Oct. 4, 1966 C. A. LEWIS, JR., ETAL 3,276,648

INTERMITTENT WEB FEED MECHANISM WITH TRIGGER STOP

Filed May 7, 1964 3 Sheets-Sheet 1

FIG.1

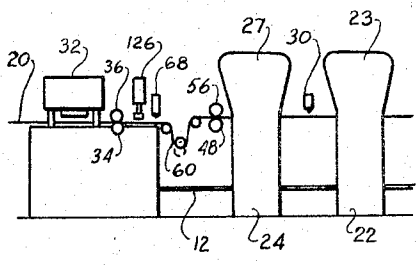


FIG.2

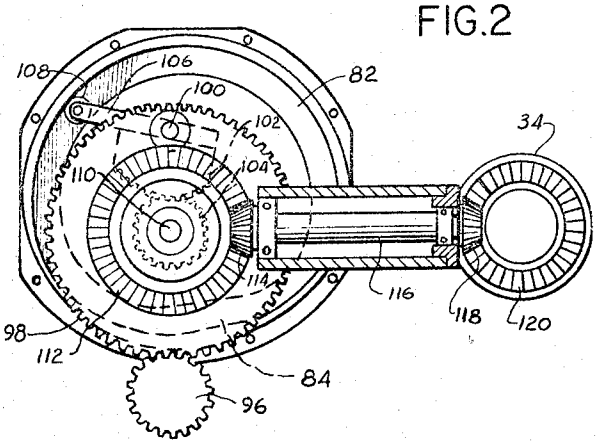
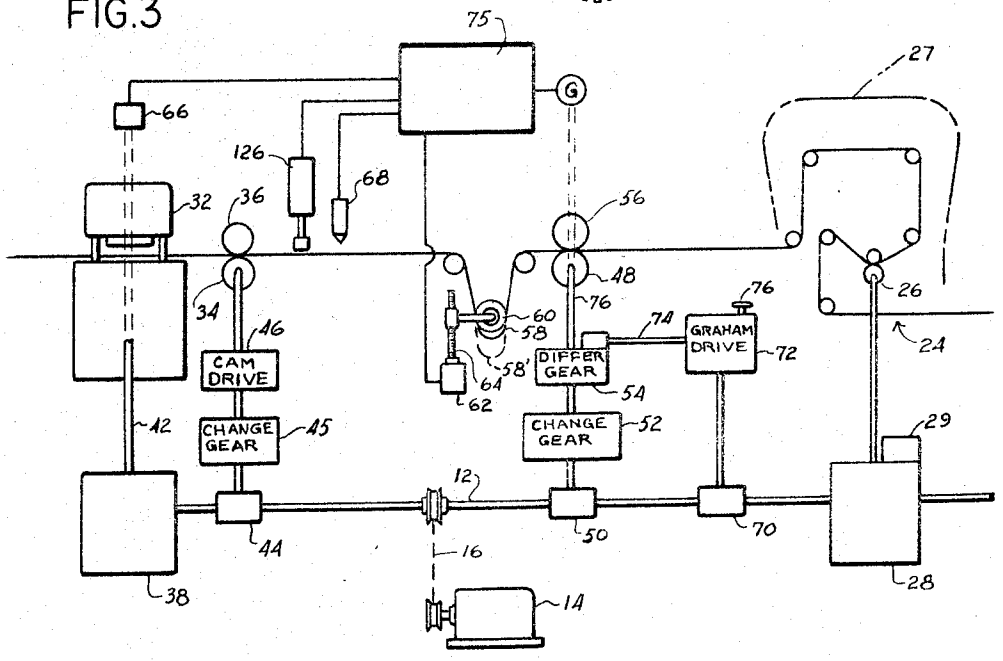


FIG.3



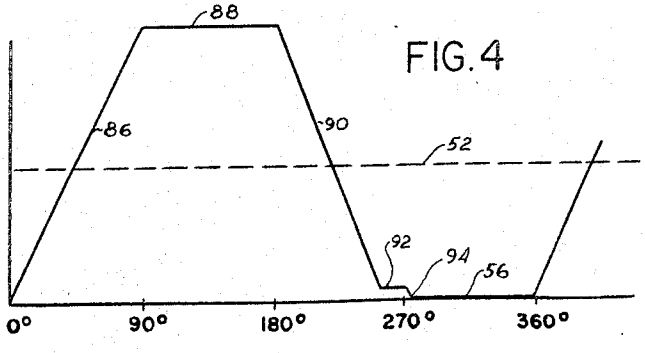


FIG.4

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INTERMITTENT WEB FEED MECHANISM WITH TRIGGER STOP

Filed May 7, 1964 3 Sheets-Sheet 2

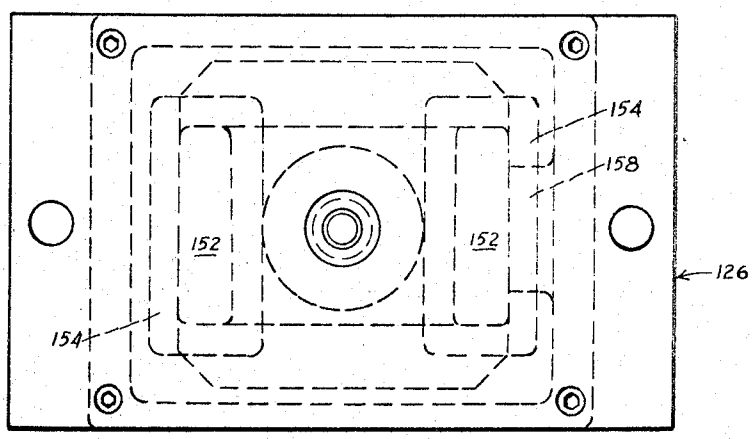


FIG.5

FIG.6

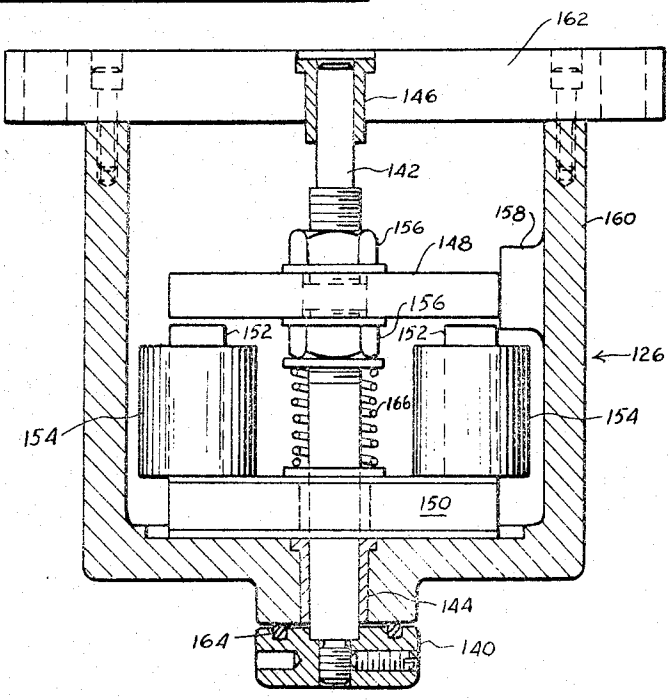
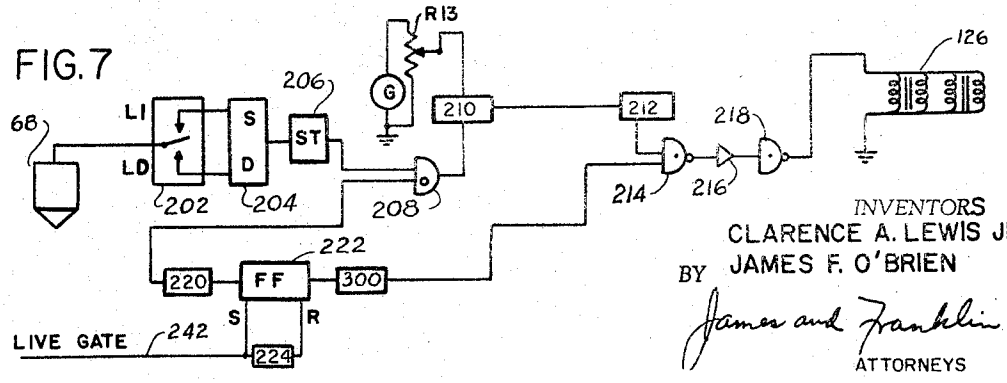


FIG.7



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INTERMITTENT WEB FEED MECHANISM WITH TRIGGER STOP

Filed May 7, 1964 3 Sheets-Sheet 3

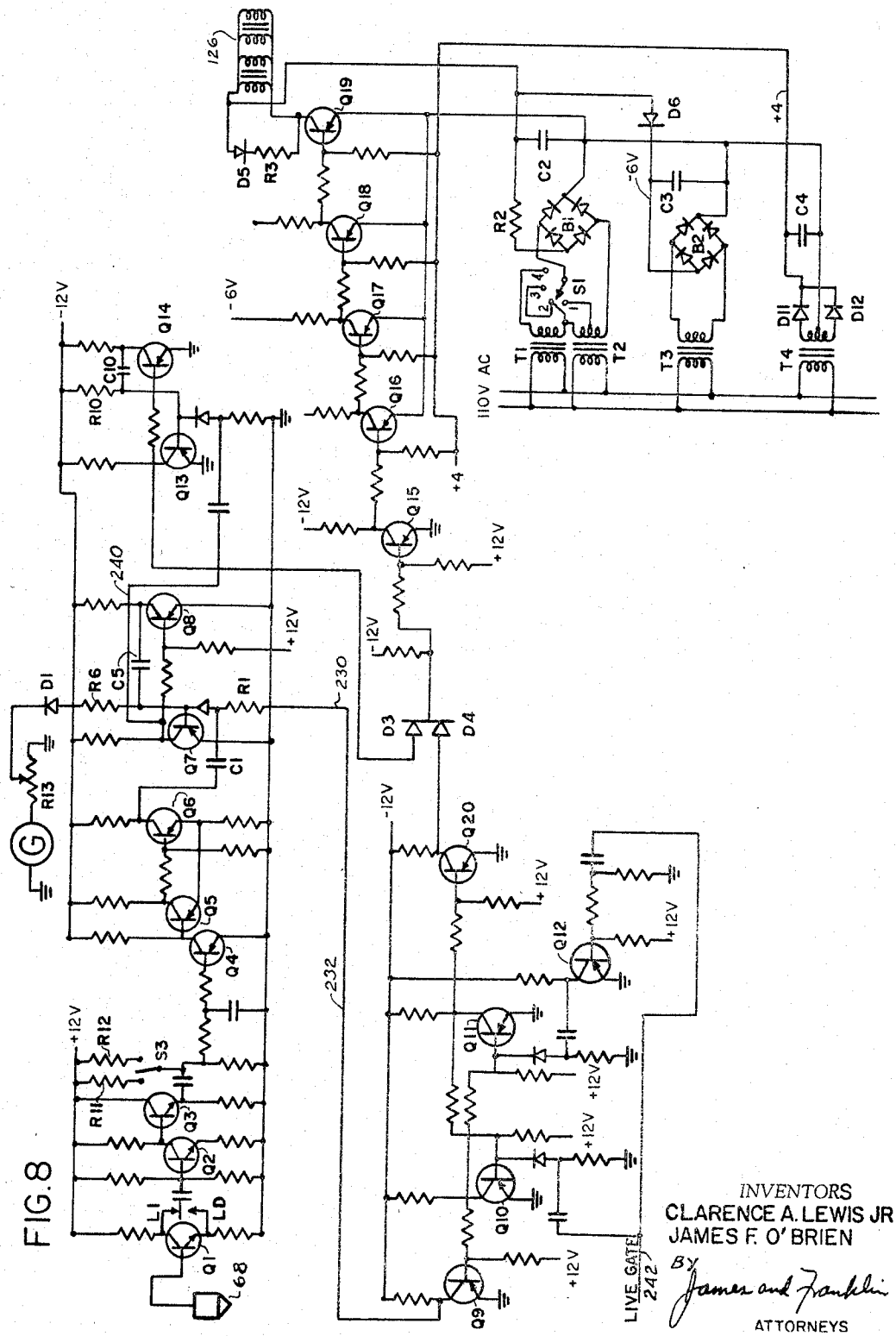


FIG. 8

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United States Patent Office

3,276,648

Patented Oct. 4, 1966

3,276,648

INTERMITTENT WEB FEED MECHANISM WITH TRIGGER STOP

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Filed May 7, 1964, Ser. No. 365,754
21 Claims. (Cl. 226—33)

This invention relates to intermittent web feed systems, and more particularly to a photo-electrically timed web clamp arrangement to improve the accuracy of such systems.

There are machines which feed a web continuously at one point, and intermittently at another. An example is the combination of a rotary printing press with a reciprocating press which scores, creases, punches or cuts a printed web. For brevity the term "punch" is here used for all such operations. The punch press works on an intermittently stationary web, but the web is moving at constant velocity in the printing press.

It has already been suggested in U.S. Patent 3,025,740, issued March 20, 1962, to change the variable speed cycle of the web to provide a brief interview of low uniform velocity just before the dwell period, and to combine that with a clamp or so called "trigger stop" which stops the web at the desired instant during the brief interval of low velocity movement. The variable speed drive may be mechanical, but the clamp is controlled by a photo-electric eye or scanner which responds to a target printed on the web, and does so at a point close to the punch press, thereby insuring accuracy of cut-to-print registry.

The general object of the present invention is to improve such a system, and more particularly the clamps and the electrical control circuitry for operating the clamps.

To accomplish the foregoing general object, and other more specific objects which will hereinafter appear, our invention resides in the intermittent web feed mechanism, and the elements thereof, and their relation one to another, as are hereinafter more particularly described in the following specification. The specification is accompanied by drawings in which:

FIG. 1 is a side elevation drawn to small scale showing apparatus utilizing the present invention;

FIG. 2 is a fragmentary section explanatory of one form of variable speed drive which may be used as a part of the present invention;

FIG. 3 is a schematic view explanatory of the invention;

FIG. 4 is a graph showing the variable speed of the web;

FIG. 5 is a plan view of one of the clamps;

FIG. 6 is a vertical section through the clamp;

FIG. 7 is a block diagram for the system; and

FIG. 8 is an electrical diagram for the system.

Referring to the drawing, and more particularly to FIG. 1, the machinery may be driven by a main drive shaft **12**, which extends lengthwise of the moving web **20**. Shaft **12** is driven by a main driving motor **14** (FIG. 3), operating through belts, chains or gearing indicated at **16**.

The web **20** is acted on by a series of color printing units, which may be of the gravure type. Two such units are here shown at **22** and **24** in FIG. 1. They may be conventional, and may include driers at **23** and **27**. Each has a gravure cylinder **26** (FIG. 3) driven by main shaft **12** through gearing indicated at **28**. Mechanism, including electric eye scanners **30** (FIG. 1), may be provided between successive printing units to maintain the different

colors in registration, and for this purpose, the gearing symbolized at **28** (FIG. 3) may include an appropriate running register, preferably of the planetary or differential gear type, which permits the automatic feed of a slight positive or negative motion from correction motor **29** to maintain registration.

The printed web is fed to a punch press **32** by means of an intermittent feed roller **34**, cooperating as usual with an idler **36**. The press **32** is driven by the main shaft **12** through appropriate gearing at **38**, and serving to reciprocate the punch, as by means of connecting rods (not shown) leading to eccentrics on the punch press shaft **42**. The intermittent feed roller **34** is also driven from main shaft **12**, as by means of gearing in box **44** and change gear box **45** and box **46**, the latter including appropriate cam or like mechanism to convert the continuous rotation of shaft **12** to an intermittent rotation of roller **34**. Feed roller **34** preferably has a small overfeed or slippage when the web is stopped.

The apparatus includes a web pull unit using a pull roller **48** which is driven from the main drive shaft **12** through gearing at **50**, driving a change gear box **52**, and differential gearing **54**, to shaft **76**. Pull roller **48** cooperates with an idler **56**. A loop of web is provided at **58** between the uniform velocity pull roller **48** and the intermittent feed roller **34**. During each cycle this loop grows slack, say to the dotted line position **58'**, during dwell at intermittent roller **34**, and then the loop is taken up and reduced to minimum dimension. If desired, this latter position of the loop may be determined by a fixed stop cylinder **60**. In such case, tension builds up between the intermitten feed roller **34** and the pull roller **48**, as determined by the position of the stop cylinder **60**, and the web then may slip slightly at the intermittent feed roller **34**, which usually has a slight intentional overfeed.

To correct or maintain the overall or average register, a compensator roller may be interposed between the last printing unit and the pull roller **34**. In this case the stop roller **60** is used also as a compensator roller, instead of being truly fixed. The vertical position of compensator roller **60** is controlled by a correction motor **62**, driving vertical scews **64** which raise or lower the end bearings of the compensator roller **60**. This could be under control of a separate web scanner, located between feed roller **48** and intermittent feed roller **34**, and cooperating with a suitable phase detector mounted on or geared to the punch press shaft **42**, for one-to-one rotation with that shaft. The phase micrometer is here indicated schematically at **66**. In the present case, the web scanner is located at **68**, and the scanner is used primarily for the clamp action. The circuitry for triggering the clamp is described later, but not the circuitry for controlling register motor **62**, and the latter may be controlled by a separate scanner with conventional circuitry which requires no description.

The pull roller **48** usually is so selected (or so driven) that its peripheral speed very slightly exceeds that of the printing cylinder **26**, and therefore the web is kept under tension therebetween. The change gear box **52** includes change gears to accommodate changes in the length of the sheet or print, so that it will not be necessary to change the diameter of the roller **48** for each different print length.

The change gear box **52** preferably is supplemented by a drive of the positive infinitely-variable type so that very fine adjustment of gear ratio may be obtained. In the present case, main shaft **12**, through gearing **70**, drives a positive infinitly-variable drive **72**, in this case a "Graham" drive, which through shaft **74** feeds a small motion into the differential gearing at **54**, thereby modify-

ing the speed of feed roll **48** in fine degree under control of a hand wheel **76**.

A similar fine speed adjustment is not provided for change gear box **45** because the intermittent drive must remain locked in phase relation to the punch press **32**, and therefore a geared drive is needed. The change gear box **45** is arranged for small changes, and any residual discrepancy is put into the overfeed and slippage at roller **34**, as previously mentioned.

Referring to FIG. 2, the variable feed mechanism (represented by box **46** in FIG. 3) is of the type disclosed in McIlvain Patent 2,658,406 and it includes a cam **82**. The shape of the cam in the region **84** produces a brief interval of uniform low velocity immediately preceding the dwell period.

This is illustrated by the graph shown in FIG. 4, which is characterized by acceleration **86** and uniform high velocity **88**, followed by a deceleration **90**, which is discontinued when a very low velocity is reached, and the low velocity is maintained for a brief interval, as is indicated at **92**. Thereafter the web is again decelerated at **94** to bring it to zero velocity shown at **56**. The deceleration **94** may be called "stoppage" to distinguish it from the main deceleration **90**. The average web speed is indicated at **52'**, this being the speed in the printing press. The interval **92** of uniform low velocity is suitably located to straddle the desired clamp instant. The web target comes under the scanner, and the clamp stops the web, during this low velocity movement. The clamp is released before renewed acceleration begins.

Reverting to FIG. 2, and considering the variable speed drive in greater detail, the power input is at pinion **96**, meshing with a gear **98**, which revolves the pivot **100** of a planet gear **102**, meshing with a sun gear **104**. Inasmuch as planet gear **102** turns only a fraction of a revolution on the said pivot **100**, the planet may be mutilated, leaving only a sector of a gear, as shown. The sector **102** is affixed to an arm **106** oscillatable about pivot **100**. Arm **106** carries a cam follower roller **108** which is received in the cam groove **82** previously referred to. The cam and its groove are stationary.

The output is applied by sun gear **104** to a shaft **110** which leads to a bevel gear **112** meshing with a bevel pinion **114** which in turn drives a shaft **116** leading to bevel gear **118** meshing with bevel gear **120**. The latter turns the feed roller **34** previously referred to.

Referring to FIG. 3, the scanner **68** is controlled by the previous operation on the web, in this case the printing on the web. There is circuitry indicated at **75** responsive to scanner **68** for precision web control by means of a pair of clamps **126** (one near each edge of the web) located near the punch press **32**, and arranged to momentarily clamp and positively stop the web.

Referring to FIGS. 5 and 6, the downwardly movable pad of the clamp **126** is indicated at **140**, and is carried at the lower end of a vertically slidable rod **142** which is vertically slidable in bearings **144** and **146**. The rod **142** carries a ferrous armature **148** which is shown in its raised position. This is pulled downward by a U-shaped magnet, the core of which comprises a yoke **150** with upright legs **152** around which coils **154** are placed. It will be understood that the armature **156** and the core **150**, **152** are preferably built up of laminations in conventional fashion. The coils **154** may be rectangular, as indicated in FIG. 5.

The height and therefore the maximum travel of the armature **148** is adjustable by means of nuts **156**, between which the armature is clamped. Rotation of the armature is prevented by means of a stationary guide **158** bearing against one end of the armature. The bearings and the guide are carried by a frame **160** secured to top plate **162**, these parts preferably being non-ferrous. The top of the pad **140** may be fitted with a rubber "O" ring **164** acting as a bumper or stop. The pad and armature are normally raised by means of a compression

spring **166** disposed around the rod **142**. They are pulled down when the magnet coils **154** are energized. The clamp is mounted so close to the web that the actual travel of the pad is reduced to a very slight amount, say 0.020 inch.

The phase micrometer **66** (FIG. 3) is a known device used in registration systems, it comprising an opaque disc or cup which rotates with the shaft, and which has a slot or window. A lamp is disposed on one side and a photodiode on the other side of the rotating element, so that an electrical pulse is delivered as the slot moves between the lamp and diode. The resulting "live gate" may be considerably wider than the narrow pulse obtained from the web scanner **68**, but the latter must be coincident, and therefore the target on the web need not have a "clear track," that is, other markings may appear on the web without affecting the scanner **68**. In most cases, therefore, the selected target may be a part of the regular printed matter which is anyway being printed on the web.

In the present system, the live gate is given an additional function in that the trailing edge of the said gate is employed to terminate the energization of the clamp magnets in order to release the clamps.

Referring now to the block diagram is FIG. 7, the output of web scanner **68** is fed into a block **202** which provides for light increase or light decrease at the target on the web. The output of block **202** proceeds to an amplifier **204**, at which the sensitivity of the amplifier can be selected. This pulse proceeds through a Schmidt trigger **206**, the output of which is a pulse having constant amplitude and rise time. The Schmidt trigger pulse is combined at an inhibited AND gate **208**. This gate is enabled by the live gate signal; that is, an output pulse will occur when the web pulse occurs, but only if the live gate pulse is present. (The term "enable" means that the gate is receptive to and permits an output; and the term "inhibit" means that it is not receptive or prevents an output.)

The leading edge of the live gate pulse sets flip-flop circuit **222**, and through an inverter **220** (which produces an output which is the opposite of its input), appears at gate **208** as the enabling input. Thus a selected web pulse through gate **208** will actuate a one shot monostable multi-vibrator **210** to produce a pulse which is delayed in time. This delayed pulse proceeds to another one shot circuit **212**, and actuates that circuit, and again a delayed pulse is produced. At this block **212** the first delayed pulse is utilized, and in turn appears at an AND gate **214**. The other input to AND gate **214** is derived through a flip-flop circuit FF**222** and an inverter **300**, so that when both of the aforementioned pulses (meaning the first delayed pulse and the output of inverter **300**) appear at gate **214**, an output pulse is produced which is amplified through amplifier **216** and triggers a gate **218**, which in turn actuates the four clamp coils for the two clamps **126**.

For precision, the timing of the web clamp action must allow for delay in the magnet action. This delay is a constant, but the amount of web travel will depend on the web speed. We therefore provide means to compensate automatically for changes in web speed.

There is known circuitry to produce a delay, but not to produce an anticipatory lead time. Accordingly, an initial exaggerated anticipatory lead is mechanically provided, as by fixing the scanner location earlier along the web a distance corresponding to the maximum lead that may be needed (the lead needed for the highest web speed). Then by introducing a variable delay, the net effect is as though introducing a variable lead time.

The one-shot mono-stable multi-vibrator **210** is the variable delay circuit. The magnitude of delay that is wanted is inversely proportional to the speed of the web. This is accomplished with the aid of a tachometer generator G driven in proportion to web speed, or in this case, by shaft **76** (FIG. 3) of feed roll **48**. The output of

generator G (FIG. 7) is supplied to the one shot circuit **210**, preferably through a potentiometer **R13**, which may be located remotely, for final adjustment without moving the scanner, should such final adjustment be needed.

Referring now to FIG. 8, and specifically to the details of the circuitry, the block labeled **202** in FIG. 7 comprises in FIG. 8 the transistor **Q1** and switch LI–LD (light increase-light decrease). The block labeled **204** in FIG. 7, comprises in FIG. 8 the transistors **Q2**, **Q3**, and switch **S3**. Transistors **Q2** and **Q3** provide amplification, and switch **S3** selects the desired sensitivity, by connecting to either **R11** or **R12**, which differ in value. The Schmidt trigger (**206** in FIG. 7) in FIG. 8 centers around the transistors **Q4**, **Q5**, and **Q6**. The output of the Schmidt trigger proceeds to a one shot circuit (block **210** in FIG. 7) which in FIG. 8 centers around the transistors **Q7** and **Q8**. The inhibited AND gate **208** in FIG. 7, in FIG. 8 centers around capacitor **C1** and resistor **R1**, the latter being connected by wires **230** and **232** to transistor **Q9**. If the collector voltage of transistor **Q9** is close to ground, i.e., approximately zero, indicating that the live gate pulse is present, a pulse can combine from the output of the Schmidt trigger circuit centering about transistors **Q4**, **Q5** and **Q6** and through condenser **C1**, and thereby actuate the one shot circuit centering on transistors **Q7** and **Q8**. If, however, the collector voltage of transistor **Q9** is high, approximately say —12 volts, indicating that the live gate pulse is not present, a pulse from the output of the Schmidt trigger will not fire the one shot circuit of transistors **Q7** and **Q8**.

The D.C. tachometer generator G provides an output voltage proportional to press speed. This voltage appears at diode **D1**, and through the RC combination of resistor **R6** and capacitor **C5**, provides the proper time constant which in turn establishes the delay period of the one-shot circuit of transistors **Q7**, **Q8**. Thus, as the press increases in speed, a higher output voltage will appear at diode **D1**, which in turn produces a shorter delay period, as is desired.

The compensation produced by the multi-vibrator and generator combination is approximate, since neither is truly linear. However, the approximation is within the register accuracy required of the apparatus.

The delayed pulse appears through line **240** and actuates the other one-shot circuit based on transistors **Q13** and **Q14** (or block **212** in FIG. 7). However, this circuit is actuated in less than a microsecond, and therefore the output pulse on line **240** appears immediately at diode **D3**. (A microsecond is negligible compared to the desired delay which is in milliseconds.)

When inputs at both diode **D3** and diode **D4** are present, the trigger stops **126** are actuated through cascaded transistors **Q15**, **Q16**, **Q17**, **Q18**, and **Q19**. These five transistors have adequate current amplification to provide the several amperes required to energize the four magnet coils **126** of the clamps.

Thus, the clamp action is initiated in proper time relative to the target on the web to actually stop the web in registry with the die in the punch press. This variable lead time is made to occur during the low speed uniform velocity period **92** (FIG. 4) of the intermittent web feed cycle. Without the uniform velocity interval, there would be no simple linear relation between time delay and web travel. This constitutes an additional advantage when using the special cycle shown in FIG. 4.

However, a web clamp action could be used without the special illustrated cycle. In such event less accuracy would be obtainable, but in some cases may be adequate. Of course, with a higher speed operation of the clamp the error resulting from use of an ordinary cycle would be reduced.

There is a practical limit on the speed of clamp operation, because if operated under excessive power to gain speed, the clamp may mar the paper web. The ability to secure accurate registration without resorting to excessive clamp speed is one of the advantages of the present system, although very high clamp speed is available from the present circuitry if wanted. A four-position switch **S1** is provided for selection of clamp speed, so that the speed may be reduced in the event that marring of the web is noticed.

To release the magnets we employ the trailing edge of the live gate of the phase micrometer. The gate may be opened up or widened somewhat for this purpose.

The trailing edge of the live gate pulse from line **242** appears at transistor **Q12**, which is an inverter. The output of this inverter resets a flip-flop circuit which is in block **222** in FIG. 7, and which in FIG. 8 centers about transistors **Q10**, **Q11**. The inverter block **300** in FIG. 7, is **Q20** in FIG. 8. There then is no further input to diode **D4**. This in turn de-activates the magnet coils **126** through the five amplifying transistors **Q15** through **Q19**.

The clamp magnets have sufficient holding power when energized at say six volts, but then would require too long to clamp the web. This clamp operating time is reduced by first hitting the magnets with a momentary high voltage, say seventy volts. The high voltage is obtained by discharge of a storage capacitor, and is so brief that it cannot harm the magnets.

Transformer **T3** and the bridge circuit marked **B2**, in combination with capacitor **C3**, provides a —6 volt power source, which is utilized for the holding power required for the clamp coils. However, if this voltage were utilized in initiating the clamping cycle, the time constant of the coils would be approximately forty milliseconds. This would be excessive and objectionable inasmuch as accurate register would be difficult to maintain. Therefore, a much higher voltage is made available through transformers **T1** and **T2**, switch **S1**, rectifier **B1**, and the combination of resistor **R2** and capacitor **C2**. This higher voltage is utilized only momentarily to initiate the clamping cycle in order to effectively reduce the delay time until the clamp comes in contact with the web. The resistor **R2** has a high resistance (say fifty ohms) relative to the clamp coils (say one ohm) and therefore the higher voltage is applied only momentarily, and thereafter is lost across resistor **R2**.

The circuit functions as follows: The RC combination of **R2** and **C2** establishes a time period at which the capacitor **C2** will charge to 67% of the maximum voltage represented by the setting of switch **S1**. Thus, if the repeat rate of the press is, say three hundred strokes per minute, the time constant represented by circuit **R2**, **C2** should be less than 0.2 second (the reciprocal of 300 divided by 60). The capacitor is charged to 67% of maximum voltage in each press cycle, this being a high voltage compared to the low holding voltage.

The initial voltage actually used may be varied by means of switch **S1**, here shown as having four positions or transformer taps. The high voltage with the switch **S1** set in highest position **4** is approximately seventy volts in the present circuit. At the instant that the turn-on signal reaches transistor **Q19**, capacitor **C2** is discharged through the clamp coils **126**. Thus, a high energy pulse is available to initiate the actuation cycle. If set at seventy volts, the effective time constant of the clamp circuit is reduced from, say, forty to less than four milliseconds. (This is computed by dividing the forty milliseconds by the voltage ratio of seventy to six, which comes out somewhat less than four milliseconds.)

When the capacitor voltage discharges to a value less than —6 volts, diode **D6** becomes forward biased and conducts, and thereafter the power to hold the clamps is derived through transformer **T3** and rectifier bridge **B2**, in combination with capacitor **C3**. Thus, rectifier or power diode **D6** acts as an OR circuit to allow the higher of the two voltages (—6 volts, or —70 volts from capacitor **C2**) to appear as a supply for the coils **126**. Differently expressed, the diode **D6** is polarized to isolate the two very different voltage supplies for the clamp cords.

It is also desirable to reduce the deactivation time constant (for fast magnet release) so that it is approximately equal to the actuation time consant, typically four milliseconds. This fast deactivation is accomplished as follows: When transistor Q19 is deenergized or turned off, the four magnet coils **126** act as a current generator, and through the combination of diode D5 and resistor R3 provide a circuit such that a voltage is generated across resistor R3, the magnitude of this voltage being equal to the instantaneous coil current times the resistance value of R3. If this instantaneous coil-holding current were, for example, four amperes, and we made the value of R3 equal to 17.5 ohms, the voltage appearing across resistor R3 at the instant of deactivation would be equal to seventy volts. This would allow the coils to deenergize in the same time as is required to energize them. No attempt is made to release the magnets in less time, because of high voltage restriction as applied to transistor Q19.

If the press happens to be stopped with the clamps down, they would be overheated by continuous energization, for they are designed for brief intermittent energization or a low duty cycle. It could happen that the press stops at the live gate, in which case the coils might remain continuously energized. This would require that they be designed for 100% duty cycle, which would be a design disadvantage since the coils and their components would have to be unusually large. Here they may be small because they are energized only intermittently.

The purpose of the one shot circuit **212** in FIG. 7, which in FIG. 8 is represented by the transistors Q13, Q14, is to make sure that the magnet coils are never energized for a time greater than that represented by the time constant of the RC circuit F10, C10. This protects the coils against continuous energization. The requirement for the time constant represented by delay circuit R10, C10 is merely that the time be less than the highest repetitive rate ever required of the press, for example, three hundred strokes per minute or 0.2 second.

The transformer T4 and diodes D11 tnd D12 and filter capacitor C4 constitute a plus four volt power supply for reverse biasing all transistors in order to ensure that they will be non-conducting in the "off" condition. The extension of the 110 volt A.C. leads at the bottom of the diagram represents connections to additional power supply circuits like that just described, but which serve to supply the other voltages used in the circuit, namely, plus twelve volts, and minus twelve volts. These voltages are indicated at various points on the diagram and may be assumed connected to such additional power supplies.

It is believed that the construction and operation of our improved system, as well as the advantages thereof, will be apparent from the foregoing detailed description. The circuitry employs solid-state components and therefore is compact and trouble-free. The clamps are operated magnetically, thereby eliminating hydraulics and simplifying the mechanism required.

A time allowance is provided for delay in the action of the clamp magnets, and there is automatic compensation for a change in web speed in order to appropriately vary the said time allowance. The live gate, which is anyway employed for the scanner, is additionally used to release the clamps. The magnets are small in dimension and relatively inexpensive, and yet exert adequate clamping force because they are designed for a low duty factor. Their action is greatly speeded by momentary application of an initial voltage very much higher than the clamp holding voltage, this initial voltage being obtained by discharge of a storage capacitor. Additional safety means cuts out even the much lower holding voltage after a time interval which exceeds the maximum time interval for normal release of the clamps by means of the live gate, on the rare chance of this happening, as by reason of the press stopping at the live gate, or a possible circuit failure.

It will be apparent that while we have shown and described our system in a preferred form, changes may be made without departing from the scope of the invention, as sought to be defined in the followig claims. In the claims, the reference to "automatic compensation for change in web speed" means approximate rather than exact compensation.

We claim:

1. A system for feeding a moving web through web-treating apparatus which operates on the web when stationary and for causing said operation to be in proper registration with a previous operation on the web, said apparatus comprising an intermittent web feed mechanism including feed rollers to move the web through the apparatus intermittently, a clamp preceding the apparatus to momentarily clamp the web while it is moving slowly, and means including an electric eye web scanner to trigger the clamp, said clamp being electromagnetically actuated, said scanner serving to trigger said clamp slightly ahead to allow time for the clamp to operate, and means driven by the apparatus at a speed proportional to the web speed to vary the trigger timing lead in order to compensate for any change in average web speed.

2. A system for feeding a moving web through web-treating apparatus which operates on the web when stationary and for causing said operation to be in proper registration with a previous operation on the web, said apparatus comprising an intermittent web feed mechanism including feed rollers to move the web through the apparatus intermittently, a clamp preceding the apparatus to momentarily clamp the web while it is moving slowly, means including an electric eye web scanner to trigger the clamp, said clamp being electromagnetically actuated, said scanner serving to trigger said clamp slightly ahead to allow time for the clamp to operate, a storage capacitor to momentarily supply a high clamp voltage to the clamp magnet, and a source of much lower holding voltage for the clamp magnet.

3. A system for feeding a moving web through web-treating apparatus which operates on the web when stationary and for causing said operation to be in proper registration with a previous operation on the web, said apparatus comprising an intermittent web feed mechanism including feed rollers to move the web through the apparatus intermittently, a clamp preceding the apparatus to momentarily clamp the web while it is moving slowly, means including an electric eye web scanner to trigger the clamp, said clamp being electromagnetically actuated, means to cause release of the clamp, and additional safety means to release the clamp after a time interval substantially exceeding the maximum interval for normal release of the clamp.

4. A system for feeding a moving web through web-treating apparatus which operates on the web when stationary and for causing said operation to be in proper registeration with a previous operation on the web, said apparatus comprising an intermittent web feed mechanism including feed rollers to move the web through the apparatus intermittently, a clamp preceding the apparatus to momentarily clamp the web while it is moving slowly, and means including an electric eye web scanner to trigger the clamp, a phase micrometer driven by the apparatus to provide a live gate within which the scanner pulse must fall in order to be effective to operate the clamp, and means responsive to the trailing edge of the live gate to release the clamp.

5. A system for feeding a moving web through web-treating apparatus which operates on the web when stationary and for causing said operation to be in proper registration with a previous operation on the web, said apparatus comprising an intermittent web feed mechanism including feed rollers to move the web through the apparatus intermittently, a clamp preceding the apparatus to momentarily clamp the web while it is moving slowly, and means including an electric eye web scanner to trigger the clamp, a phase micrometer driven by the apparatus to

provide a live gate within which the scanner pulse must fall in order to be effective to operate the clamp, means responsive to the trailing edge of the live gate to release the clamp, said clamp being electromagnetically actuated, and an additional safety means to cut out the holding voltage after a time interval substantially exceeding the maximum interval for normal release of the clamp by means of the live gate.

6. A system for feeding a moving web through web-treating apparatus which operates on the web when stationary and for causing said operation to be in proper registration with a previous operation on the web, said apparatus comprising an intermittent web feed mechanism including feed rollers to move the web through the apparatus intermittently, a clamp preceding the apparatus to momentarily clamp the web while it is moving slowly, means including an electric eye web scanner to trigger the clamp, said clamp being electromagnetically actuated, said scanner serving to trigger said clamp slightly ahead to allow time for the clamp to operate, means driven by the apparatus to vary the trigger timing lead in order to compensate for any change in average web speed, a storage capacitor to momentarily supply a high clamp voltage to the clamp magnet, and a source of much lower holding voltage for the clamp magnet.

7. A system for feeding a moving web through web-treating apparatus which operates on the web stationary and for causing said operation to be in proper registration with a previous operation on the web, said apparatus comprising an intermittent web feed mechanism including feed rollers to move the web through the apparatus intermittently, a clamp preceding the apparatus to momentarily clamp the web while it is moving slowly, means including an electric eye web scanner to trigger the clamp, said clamp being electromagnetically actuated, said scanner serving to trigger said clamp slightly ahead to allow time for the clamp to operate, a storage capacitor to momentarily supply a high clamp voltage to the clamp magnet, a source of much lower holding voltage for the clamp magnet, a phase micrometer driven by the apparatus to provide a live gate within which the scanner pulse must fall in order to be effective to operate the clamp, and means responsive to the trailing edge of the live gate to release the clamp.

8. A system for feeding a moving web through web-treating apparatus which operates on the web when stationary and for causing said operation to be in proper registration with a previous operation on the web, said apparatus comprising an intermittent web feed mechanism including feed rollers to move the web through the apparatus intermittently, a clamp preceding the apparatus to momentarily clamp the web while it is moving slowly, means including an electric eye web scanner to trigger the clamp, said clamp being electromagnetically actuated, said scanner serving to trigger said clamp slightly ahead to allow time for the clamp to operate, a storage capacitor to momentarily supply a high clamp voltage to the clamp magnet, a source of much lower holding voltage for the clamp magnet, a phase micrometer driven by the apparatus to provide a live gate within which the scanner pulse must fall in order to be effective to operate the clamp, means responsive to the trailing edge of the live gate to release the clamp, and additional safety means to cut out the holding voltage after a time interval substantially exceeding the maximum interval for normal release of the clamp by means of the live gate.

9. A system for feeding a moving web through web-treating apparatus which operates on the web stationary and for causing said operation to be in proper registration with a previous operation on the web, said apparatus comprising an intermittent web feed mechanism including feed rollers to move the web through the apparatus intermittently, a clamp preceding the apparatus to momentarily clamp the web while it is moving slowly, means including an electric eye web scanner to trigger the clamp, said clamp being electromagnetically actuated, said scanner serving to trigger said clamp slightly ahead to allow time for the clamp to operate, means driven by the apparatus to vary the trigger timing lead in order to compensate for any change in average web speed, a storage capacitor to momentarily supply a high clamp voltage to the clamp magnet, a source of much lower holding voltage for the clamp magnet, a phase micrometer driven by the apparatus to provide a live gate within which the scanner pulse must fall in order to be effective to operate the clamp, and means responsive to the trailing edge of the live gate to release the clamp.

10. A system for feeding a moving web through web-treating apparatus which operates on the web when stationary and for causing said operation to be in proper registration with a previous operation on the web, said apparatus comprising an intermittent web feed mechanism including feed rollers to move the web through the apparatus intermittently, a clamp preceding the apparatus to momentarily clamp the web while it is moving slowly, means including an electric eye web scanner to trigger the clamp, said clamp being electromagnetically actuated, said scanner serving to trigger said clamp slightly ahead to allow time for the clamp to operate, means driven by the apparatus to vary the trigger timing lead in order to compensate for any change in average web speed, a storage capacitor to momentarily supply a high clamp voltage to the clamp magnet, a source of much lower holding voltage for the clamp magnet, a phase micrometer driven by the apparatus to provide a live gate within which the scanner pulse must fall in order to be effective to operate the clamp, means responsive to the trailing edge of the live gate to release the clamp, and additional safety means to cut out the holding voltage after a time interval substantially exceeding the maximum interval for normal release of the clamp by means of the live gate.

11. A system as defined in claim 1, in which the intermittent web feed mechanism includes a cam so shaped that the cycle produced by rotation of the cam includes acceleration, deceleration, approximately uniform low velocity, stoppage, and dwell of the web, and in which the scanner triggers the clamp during the aforesaid low velocity movement of the web.

12. A system as defined in claim 2, in which the intermittent web feed mechanism includes a cam so shaped that the cycle produced by rotation of the cam includes acceleration, deceleration, approximately uniform low velocity, stoppage, and dwell of the web, and in which the scanner triggers the clamp during the aforesaid low velocity movement of the web.

13. A system as defined in claim 4, in which the intermittent web feed mechanism includes a cam so shaped that the cycle produced by rotation of the cam includes acceleration, deceleration, approximately uniform low velocity, stoppage, and dwell of the web, and in which the scanner triggers the clamp during the aforesaid low velocity movement of the web.

14. A system for feeding a moving web through web-treating apparatus which operates on the web when stationary and for causing said operation to be in proper registration with a previous operation on the web, said apparatus comprising an intermittent web feed mechanism including feed rollers to move the web through the apparatus intermittently, a clamp preceding the apparatus to momentarily clamp the web while it is moving slowly, and means including an electric eye web scanner having an output pulse, a Schmidt trigger circuit, a mono-stable multi-vibrator, and a cascaded power amplifier, said clamp being electromagnetically actuated, and said scanner output pulse being supplied to said Schmidt trigger circuit, the output pulse of which triggers the mono-stable multivibrator, the output of which is greatly amplified through said cascaded power amplifier in order to energize the clamp, said scanner serving to trigger said clamp slightly ahead to allow time for the clamp to operate.

15. A system as defined in claim 14 in which a phase micrometer produces a live gate which is supplied to a flip-flop circuit, the output of which is connected to an AND gate, means whereby the other input to the said AND gate is derived from the aforesaid mono-stable multi-vibrator only when the proper target web pulse is received, the output of said AND gate being connected to the aforesaid amplifier, and the trailing edge of the live gate serving to reset the flip-flop circuit and to thereby deenergize the clamp.

16. A system as defined in claim 15 in which the scanner is so positioned as to introduce excess lead time in the operation of the clamp, and a delay circuit which is introduced between the aforesaid Schmidt trigger and the mono-stable multi-vibrator in order to establish the correct lead time.

17. A system as defined in claim 16 in which said delay circuit has a variable delay depending on the voltage supplied to it from a voltage supply, and a potentiometer in series with said voltage supply which potentiometer may be adjusted to vary the delay in the operation of the clamp.

18. A system as defined in claim 14 in which the scanner is so positioned as to introduce excess lead time in the operation of the clamp, and a delay circuit is introduced between the aforesaid Schmidt trigger and the mono-stable multi-vibrator to establish the correct lead time, and in which said delay circuit has a variable delay depending on the voltage supplied to it, and in which a voltage tachometer is mechanically connected to be driven at a speed proportional to the web speed and serves as a voltage supply for the aforesaid delay circuit, so that there is automatic compensation in the amount of delay in the event of a change in web speed.

19. A system as defined in claim 18 in which a phase micrometer produces a live gate which is supplied to a flip-flop circuit, the output of which is connected to an AND gate, means whereby the other input to the said AND gate is derived from the aforesaid mono-stable multi-vibrator only when the proper target web pulse is received, the output of said AND gate being connected to the aforesaid amplifier, the trailing edge of the live gate serving to reset the flip-flop circuit and to thereby deenergize the clamp.

20. A system as defined in claim 19, in which the intermittent web feed mechanism includes a cam so shaped that the cycle produced by rotation of the cam includes acceleration, deceleration, approximately uniform low velocity, stoppage, and dwell of the web, and in which the scanner triggers the clamp during the aforesaid low velocity movement of the web.

21. A system for feeding a moving web through web-treating apparatus which operates on the web when stationary and for causing said operation to be in proper registration with a previous operation on the web, said apparatus comprising an intermittent web feed mechanism including feed rollers to move the web through the apparatus intermittently, a clamp preceding the apparatus to momentarily clamp the web while it is moving slowly, means including an electric eye web scanner to trigger the clamp, said clamp being electromagnetically actuated, said scanner serving to trigger said clamp slightly ahead to allow time for the clamp to operate, the intermittent web feed mechanism including a cam so shaped that the cycle produced by rotation of the cam includes acceleration, deceleration, approximately uniform low velocity, stoppage, and dwell of the web, and said scanner serving to trigger the clamp during the aforesaid low velocity movement of the web.

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