

962 W. H. PORTER 3,036,483
CONTROL MEANS FOR ADJUSTING SLITTER SCORER MECHANISM
IN RESPONSE TO LATERAL DISPLACEMENTS
OF A MOVING WEB

4 Sheets-Sheet 1

This technical drawing illustrates a mechanical assembly, likely a multi-rod pump or valve, shown in two views: a front view on the left and a side view on the right.

Front View (Left):

- Top Section:** Features a horizontal rod (21) passing through a series of components including a nut (22), a washer (25), a flange (24), and a seal (26). Below this is a housing (27) with a central opening (28) and a flange (29).
- Central Section:** Consists of a vertical rod (3) passing through a series of seals (5, 11, 12, 9) and a central component (14). The rod is supported by a base (6) and a flange (8).
- Bottom Section:** Includes a base (6) with a central opening (7) and a flange (5). Below this is a component (41) with a central opening (40).

Side View (Right):

- Top Section:** Shows the side profile of the top housing (27) and the central rod (3) passing through it.
- Central Section:** Shows the side profile of the central rod (3) passing through the seals (5, 11, 12, 9) and the central component (14).
- Bottom Section:** Shows the side profile of the base (6) and the central opening (7).

The drawing uses standard mechanical notation, including dashed lines to indicate hidden internal features and various numbered callouts to identify specific components.

FIG. 3.

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FIG. 7

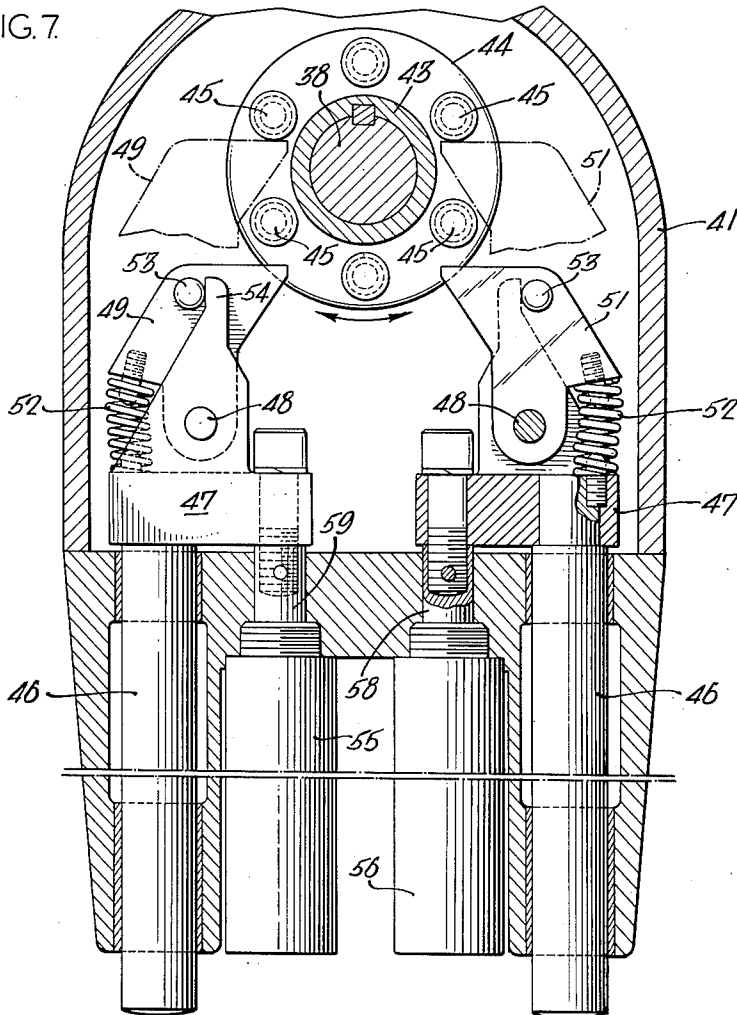
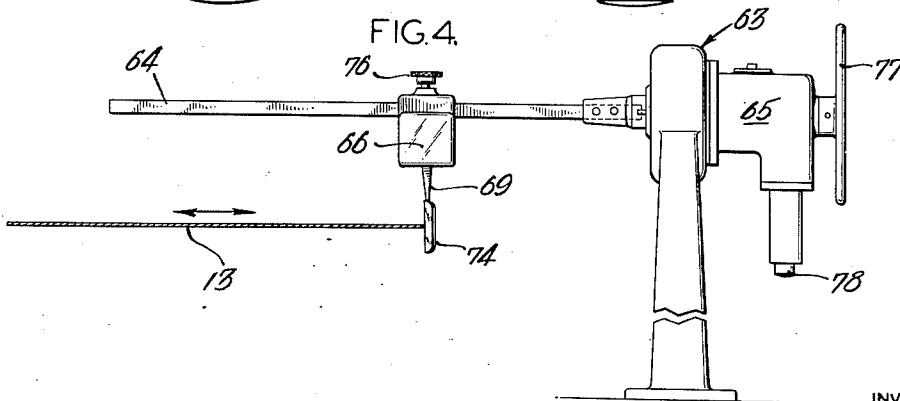


FIG. 4



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FIG. 5.

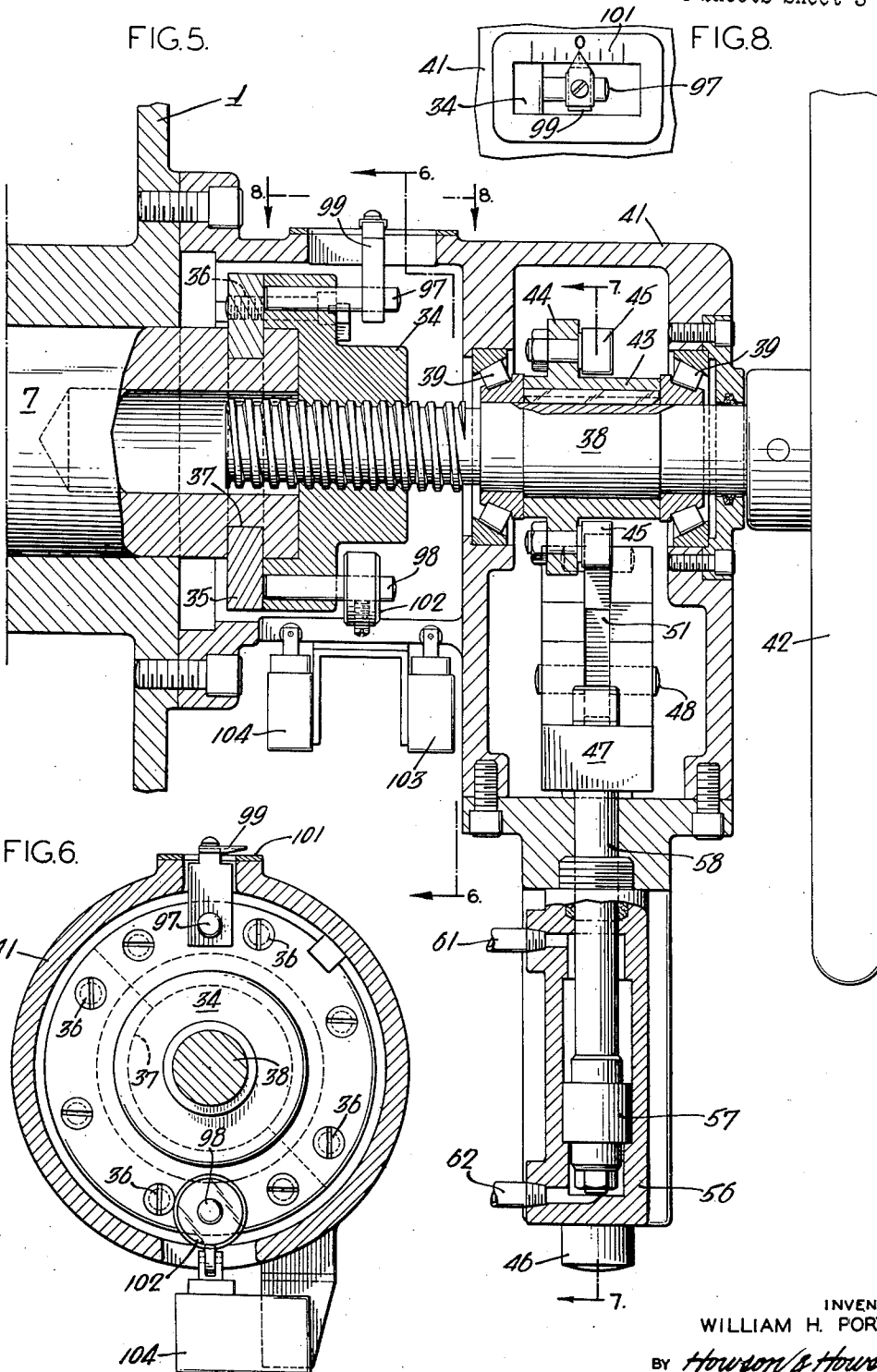


FIG. 8.

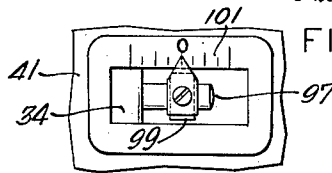
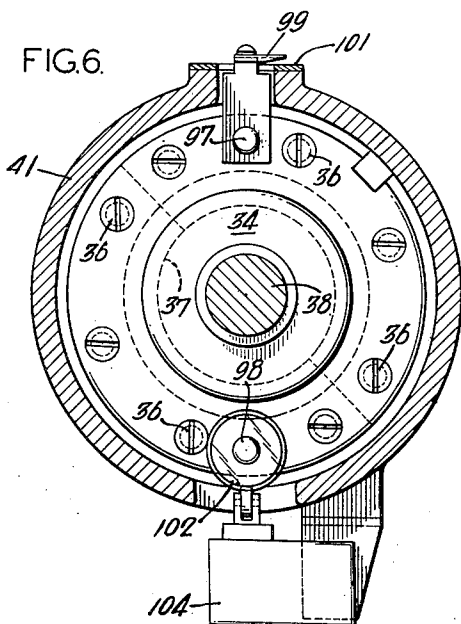


FIG. 6.



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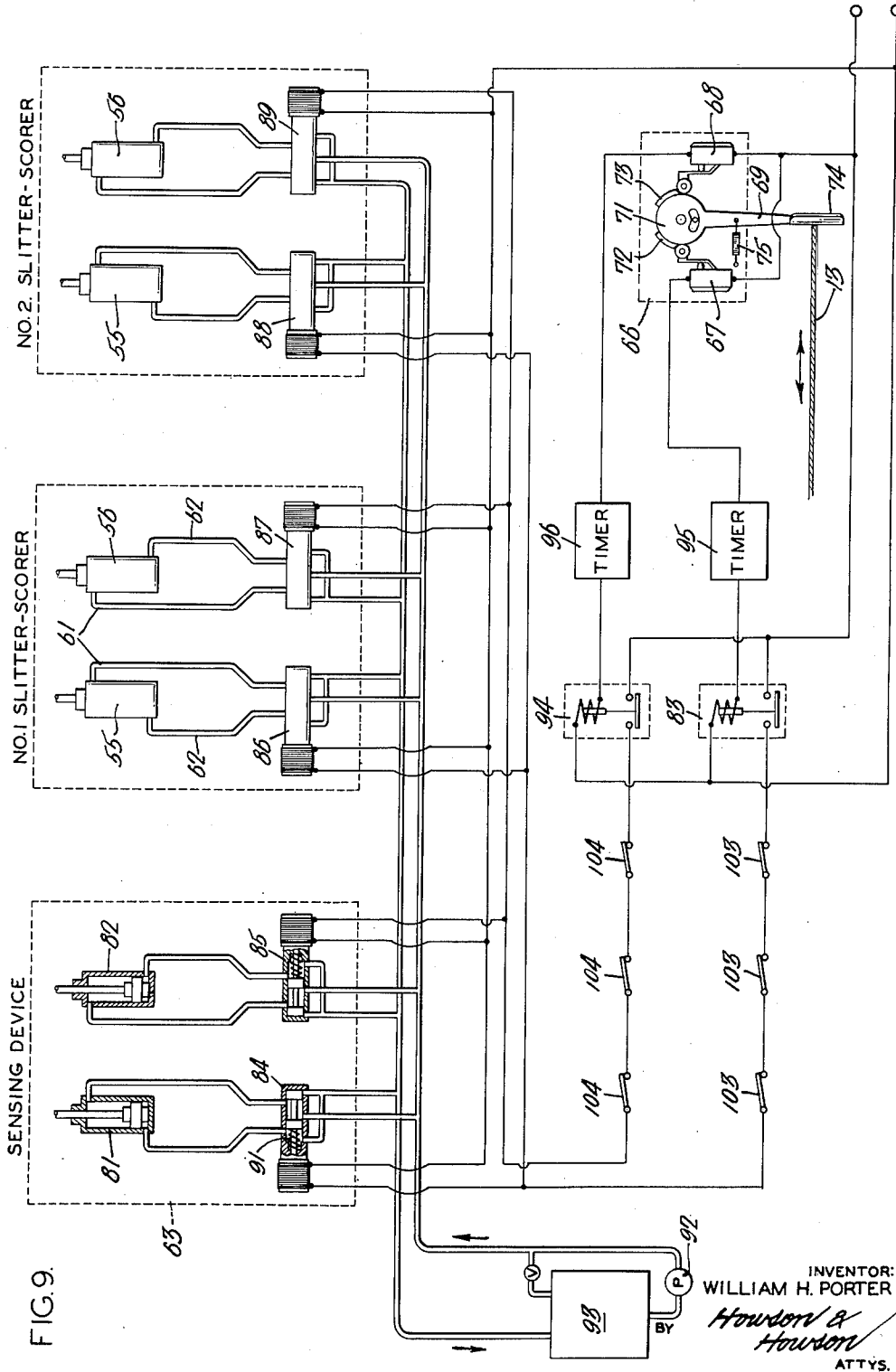
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4 Sheets-Sheet 4



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CONTROL MEANS FOR ADJUSTING SLITTER SCORER MECHANISM IN RESPONSE TO LATERAL DISPLACEMENTS OF A MOVING WEB

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Continuation of application Ser. No. 642,165, Feb. 25, 1957. This application June 10, 1959, Ser. No. 819,423
9 Claims. (Cl. 83—74)

This invention relates to improvements in machines for slitting, scoring or performing other operations on travelling web stock, and is a continuation of my application Serial No. 642,165, now abandoned, filed February 25, 1957.

In slitter-scorer machines, for example, of the type used in the paper box industry, a preformed double-faced strip of corrugated board or other web stock may be passed continuously through one or more slitting and scoring units wherein the stock is scored and/or slit longitudinally as required. Frequently the web is trimmed at the edges by removal of narrow strips of the material. Since the web stock is subject to structural variations which may tend to divert it laterally from a straight line course through the machine, it has been proposed to provide the said units with means for lateral adjustment of the slitting and scoring heads so as to correct relative misalignment of the web with the slitting and scoring elements and to maintain within reasonable limits a uniform slit and scored end product. Conventionally, these adjustments have been made manually, and individually in each unit. Under these circumstances, the misalignments are correctable only after they become visually apparent so that desirably close uniformity of end product is not achievable, and it is necessary also where edge trimming is required to provide web stock of width materially in excess of the width required in the end product.

A principal object of the present invention is to provide means responsive directly to the lateral displacements of the web stock which result in said misalignments so that the corrective movement of the respective heads substantially coincides with the web displacement. In this manner, the original tracking relation of the web with the slitting and/or scoring elements remains substantially undisturbed despite lateral displacements of the web with a resultant high degree of uniformity in the scored and/or slit end product. Correspondingly, the difference in width between the stock web and of the end product may be relatively small with consequent material economy of the web stock material.

Another object of the invention is to provide for automatic realignment of the slitting and scoring elements with the web by means not interfering with the conventional manual adjustment of the said elements of a slitter-scorer described above.

Still another object of the invention is to provide automatic adjustment means of the character set forth using fluid components, specifically hydraulics, to afford simple synchronized movements of two or more relatively remote slitter-scorer heads for the corrective purpose set forth without requirement for elaborate electronic feedback devices and without tendency to "hunt."

A further object of the invention is to provide automatic adjustment devices of the character described affording accurate control of the speed of the adjustment movements.

The invention will be more readily understood by reference to the attached drawings wherein:

FIG. 1 is a diagrammatic top plan view of a slitter-scorer machine comprising a plurality of slitting and scoring units and made in accordance with the invention;

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FIG. 2 is a side elevational view of that portion of the machine shown diagrammatically in FIG. 1;

FIG. 3 is an enlarged sectional view on the line 3—3, FIG. 1;

FIG. 4 is an enlarged sectional view on the line 4—4, FIG. 1;

FIG. 5 is an enlarged fragmentary sectional view on the line 5—5, FIG. 1;

FIG. 6 is a sectional view on the line 6—6, FIG. 5;

FIG. 7 is a sectional view on the line 7—7, FIG. 5;

FIG. 8 is a fragmentary top plan view from the line 8—8, FIG. 5; and

FIG. 9 is a diagrammatic view illustrating the electro-hydraulic system controlling the operations of the automatic alignment mechanism illustrated in the other figures of the drawings.

With reference to the drawings, the slitter-scorer machine therein illustrated as an embodiment of the invention comprises a plurality of slitter-scorer units of which two are indicated by reference numerals 1 and 2. In the present instance each of these units is of triplex type comprising three separate sets of shafts, designated generally by the reference numerals 3, 4 and 5, which are mounted in a common rotary head 6. The head is mounted on a rotary shaft 7 and is adjustable angularly about the shaft axis so as to bring the sets of shafts selectively to a position at the top of the head now occupied by the shafts 3, 3. The sets of shafts in unit 1 carry two sets of slitter knives in the present instance, 8, 8 and 9, 9 and two sets of scoring elements 11, 11 and 12, 12. A strip 13 of web stock passes continuously through the heads 1 and 2 between the shafts 3, 3 which in the present instance lie at the tops of the two heads. The knives 8, 8 and 9, 9 are arranged to operate on the longitudinal edge portions of this strip so as to trim the latter to a required width. In the head 2 the shafts 3, 3 between which the web 13 passes are provided with two sets of scoring elements designated in FIG. 1 by the reference numeral 14, 14.

As shown in FIG. 3, one end of the shaft 7 of the respective units has keyed thereto a gear 15 by means of which the shaft 7 may be rotated and with it the head 6. Rotation of the gear 15 may be effected through a pinion 16 on the inner end of a stub shaft 17 the outer end of which is connected through a gear reduction unit 18 with an electric motor 19. A line shaft 21 is connected by way of a sprocket 22, chain 23, and sprocket 24 with a bevel pinion 25, said pinion meshing with a pinion 26 on a shaft 27 which carries at its other end a spur gear 28. Between the pinion 26 and the gear 28 is a magnetic clutch 29 by means of which gear 28 may be disconnected from the pinion 26 and the other transmission parts connected to the pinion. The gear 28 is normally operated from the line shaft 21 to drive the shafts 3, 3 by way of a gear 31 on the end of the lower shaft 3, a gear 32 on the same shaft, and intermeshing gear 33 on the upper shaft 3 of the set.

It will be noted that each of the other sets of shafts 4, 4 and 5, 5 is provided with gears corresponding to gears 31, 32 and 33 so that when the head 6 is rotated through an angle of 120° the shafts 4, 4 or 5, 5 depending on direction of rotation, will be brought to top position and will be operatively connected with the gear 28 and through the gear with the line shaft 21. Rotation of the head 6 through the 120° angle may be effected through the motor 19, reduction gear 18, then gears 15 and 16 previously described. In such substitution of one set of shafts for another, the clutch 29 is actuated to disconnect the driving gear 28 from the line shaft 21 so that this gear may come into mesh with the gear element 31 of the substituted set of shafts without interference.

At their opposite ends, the shafts 7 of the respective

heads are attached to an internally threaded member or nut 34. In the present instance, the nut is secured to the shaft against relative axial displacement by means of a ring 35 which is secured by screws 36 to the inner end of the nut 34 and which projects into a peripheral groove 37 in the shaft. The nut is held against rotation but is free to move axially in the frame 41 of the unit. Threaded into the nut 34 is a screw shaft 38 the outer end portion of which is journaled in anti-friction bearings 39, 39 in the frame 41, and to the outer end of the screw shaft 38 is attached a hand wheel 42. Rotation of the screw by way of the hand wheel will effect an axial adjustment through the nut 34 and attaching ring 35 of the shaft 7 and with it of the head 6 and the slitter-scorer shafts in the head. Such axial adjustment of the shaft and head is permitted by the keyed connection of the shaft 7 with the gear 15 and is accompanied by relative axial displacement of the meshing gears 31 and 28, see FIG. 3.

Keyed to the shaft 38 between the bearings 39, 39 is a collar 43 having a radial flange 44 in which are secured an annular series of projecting buttons 45. Slidably supported in the frame 41 below the collar 43 and one at each side of a vertical plane intersecting the axis of the shaft 38 is a guide pin 46 to the upper end of each of which is attached a block 47. Pivotaly connected to the block 47 on a pin 48 is a pawl, 49 and 51 respectively. The pawl 49 is urged in a clockwise direction as viewed in FIG. 7, by a spring 52, such clockwise movement being limited by a stop pin 53 on the pawl which engages a stop 54 on the block 47. In the normal retracted position as shown in full lines in FIG. 7 the pawl 49 occupies a position with respect to the collar 43 such that if the guide pin 46 moves upwardly, the pawl will be elevated to the position shown in broken lines and in this movement will engage one of the buttons 45 to rotate the collar 43 and with it the shaft 38 through an angle of approximately 60° in the clockwise direction. The pawl 51 of the pin 46 is similarly arranged at the opposite side of the collar 43 so that when elevated to the broken line position shown in FIG. 7, the pawl by engagement with the immediately overlying button 45 will act to rotate the collar and shaft 38 in a counterclockwise direction through an angle of approximately 60°. Such angular movement of the shaft 38 will, as previously described, result in an axial adjustment of the shaft 7.

In downward movements of the pawls to their normal retracted positions, the engagement of the undersides of the pawls with the underlying buttons 45 will result in angular displacements of the pawls against pressure of the springs 52 without effect upon the position of the collar and shaft.

Mounted in the frame 41 adjacent the pins 46 is a pair of hydraulic cylinders 55 and 56 (see FIG. 7). Operating in each of these cylinders is a piston 57 (see FIG. 5) having a rod 58 and 59 respectively which extends upwardly and is attached to the proximate block 47. Hydraulic fluid may be introduced to the tops and bottoms respectively of the cylinders 55 and 56 by pipes 61 and 62 which are connected to a fluid pressure source as hereinafter described. Means is provided, also as hereinafter set forth, for hydraulically actuating the pistons 57 of the respective cylinders 55 and 56 selectively and individually to elevate and depress the blocks 47 and pawls 49 and 51 to angularly adjust the shaft 38 to effect required axial adjustments of the shaft 7.

Located in advance of the slitter-scorer head 1 (with reference to the direction of travel of the web 13) is a sensing device indicated generally by the reference numeral 63. This device comprises a rod 64 which extends from a housing 65 over the edge of the web 13. The rod carries a casing 66 which houses a pair of micro-switches 67 and 68 (see FIG. 9) and a pivoted arm 69 having at its hub 71 switch-actuating cams 72 and 73 respectively. The arm 69 extends downwardly from the casing and has

at its lower end a shoe 74 which engages the edge of the web 13. A light spring 75 maintains contact of the shoe with the web edge. If the web moves to the right, as viewed in FIG. 9, the resulting displacement of the arm 69 causes cam 72 to actuate switch 67. A reverse lateral displacement of the web will result in actuation of switch 68 by cam 73. The casing 66 is slidably adjustable longitudinally of the rod 64 and is anchored in adjusted position by set screw 76. In initiating a machine operation the casing will be set so that with the shoe 74 in contact with the edge of the web 13, the arm 69 will occupy a centered position with respect to switches 67 and 68 as shown in FIG. 9. The device is then in condition to sense lateral displacement of the web in either direction.

The housing 65 contains a nut corresponding to the nut 34 previously described which is slidable axially but held against rotation in the housing. In this case, however, the nut may be rigidly attached to the rod 64 which is itself a non-rotating element. The housing also contains hydraulically actuated mechanism for adjusting the nut axially identical with that contained in housing 41 previously described and including a nut-actuating screw shaft (shaft 38) having a hand wheel 77 for manual operation; a flanged collar (collar 43) keyed to the shaft and having buttons corresponding to the buttons 45; spring pressed pawls corresponding to pawls 49 and 51 and similarly mounted on guide pins 78 and 79, see FIG. 2; and pawl actuating hydraulic cylinders 81 and 82 (FIG. 2) corresponding to cylinders 55 and 56.

As hereinafter more specifically described, the switches 67 and 68 are operatively associated respectively with the cylinders 81 and 82 so that actuation of either switch by a lateral displacement of the web will result in a displacement of the rod 64 in the same direction and to an extent necessary to return the arm 69 to the original centered position with respect to the switches as shown in FIG. 9. The switches are similarly associated with the cylinders 55 and 56 of the units 1 and 2, so that displacement of the web will be accompanied also by an axial adjustment of the shafts 38 of said units and of the slitting-scorer heads in the same direction, as and to the same extent as the web displacement so that the slitting and scoring elements will remain in their original positions of alignment with the web. A control system for obtaining the desired automatic adjustments of the said heads and of the sensing device is shown in FIG. 9.

With reference to FIG. 9, let it be assumed that the sensing arm 69, in engagement with the edge of the web 13 as described, is in the normal median position shown at the lower right of FIG. 9. If now the web moves laterally to the right, as viewed in FIG. 9, from its normal path of travel, even to a slight degree, the arm 69 will be displaced against the pull of the spring 75 and will immediately close micro-switch 67. The closing of switch 67 will energize relay 83 and will thereby close the circuit containing the solenoids of valves 84, 86 and 88 thereby moving these valves from the position which they normally occupy under pressure of their respective springs 91. In this normal position, the valves admit pressure fluid from pump 92 to the tops of cylinders 81 and 55 while connecting the lower ends of the cylinders with the sump 93. Energization of the solenoids as described shifts the valve elements to the left and reverses the hydraulic connections so that pressure fluid is admitted to the lower ends of cylinders 81 and 55. Under these circumstances, the rod 64 of the sensing device and the rotary heads of the slitter-scorer units 1 and 2 will all be adjusted in the same direction as that of the web displacement, i.e. to the right as viewed in FIGS. 3 and 4, and this movement will be continued until the arm 69 of the sensing device will have returned to the median position with consequent reopening of switch 67. The movement of the slitter-scorer heads in this adjustment will be the same as that of the rod 64 of the sensing device and the same also as the lateral displacement of the

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web 13 so that the original alignment between the web and the slitting and scoring elements is maintained. A displacement of the web in the opposite direction will result in closing the micro-switch 68 with consequent actuation of normally open relay 94 and energization of the solenoids of valves 85, 87 and 89 to admit pressure fluid to the bottoms of cylinder 82 of the sensing device and cylinders 56, 56 of the slitter-scoring units 1 and 2. This will result in a movement of the rod 64 of the sensing device and of the rotary heads of the units 1 and 2 and in direction i.e. to the left in FIGS. 3 and 4, to compensate again for the incipient misalignment between the web and the slitting and scoring elements.

The foregoing cycle of operations applies to movements of the web of a magnitude that can be compensated by angular movements of the collars 43 of not more than 60°, or in other words by a single stroke of the pawl 49 or 51 as the case may be. If the required compensating movement is in excess of that obtainable by one full stroke of the pawl, it becomes necessary to provide for retraction of the pawl after the first stroke in order that it may move the required additional stroke or frictional part thereof. This may be accomplished by use of timer switches 95 and 96 in series respectively with the relays 83 and 84 and adjusted to break the circuit after completion of each full stroke of the said pawls, with consequent de-energization of the associated pawl-control solenoid valves 84 to 89, and to again complete the circuit after return of the pawls to the retracted positions. Timer switches of this type and their mode of operation are well known in the electrical art.

With reference to FIGS. 5 and 6, it will be noted that the nut 34 is provided with a pair of pins 97 and 98 respectively. To pin 97 is attached a pointer 99 which coacts with a scale 101 (see FIG. 8) to indicate the extent of the off-center position of the associated slitter-scoring head. Pin 98 carries a collar 102 which is operatively associated with a pair of normally closed electrical switches 103 and 104 respectively. An extreme movement in either direction of the shaft 7, or of the arm 64 of the sensing device, from its normally centered position will result in opening one or other of switches 103 and 104 and will thereby open the control circuits to preclude further adjustments of the shafts. The switches and their location in the control system is shown in FIG. 9.

I claim:

1. A machine for performing work such as slitting and scoring on continuously travelling web stock, comprising work mechanism for performing said work, a first actuating means operable to effect positive adjustment of the work mechanism in opposite directions laterally of the web in intermittent step-by-step increments, a first reversible hydraulic motor means for operating said first actuating means, a sensing device responsive to lateral displacements of said web from a predetermined path of travel spaced in advance of and independently of said work mechanism in a position adjoining the web, a second actuating means operable to effect positive adjustment of the sensing device laterally of the web in intermittent step-by-step increments, a second reversible hydraulic motor means for operating said second actuating means, and control mechanism including means actuable by said sensing device operable to control the first and second hydraulic motor means in response to said lateral displacements of the web to effect simultaneous equal positive adjustments of the sensing device and work mechanism laterally of the web and thereby restore said sensing device and work mechanism to their original relationship with respect to the web at the termination of the web displacement movement.

2. A machine for performing work such as slitting and scoring on continuously travelling web stock, comprising work mechanism for performing said work movable laterally of the web in response to lateral displacements of the

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web to maintain a relatively fixed relation between the work mechanism and the web, a first actuating means operable to effect positive displacement of said work mechanism in opposite directions laterally of the web in intermittent step-by-step increments, a first hydraulic motor means for operating said first actuating means, a hydraulic system containing said first hydraulic motor means together with valve means to control the operations thereof, a sensing device responsive to lateral displacements of said web from a predetermined path of travel spaced in advance of and independently of said work mechanism in a position adjoining the web, a second actuating means operable to effect positive adjustment of the sensing device laterally of the web in intermittent step-by-step increments to maintain a constant relation between the sensing device and the web, a second hydraulic motor means in said system for operating said second actuating means, and mechanism including means selectively operable by the sensing device in response to lateral displacements of the web for controlling said first and second hydraulic motor means to effect equal positive adjustments of said work mechanism and the sensing device laterally of the web in response to said lateral displacements of the web and thereby restore said sensing device and said work mechanism to their original relationship with respect to the web at the termination of the web displacement movement.

3. A machine as claimed in claim 1 wherein each of said first and second actuating means for adjusting the work mechanism and sensing device laterally of the web is provided with manual means separately operable at will to effect transverse adjustments of the work mechanism and sensing device relative to each other and to the web concurrently with and independently of the operation of said actuating means.

4. A machine as claimed in claim 1 having a second work mechanism provided with a separate actuating means operable to effect positive displacement of said second work mechanism in opposite directions laterally of the web in intermittent step-by-step increments, a separate hydraulic motor means for operating said actuating means, and means in the control mechanism of the machine operable to effect positive adjustments of said second work mechanism laterally of the web in simultaneous correspondence with the first work mechanism and sensing device and thereby restore both work mechanisms and the sensing device to their original relationships with respect to the web at the termination of the web displacement movement.

5. A machine as claimed in claim 4 wherein each of the actuating means for adjusting respectively the two work mechanisms and sensing device laterally of the web is provided with manual means separately operable at will to effect transverse adjustments of the said work mechanisms and sensing device relative to each other and to the web concurrently with and independently of the operation of said actuating means.

6. A machine for performing work such as slitting and scoring on continuously travelling web stock, comprising work mechanism for performing said work, a first actuating means operable to effect positive adjustment of the work mechanism in opposite directions laterally of the web in intermittent step-by-step increments, a first reversible hydraulic motor means for operating said first actuating means, valve elements for controlling said first hydraulic motor means, a device including a sensing head spaced in advance of said work mechanism for sensing lateral displacements of said web from a predetermined path of travel, means adjustably supporting said sensing head independently of said work mechanism in a position adjoining the web for movement laterally of the web, a detector element carried by said head and responsive to lateral displacements of the web, a second actuating means operable to effect positive adjustment of the sensing head and detector element relative to said support means and laterally of the web in intermittent step-by-step increments,

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a second reversible hydraulic motor means for operating said second actuating means, valve elements for controlling said second hydraulic motor means, a separate solenoid means for operating the control valve elements of each said first and second hydraulic motor means, an electric circuit including said solenoid means, switch means in said circuit actuable by said detector element for controlling the first and second hydraulic motor means in response to said lateral displacements of the web to effect simultaneous equal positive adjustments of the detector element and work mechanism laterally of the web and thereby restore said detector element and work mechanism to their original relationship with respect to the web at the termination of the web displacement movement and timer means for periodically deactivating said solenoid means to obtain adjustment in intermittent step-by-step increments.

7. A machine for performing work such as slitting and scoring on continuously travelling web stock, comprising first and second work mechanisms for performing said work each movable laterally to the web in response to lateral displacements of the web to maintain a relatively fixed relation between the work mechanisms and the web, first and second actuating means operable respectively to effect positive displacement of said first and second work mechanisms in opposite directions laterally of the web in intermittent step-by-step increments, first and second hydraulic motor means respectively for operating said first and second actuating means, a hydraulic system containing said first and second hydraulic motor means together with valve means to control the operations thereof, a device including a sensing head spaced in advance of said first work mechanism for sensing lateral displacements of said web from a predetermined path of travel, means adjustably supporting said sensing head independently of said first and second work mechanisms in a position adjoining the web for movement laterally of the web, a detector element carried by said head and responsive to lateral displacements of the web, a third actuating means operable to effect positive adjustment of the sensing head laterally of the web in intermittent step-by-step increments to maintain a constant relation between the detector element and the web, a third hydraulic motor means in said hydraulic system for operating said third actuating means, valve means in said hydraulic system for controlling operation of said third hydraulic motor means, and an electric circuit including means selectively

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operable by the detector element in response to lateral displacements of the web for actuating simultaneously the valve means in said hydraulic system to effect equal positive adjustments of said first and second work mechanisms and the detector element laterally of the web in response to said lateral displacements of the web and thereby restore said detector element and said first and second work mechanisms to their original relationship with respect to the web at the termination of the web displacement movement.

8. A machine as claimed in claim 6 wherein each of said first and second actuating means for adjusting the work mechanism and sensing head laterally of the web is provided with manual means separately operable at will to effect transverse adjustments of the work mechanism and sensing head relative to each other and to the web concurrently with and independently of the operation of said actuating means.

9. A machine as claimed in claim 6 having a second work mechanism provided with a separate actuating means operable to effect positive displacement of said second work mechanism in opposite directions laterally of the web in equal step-by-step increments, a separate hydraulic motor means for operating said actuating means, valve elements for controlling said hydraulic motor means, and separate solenoid means in the electric circuit of said machine for operating said valve elements, said separate solenoid means being controlled by the switch means in said circuit actuable by the detector element in response to lateral displacements of the web to effect positive adjustments of said second work mechanism laterally of the web in simultaneous correspondence with the first work mechanism and detector element and thereby restore both work mechanisms and the detector element to their original relationship with respect to the web at the termination of the web displacement movement.

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**UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION**

Patent No. 3,036,483

May 29, 1962

William H. Porter

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 5, line 23, for "frictional" read -- fractional --;
column 6, line 74, for "support" read -- supporting --.

Signed and sealed this 11th day of September 1962.

SEAL)

Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents