fig. 1a is a view on a larger scale of a portion of the apparatus shown in Fig. 1;

Fig. 2 is a side elevation of a portion of the apparatus shown in Fig. 1, on a larger scale with the assembly rolls shown in section;

Fig. 2a is a diagrammatic view of the photo-electric control mechanism;

Fig. 3 is a plan view of one end of the assembly rolls and associated mechanism;

Fig. 4 is a section on the line IV—IV of Fig. 3;

Fig. 5 is a plan view of a portion of the assembled shell and cover paper;

Figs. 6, 7 and 8 are vertical sections through the upper assembly roll in different positions illustrating the action of the plaiting finger, and

Fig. 9 is a section on the line IX—IX of Fig. 4.

A web of shell material S (Figs. 1 and 2) and a web of cover material C, the under surface of which has been coated with glue, are pressed together by a pair of assembly rolls 10, 12 to form a web of blank material from which box or box cover blanks are formed. Prior to being pressed between the rolls 10 and 12 the web of shell material has been acted upon by mechanism which forms grooves a (Fig. 5) which separate the corner laps from the end wings and their extensions. The outer edges of the corner laps and the immediately adjacent portions of the side wings are cut away at b to receive the end wing extensions as described more fully in Patent No. 1,988,451 above referred to. After the webs are combined, the web of shell material is acted upon by various mechanisms as shown in that patent to form box blanks, such as the cover slitting mechanism R and the cutting-off mechanism Y' (Fig. 1).

Rolls of cover paper 14, 16 are carried by rails 18, the paper normally being drawn from a roll located at the right end of the rails as illustrated in Fig. 1 from which the paper passes under a guide roll 20, thence around guide rolls 22, 24 and a glue roll 26, which receives glue from a transfer roll 28. The paper with the glue thereon then passes downwardly around the upper assembly roll 12 by which it is pressed into engagement with the upper surface of the web of shell material S. When the roll is nearly exhausted it is moved into the position as shown at 14 at the left end of the rails and a new roll 16 is positioned at the right end. Just prior to complete exhaustion of the paper on the roll 14 the end of the web on the roll 16 is spliced thereto. In preparation for this, the end of the web on the roll 16 is placed between the roll 20 and a cooperating roll 30. These rolls are normally held in spaced apart relation as will be explained, but the roll 20 which is supported by arms 32 pivoted at 34 to the frame of the machine is allowed to drop by gravity to force the paper thereunder into contact with the paper from the roll 16 lying on the roll 30 when the splice is to be made. Consequently if glue has been previously applied to the upper surface of the web from the roll 16 it will be secured to the web from the roll 14. The construction and manner of operation of the splicing means and coil supporting means is illustrated and described in detail in Letters Patent of the United States No. 2,094,896 granted October 5, 1937 on an application filed in my name to which reference may be made for a more detailed description thereof.

The lower roll 10 of the assembly rolls is rotated by a drive shaft 36 as shown in Patent No. 1,988,451 referred to above and this roll is

in turn connected by gears 38, 40 to the upper roll 12 so that these rolls are turned in unison at the same speed. The shaft of the lower roll 10 also carries a sprocket 42, connected by a sprocket chain 44 to a sprocket on the glue roll 26. This roll is connected by gearing to the roll 28 and also by a sprocket chain 46 to the roll 20. Thus it will be seen that these rolls are all rotated in unison from the drive shaft 36.

The web of cover paper upon which is printed a recurring design on successive sections thereof has also printed along one of its margins blackened areas 48 (Figs. 3 and 5) which are located equidistant from one another and define the successive sections on the web. The center distance between the areas 48 and accordingly the lengths of the sections when the web of cover paper is printed is slightly greater than the lengths of the blanks to be formed and in order that these sections shall be properly located with respect to the web of shell material and to the blank-forming instrumentalities of the machine, each section of the cover paper is gathered locally into a plait or fold 50 (Figs. 2 and 8) at the location where the web is to be severed. The extent to which the cover paper must be plaited so that the designs upon it will register accurately with the shell material and with the machine will depend upon the extent to which the web has stretched or shrunk following the printing thereof as determined by the distances between the areas 48. Mechanism for thus plaiting the cover paper is associated with the upper assembly roll 12 and will now be described.

The roll 12 has reduced shaft portions 52 (Fig. 4) extending from opposite ends thereof and journaled in ball bearings 54 carried by bearing housings 56. These housings are arranged for vertical movement and are urged downwardly by springs 58 to press the roll 12 toward the roll 10 and exert pressure on the webs of cover and shell materials.

The roll 12 is provided with a recess 60 (Figs. 2 and 6–8) extending lenthwise thereof in which is mounted for sliding movement a plaiting finger 62 urged outwardly of the roll by spaced compression springs 64 retained in positions by screws 66. With the finger 62 projecting outwardly of the surface of the roll, as illustrated in Fig. 6, it will press the cover paper C against the web of shell material S somewhat in advance of the bite of the rolls 10, 12. These rolls turn at equal speeds but the peripheral speed of the finger 62, when in its protruded position, will be at a higher rate. Consequently, as the roll 12 turns from the position shown in Fig. 6 to that of Fig. 7, the cover paper will be fed faster than the shell material and will slip relatively to the shell material thus forming a plait 50, the roll 12 being recessed at 68 to accommodate this plait. The peripheral speed of the web contacting portion of the finger 62 depends upon the extent of its protrusion from the roll 12 and as the roll turns in a counterclockwise direction from the position shown in Fig. 6 the finger is forced inwardly against the action of the springs 64 and its peripheral speed decreases until it lies wholly within the surface of the roll, as shown in Fig. 8, at which time its peripheral speed is the same as that of the roll and the gathering action on the cover paper ceases. During this action of the finger 62 on the cover paper, the unset glue on the cover paper acts as a lubricant to facilitate

slipping of the cover paper relatively to the shell material.

The amount of the cover paper that is gathered into the plait 50 is dependent upon the extent of protrusion of the finger 62 when the paper is contacted thereby. Thus, if the finger protrudes further from the surface of the roll than is shown in Fig. 6 it will press the cover paper against the web of shell material further in advance of the bite of the rolls and cause more of the paper to be gathered into a plait. For controlling the amount of protrusion of the finger 62 during the plaiting operation, a stop 70, carried by the roll 12, projects into a recess 72 in the finger 62. This stop has a generally cylindrical hub portion 74 by which it is mounted for turning movement in the roll 12 whereby the stop 70 may be adjusted generally radially of the roll to vary the extent of protrusion of the finger 62. The recess 72 is large enough to permit inward movement of the finger 62 to the position shown in Fig. 8 in any position of the stop 70. It will be understood that upon clockwise movement of the stop 70 from the position shown in Fig. 6, the finger 62 is permitted to protrude further outwardly of the roll 12 and upon counterclockwise movement of the stop the extent of protrusion of the finger is decreased.

For thus adjusting the position of the stop 70 there is secured thereto adjacent to an end face of the roll 12 an arm 76 carrying a cam roll 78 engageable with a cam 80. The cam 80, as shown in Fig. 4, is secured by a screw 82 to a reduced portion of the housing 56 for the bearing 54. At the time that the finger 62 is approaching the web C the cam roll 78 is riding over the high portion *a* of the cam 80 so that the stop 70 is positioned to maintain the finger 62 in its innermost position within the roll 12. Upon movement of the cam roll from the high portion *a* of the cam 80 toward the low portion *b* the stop 70 is moved in a clockwise direction permitting the finger 62 to be gradually moved outwardly of the roll 12. When the finger has been moved outwardly of the roll 12 to the required position which will depend upon the amount of gathering that is required of the web C the stop 70 is locked against further clockwise movement. The arm 76 has formed thereon a gear segment 84 which meshes with a pinion 86 rotatable on the inner portion of the shaft 52 (Fig. 4) adjacent to the end face of the roll 12. As long as the gear 86 is free to turn relatively to the roll 12 the arm 76 can move relatively to the roll. If, however, the gear 86 is locked against rotation relatively to the roll the arm 76 likewise becomes locked against movement relatively to the roll and the cam roll 78 can lo longer follow the surface of the cam 80.

For locking the gear 86 against turning movement on the shaft 52 at the proper time a locking ring 88 is provided for clamping the gear 86 against the end face of the roll. The locking ring 88 is carried by a bar 90 which projects through a diametrically extending opening in the shaft 52 the opening being of sufficient size lengthwise of the shaft to permit the ring to be forced against the pinion 86 or to be moved away therefrom. Secured to the bar 90 and extending axially through the outer end of the shaft 52 is a rod 92 which terminates outwardly of the shaft as shown in Figs. 3 and 4. Positioned for engagement with the outer end of the rod 92 is a lever 94 pivoted at 96 to a bracket 98 secured to the frame of the machine. The outer end of the lever 94 is connected by a link 100 to the armature of a solenoid 102 arranged upon energization of the solenoid to move the lever outwardly of the rod 92 thus relieving the clamping pressure against the gear 86. A spring 104 between the housing of the solenoid 102 and the adjacent end of the lever 94 acts when the solenoid is de-energized to force the rod 92 inwardly of the shaft 52 thus exerting clamping pressure against the gear 86 locking the stop 70 in the proper position. The solenoid 102 is normally energized but is de-energized at a predetermined time in the movement of the cam roll 78 (Fig. 9) from the high part *a* of the cam 80 to the low part *b* thereof.

For controlling the de-energization of the solenoid 102 a photoelectric cell 106 (Fig. 2) is provided, this cell being arranged to receive light from a lamp 108 reflected from the web C as long as the light is not intercepted by one of the blackened portions 48 formed along the margin of the web. The photoelectric cell 106 and the lamp 108 are mounted for pivotal movement as a unit on a shaft 110 journaled in a sleeve formed on the upper end of a bracket 112 carried by the machine frame. Secured to the shaft 110 is an arm 114 pivoted to the adjacent end of an eccentric strap 116 surrounding an eccentric 118 (Fig. 4) carried by the outer end of the shaft 52. As the roll 12 rotates the photoelectric cell and the lamp are oscillated about the axis of the shaft 110 and the arrangement is such that as the cam roll 78, controlling the stop 70, moves from the high to the low portions of the cam 80, as heretofore explained, the photoelectric cell and lamp are moving downwardly but at a slower rate of speed than the web C. At the time that a blackened area 48 intercepts the light from the source 108 the photoelectric cell interrupts the flow of current through the solenoid 102 whereupon the stop 70 is locked in position. A suitable circuit for this purpose is shown diagrammatically in Fig. 2*a* and includes an amplifier 109 to which both the photoelectric cell and the solenoid are connected, the arrangement being such that current through the solenoid 102 is interrupted when the beam of light to the photoelectric cell is intercepted. The time in the downward movement of the photoelectric cell and associated lamp that the light from the lamp is intercepted by a blackened portion 48 is a measure of the amount of paper in the adjacent section of the web that must be gathered in the next rotation of the roll 12 so that the section will be properly located with respect to the shell material S and the machine. Thus the more that the web has been stretched the later will the light from the lamp 108 be intercepted by the blackened area 48 and consequently the further the finger 62 is permitted to protrude from the roll 12.

After the plaiting finger 62 moves upwardly away from the web the cam roll 78 must start riding up on to the high portion of the cam 80. During this time it is necessary that the solenoid 102 be energized to relieve the clamping pressure of the gear 86 against the roll 12 thereby to permit movement of the arm 76 relatively to the roll. During this time, however, the light from the lamp 108 is no longer intercepted by a blackened portion 48 on the web C. Accordingly, provision is made to interrupt the circuit to the lamp 108 so that no light reaches the photocell and the solenoid remains energized. For this purpose a switch 120 (Fig. 2) is secured to the frame of the machine and has a switch arm 122 arranged to

be actuated by an adjustable cam 124 secured to an end face of the lower roll 16. Thus at a predetermined time in the rotation of the roll 16 the circuit to the lamp 108 is opened at the switch 120 producing the same effect as if a blackened area intercepted the light beam thus deenergizing the solenoid 102. The switch 120 is again closed when the cam roll 78 reaches the high point of the cam 60 whereupon the aforedescribed cycle of operations is repeated.

It is important when paper from the roll 16 (Fig. 1) is to be spliced to the paper from the roll 14 that approximately the proper distance between the blackened areas should be maintained as otherwise it might require considerable time for the machine to bring the web C back into proper register with the web S with a consequent wastage of material. A blackened portion along the web C from the roll 16 may be readily positioned in a predetermined location with respect to the roll 20. This roll is normally maintained in its elevated position by a bar 130 (Fig. 1) resting upon a ledge 132 on the machine frame and held in such position by a spring-pressed plunger 133. Pivoted to the lower end of the bar is an arm 134 provided with a spring-pressed detent 136 which cooperates with a pair of shoulders on the bar 130 to maintain the arm 134 in either of two predetermined positions. With the arm in the position shown in full lines in Fig. 1 it is out of the path of movement of a cam 138 carried by the gear 40 at the end of the upper roll 12. If, however, the arm 134 is pivoted into the broken line position at the time that it is desired to make a splice, the cam 138 will engage the arm at a predetermined point in the rotation of the roll 12 with the result that the bar 130 is moved off the shoulder 132 permitting the lever 32 and the roll 20, carried thereby, to drop by gravity and to press the paper from the exhausting roll 14 into contact with the paper from the new roll 16. If the paper from the roll 16 has been properly positioned it will be spliced to the other paper at approximately the correct position so as not to interfere with the rapid register of the designs upon the web from the new roll with the web of shell paper S. Otherwise several cycles of operation of the finger 62 might be required to gather sufficient cover paper to obtain proper register thereof, with a consequent wastage of material.

A blackened plate 140 is positioned beneath the web C in a position to intercept the beam of light from the lamp 108 if the machine should be run without paper. This is to insure that the finger 62 is in retracted position as it approaches the web of shell material S.

From the above it will be seen that by a simple local gathering or plaiting action on the web C' its accurate register with the web of shell paper S and with the blank-forming instrumentalities of the machine is readily produced. The plaited portions of the cover paper are formed precisely at the locations where the composite web is later to be severed to form discrete blanks, and this plait at this location will provide material for covering the raw edge of the shell material. The blackened portions occurring at the ends of the blank will not show after the paper has been folded around the side wings and corner laps of the box blank and the blank subsequently formed into a box. Thus it is possible without interfering with the high productive capacity of the machine to employ preprinted cover paper accurately positioned on the box part with a considerable consequent saving in cost of manufacture of the box.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. In a machine for performing successive operations on a web of sheet material having designs printed on successive sections thereof, mechanism for feeding the web into the machine, means for properly registering sections of the web with the machine comprising adjustable plaiting means, and means responsive to the length of each section of the web as it approaches the plaiting means for controlling the plaiting means to shorten the section by an amount corresponding to the excess in the length of the section above a predetermined length prior to being fed to the machine.

2. In a machine for performing successive operations on a web of sheet material having designs printed on successive sections thereof, mechanism for feeding the web into the machine, the feeding mechanism including means for gathering each section of the web into a plait, and means responsive to the length of each section of the web as it is being delivered to the machine for controlling said gathering means to vary the amount of web gathered into said plait, whereby the section is shortened to a predetermined length.

3. In a machine for performing successive operations on a web of sheet material having a recurring design printed on successive sections thereof, mechanism for feeding the web into the machine comprising a pair of feed rolls, a plaiting finger carried by one of said rolls arranged upon each rotation of the roll to gather the material of the web into a transversely extending plait, and means responsive to the length of each section of the web as it approaches the rolls for adjustably controlling the action of said finger to vary the amount of web gathered into a plait whereby each section of the web is shortened to a predetermined length.

4. In a machine for performing successive operations on a web of sheet material having a recurring design printed on successive sections thereof, a web-feeding roll, a plaiting finger movable outwardly of the roll through a slot therein, means urging said finger outwardly of the roll but permitting its movement inwardly of the roll in response to the application of pressure on the finger, an adjustable stop controlling the extent of outward movement of said finger, and means responsive to the length of each section of the web as it approaches said roll for positioning said stop according to the amount of material to be gathered into a plait whereby the section is shortened to a predetermined length.

5. In a machine for performing successive operations on a web of sheet material having a recurring design printed on successive sections thereof, a web-feeding roll, a plaiting finger movable outwardly of the roll through a slot therein, means urging said finger outwardly of the roll but permitting its movement inwardly of the roll in response to the application of pressure on the finger, said roll having a recess in its periphery adjacent to the leading edge of said finger to receive the plait formed by the finger.

6. In a machine for performing successive operations on a web of sheet material having a recurring design printed on successive sections thereof, a web-feeding roll, a plaiting finger mov-

able outwardly of the roll through a slot therein, means urging said finger outwardly of the roll but permitting its movement inwardly of the roll in response to the application of pressure on the finger, an adjustable stop controlling the extent of outward movement of said finger, means operative during that portion of the rotation of the roll in which the finger is approaching the web for adjusting the stop in accordance with the length of the section of the web approaching the feed roll whereby the finger protrudes outwardly of the roll sufficiently to gather only enough of the web into a plait to shorten the section to a predetermined length.

7. In a machine for performing successive operations on a web of sheet material having a recurring design printed on successive sections thereof, a web-feeding roll, a plaiting finger movable outwardly of the roll through a slot therein, means urging said finger outwardly of the roll but permitting its movement inwardly of the roll in response to the application of pressure on the finger, an adjustable stop controlling the extent of outward movement of said finger, a stationary cam adjacent to one end of said roll, a cam follower connected to said finger and urged into contact with said cam by said first named means, said cam being arranged to permit outward movement of the stop and finger during that portion of rotation of the roll in which the finger is approaching the web, and means responsive to the length of the section of web approaching the roll for locking the stop against further outward movement when the finger is protruding sufficiently to shorten the section of the web to a predetermined length.

8. In a box blank-making machine in which a web of shell material is combined with a web of cover material having a recurring design on successive sections thereof to form a web of blank material, a pair of assembly rolls between which the webs of cover and shell material are united and fed to blank-forming mechanisms, and means associated with the cover material assembly roll for intermittently feeding each section of cover material faster than the shell material to form a plait.

9. In a box blank-making machine in which a web of shell material is combined with a web of cover material having a recurring design on successive sections thereof to form a web of blank material, a pair of assembly rolls between which the webs of cover and shell material are united and fed to blank-forming mechanisms, and means associated with one of said rolls operative at the start of the feeding action on each section of the web of cover paper for temporarily increasing the rate of feed of cover paper and forming the excess paper gathered thereby into a plait at the leading edge of the section.

10. In a box blank-making machine in which a web of shell material is combined with a web of cover material having a recurring design on successive sections thereof to form a web of blank material, a pair of assembly rolls between which the webs of cover and shell material are united and fed to blank-forming mechanisms, means operative at the start of the feeding action on each section of the web of cover paper for increasing the rate of feed of cover paper and forming the excess paper gathered thereby into a plait at the leading edge of the section, said means including a finger carried by said roll for movement outwardly thereof from a position inwardly of the roll, a spring urging said finger outwardly of said roll but permitting inward movement of the finger in response to pressure thereagainst, and means limiting outward movement of said finger in accordance with the amount of paper to be gathered thereby into a plait.

11. In a machine for combining a web of cover material having designs printed on successive sections thereof with a web of shell material to form a web of blank material and for thereafter performing successive operations on the web of blank material, a pair of assembly rolls between which webs of cover and shell material are united and fed to blank-forming mechanisms, and means for properly registering sections of the web of cover material with operating instrumentalities of the machine comprising means carried by the cover material assembly roll for gathering each section of the web of cover material into a plait to shorten the section by an amount corresponding to the excess of the length of the section above a predetermined length while the webs of cover and shell material are being combined into a web of blank material.

CUTLER D. KNOWLTON.

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