April 16, 1963 P. E. FISCHER ETAL 3,085,457

HIGH SPEED WEB STOPPING MECHANISM

Filed March 11, 1960 6 Sheets-Sheet 1

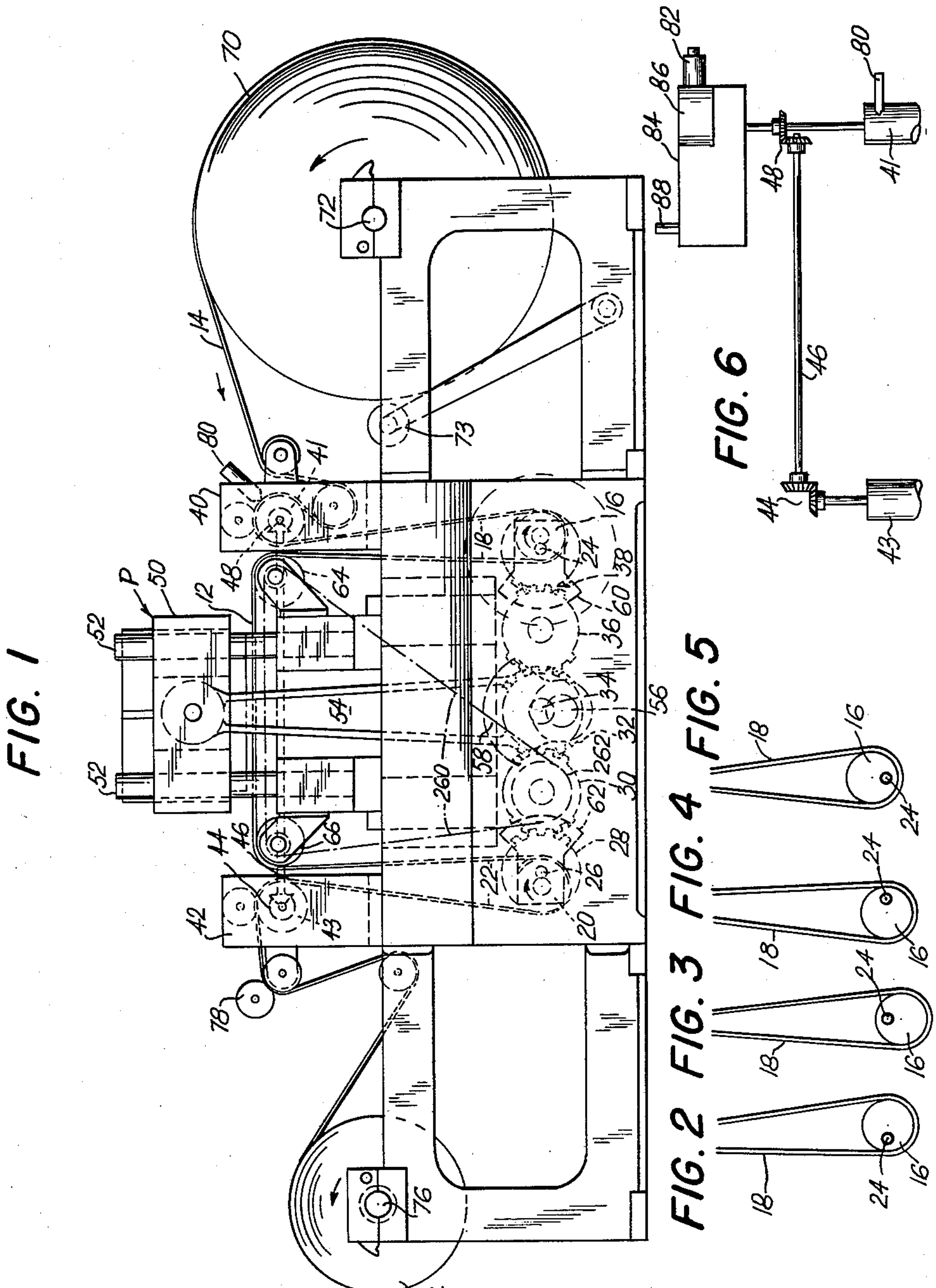

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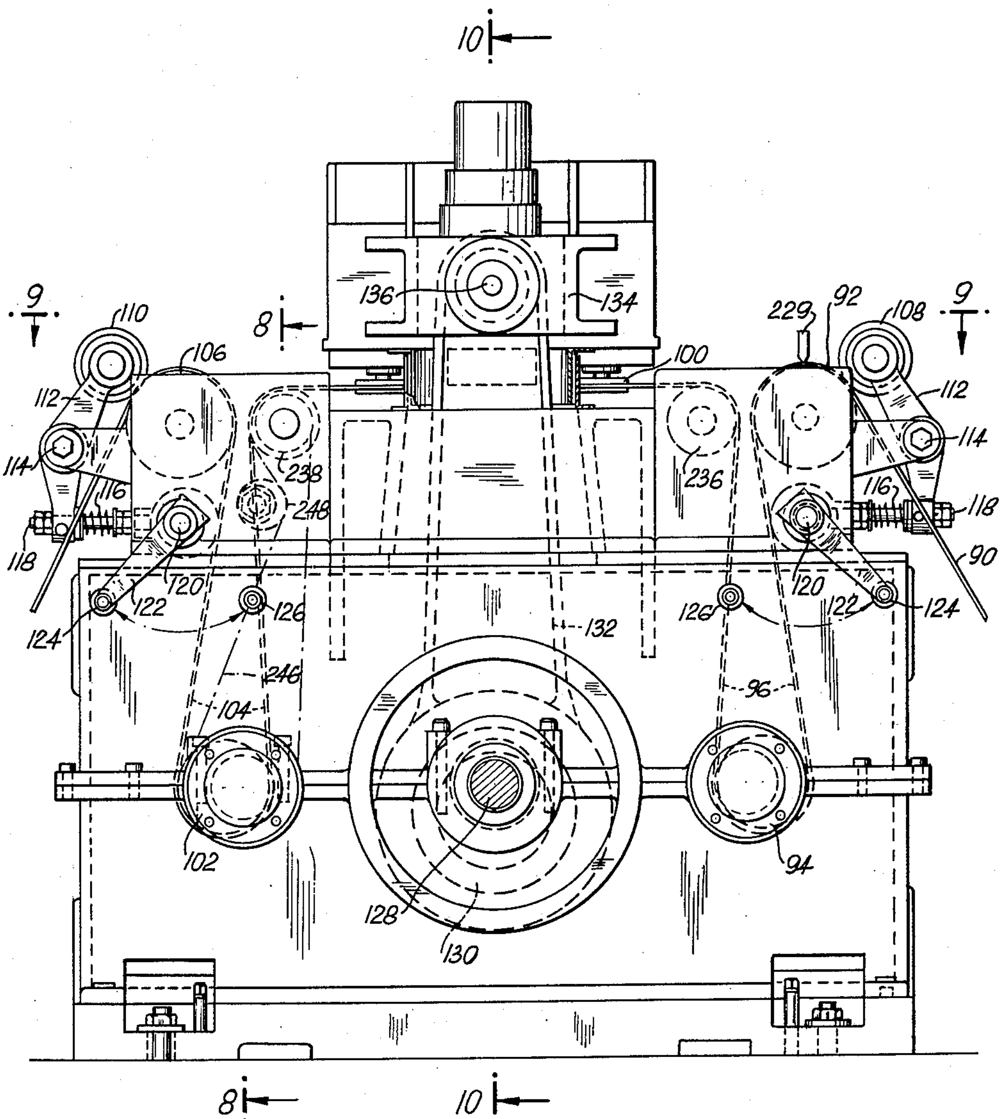
FIG. 7



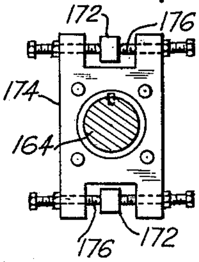


FIG. 14

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HIGH SPEED WEB STOPPING MECHANISM

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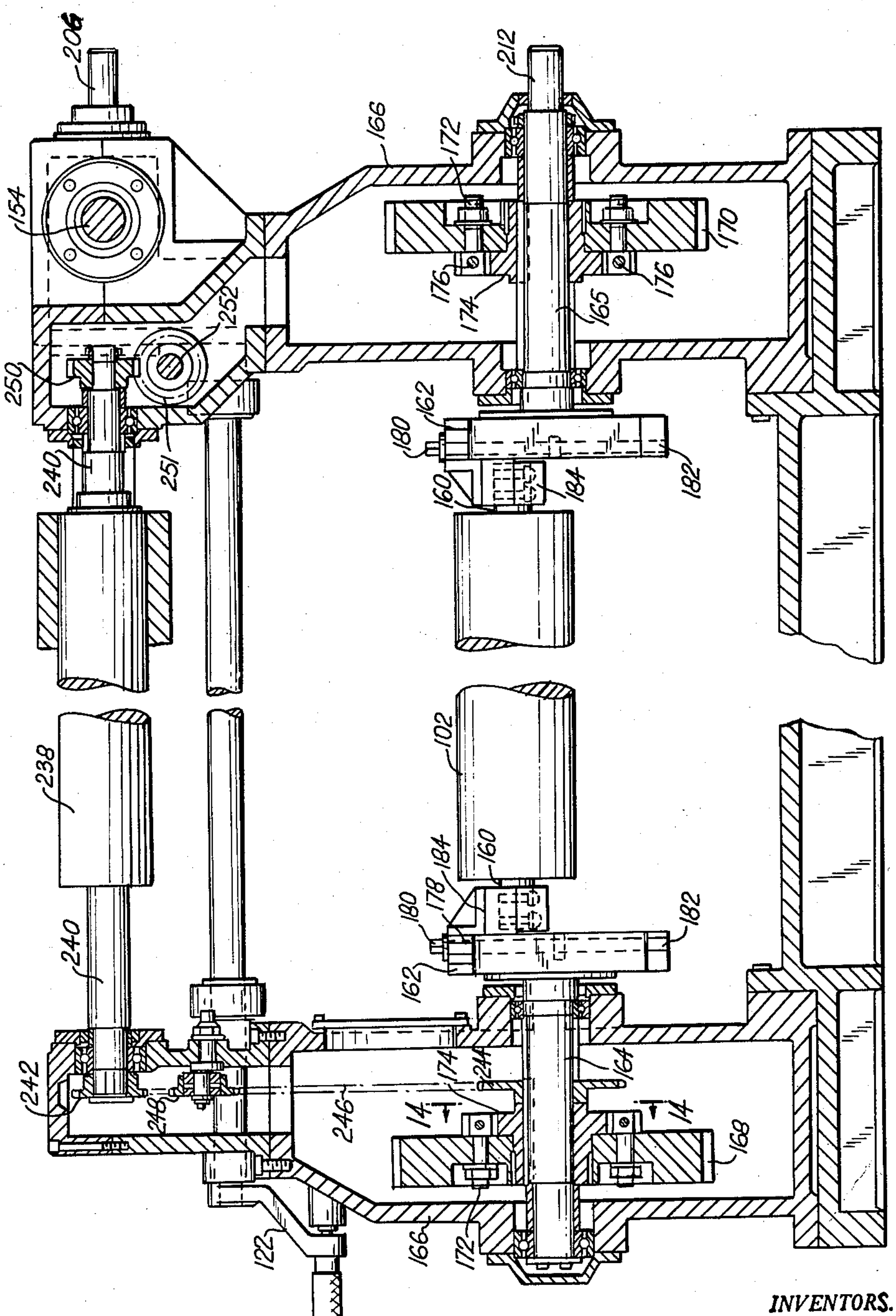
FIG. 8



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HIGH SPEED WEB STOPPING MECHANISM

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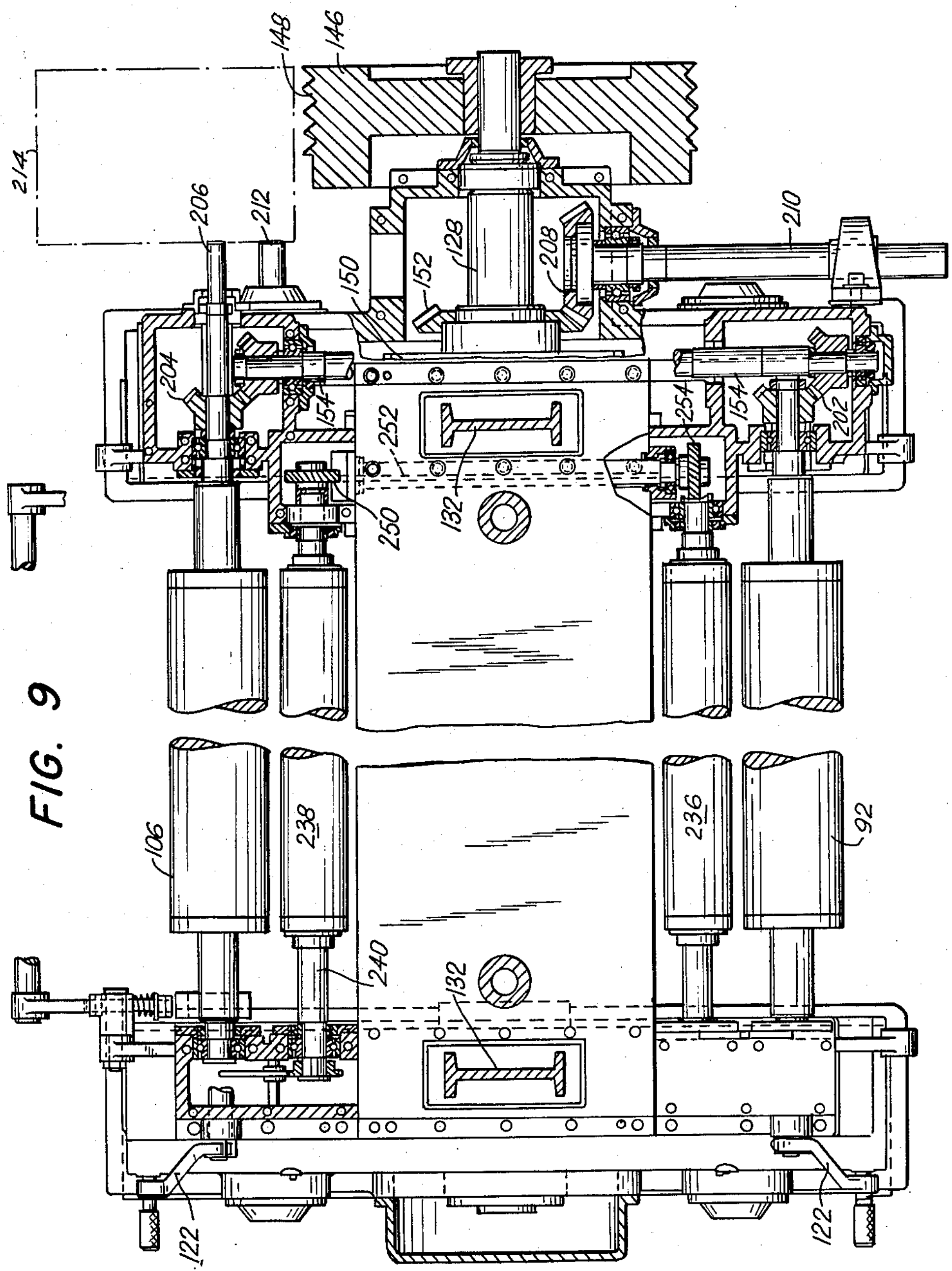

FIG. 9

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HIGH SPEED WEB STOPPING MECHANISM

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FIG. 10

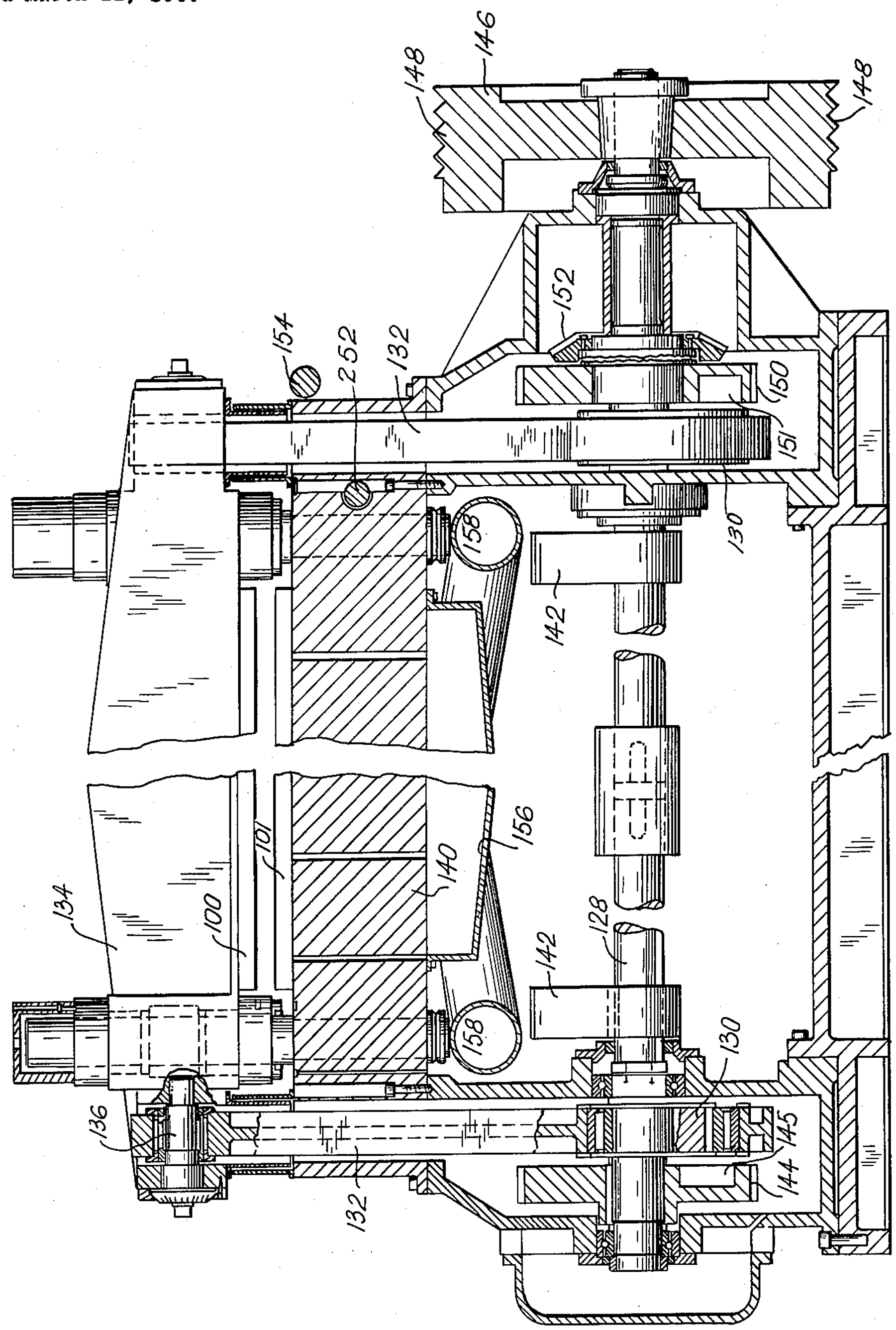

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FIG. 12

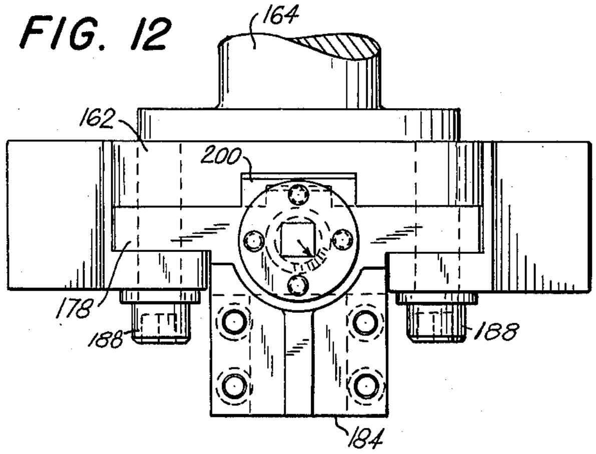


FIG. 13

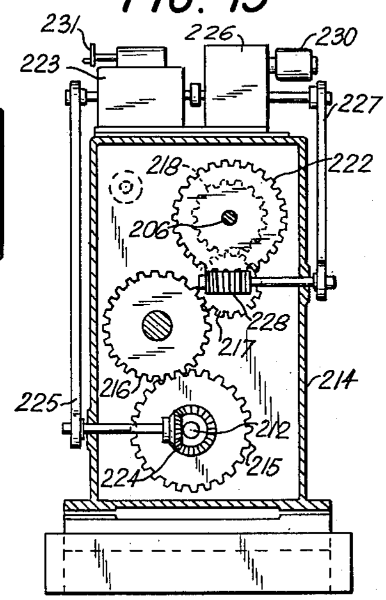


FIG. 11

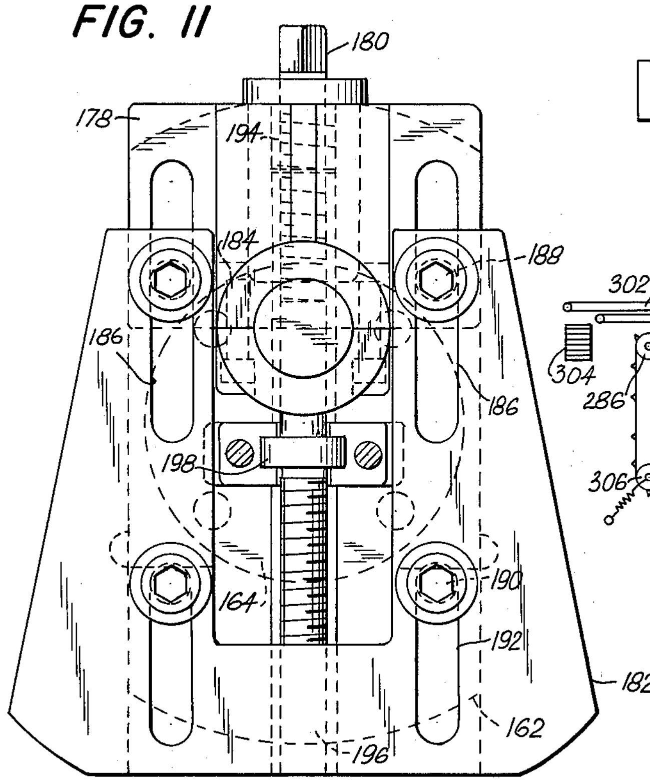


FIG. 16

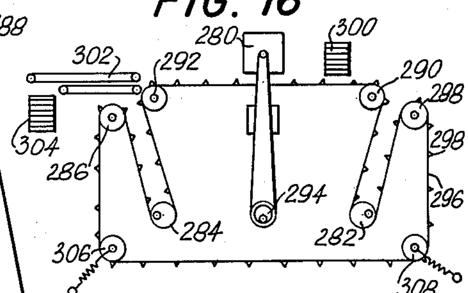
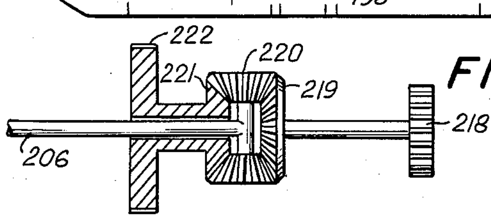


FIG. 15



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3,085,457

HIGH SPEED WEB STOPPING MECHANISM

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Filed Mar. 11, 1960, Ser. No. 14,314
2 Claims. (Cl. 83—236)

This invention relates to web stopping mechanism for repeatedly and cyclically stopping one part of an otherwise continuously travelling web, typically for use with a punch press, and relates more particularly to such mechanism intended to operate at high speed.

Such a punch press may follow other machines (for example, a printing press line) through which the web travels at uniform speed. A pawl and ratchet or a Geneva drive may be used at slow speeds, but cannot operate at high speed. Presses have been devised with a swinging punch which moves along with the web, but this requires movement back and forth of a great mass. Special cam-operated accelerating drives have been provided to alternately speed and stop the web, but such accelerating drives are complex and require reversal of reciprocating parts.

Another system has been devised in which the web is reversely looped before and after the punch press, and is fed by feed rollers which turn at uniform speed but which are physically moved back and forth. The forward movement accelerates the web, and the backward movement counteracts the forward feed thereby stopping the web. This system has advantages but still requires reversal of reciprocating parts.

The primary object of the present invention is to improve such a web stopping mechanism. A further object is to provide mechanism in which the parts rotate rather than reciprocate, thereby making it easy to balance the same. Still another object is to provide the mechanism with a web feed unit ahead of the mechanism and a web pull unit following the mechanism which are stationarily mounted and geared together for equal speed. If, as is usually the case, the punch is to be registered with printed matter already on the web, an electric eye scanning system may be employed to slightly advance or retard feed and pull units to maintain the desired registration.

The web stopping mechanism and the punch press mechanism preferably employ a common drive so as to maintain synchronism therebetween. However, the pitch length along the web may vary from one job to another, and this presents the problem of changing the stop interval produced by the web stopping mechanism. Accordingly, a further object is to facilitate change or adjustment of the pitch length.

To accomplish the foregoing general objects, and other more specific objects which will hereinafter appear, the invention resides in the punch press and web stopping mechanisms and the relation of one to the other as are hereinafter more particularly described in the following specification. The specification is accompanied by drawings in which:

FIGURE 1 is a front elevation of punch press and web stopping mechanism embodying features of the invention;

FIGURES 2, 3, 4 and 5 are explanatory of the invention;

FIGURE 6 is explanatory of a part of the web feed mechanism;

FIGURE 7 is a front elevation of another embodiment ol the invention which adds some refinements;

FIGURE 8 is a transverse vertical section taken approximately in the plane of the line 8—8 of FIGURE 7;

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FIGURE 9 is a horizontal section taken approximately in the plane of the line 9—9 of FIGURE 7;

FIGURE 10 is a transverse vertical section taken approximately in the plane of the line 10—10 of FIGURE 7;

FIGURE 11 is a view drawn to enlarged scale and shows means for simultaneously adjusting the eccentricity of a loop-forming roller and its counter-weight;

FIGURE 12 is a top view of the same;

FIGURE 13 shows a change gear and feathering drive mechanism used in the machine here described;

FIGURES 14 and 15 are explanatory of some details; and

FIGURE 16 shows a modification for handling sheets.

Referring to the drawing and more particularly to FIGURE 1, the web stopping mechanism serves to alternately stop and accelerate a portion **12** of a continuously fed web **14**, the portion **12** being at a station where the web is to be operated on, in this case by a punch press generally designated P. The web stopping mechanism comprises a first idle roller or idler **16** forming a reverse loop of web **18** ahead of the station P, and another idler **20** forming a second similar reverse loop of web **22** following the station P. A shaft **24** carries the idler **16** eccentrically, and a shaft **26** similarly carries the idler **20** eccentrically.

These shafts are geared together for continuous and equal rotation, in this case by means of a train of gears including gear **28** on shaft **26**, an idle gear **30**, gear **32** on the punch press crank shaft **34**, idle gear **36**, and gear **38** on shaft **24**. The gears are equal, or if not, are symmetrically arranged so that shafts **24** and **26** turn equally. However, the eccentric or crank mounting of the loop forming idlers **16** and **20** is so oriented that they are 180° apart or opposite in phase. This is done so that one of the loops **18**, **22** is lengthened while the other is shortened. The idlers **16** and **20** have the same radius of eccentricity, and the radius is so selected that the portion **12** of the web is stopped at desired intervals or pitch length.

The action may be explained with reference to FIGURES 2, 3, 4 and 5 of the drawing, which show idler **16** revolving eccentrically on shaft **24**. In FIGURE 2 the loop **18** is of intermediate length. In FIGURE 3, with roller **16** down, the loop **18** has its maximum length. In FIGURE 4 the loop again has an intermediate length, the same as that shown in FIGURE 2. In FIGURE 5 with the roller in its up position the loop **18** has its minimum length. Inasmuch as the other idler rotates in opposite phase, the loop **22** (FIGURE 1) is long when the loop **18** is short, and vice versa.

The maximum rate of change of loop length takes place in mid-position as shown in FIGURES 2 and 4. When loop **18** is rapidly shortening as shown in FIGURE 4, the web portion **12** has been accelerated and is moving faster than the main web **14**. When loop **18** is rapidly lengthening, as shown in FIGURE 2, the web portion **12** is decelerated because the loop motion is opposite to the normal web travel at **14**, and the parts are properly dimensioned so that the backward motion equals the forward motion, and the web portion **12** is stationary for an instant.

Considering the arrangement in somewhat greater detail, the mechanism preferably includes a continuous web feed unit **40** ahead of the press P, and a continuous web pull unit **42** following the press. The feed and pull units are geared together, as by means of miter gears **44** (FIGURES 1 and 6), shaft **46**, and miter gears **48** which interconnect the feed units for equal continuous web feed. The lower feed rollers **41** and **43** are positively driven, and the upper rollers act as pressure rollers.

The punch press P has a main shaft 34, preferably located near the bottom of the press. The stationary bolster of the press carries a lower die, while the upper die is mounted on a vertically reciprocable head or bolster 50. This is guided by guide rods 52, and is reciprocated connecting rods 54 on opposite sides of the press. The lower ends of the connecting rods lead to cranks shown at 56, and preferably counter-balanced by counter-weights 58.

The idlers 16 and 20 are preferably located near the bottom of the press so that they form generally upright loops 18 and 22. The revolving idlers are counter-balanced by appropriate counter-weights indicated at 60 and 62. This counter-balance is easy to accomplish because the idlers are rotating at uniform speed in one direction, there being no reversal or reciprocation. To help form the loops 18 and 22, there are additional guide rollers 64 and 66 at opposite ends of the press.

The machine is here shown using a pre-printed web, that is, one which has been printed and rolled up, so that the web 14 is being fed from a paper roll 70. This is mounted at 72, and may be equipped with the usual automatic brake and side guide controls, not shown. Arm 73 may sense the diameter of the roll for automatic brake control.

The web is taken up on a roll 74 mounted on a rewind stand at 76. This has its own rewind drive motor, which may be conventional and is not shown. The web leaving the pull unit 42 may, if desired, be slit prior to rewinding and a slitter for this purpose is shown at 78.

In order to register the printed web 14 with the punch action, an electric scanning head may be provided as shown at 80, and this senses a register mark on the web, and then feeds any necessary correction to the feed and pull units. This is shown in FIGURE 6 in which the feed rollers 41 and 43 are connected by miter gearing. The scanning head 80 operates a correction motor 82 in one direction or the other, and this feeds some extra motion into change gear box 84 through differential gearing in differential register mechanism 86. The input shaft 88 of the change gear box either receives the main drive, or is connected to the main shafts of the punch press. By changing the gears in the change gear box, the proper repeat length or pitch length of web may be supplied for each punch stroke. Substantially the correct ratio is provided, but slight cumulative error may be corrected by the photo-cell scanner 80 controlling correction motor 82. The drive may be refined by use of an infinitely variable drive unit with automatic ratio correction, as described in U.S. Patent 2,812,938 issued November 12, 1957.

It will be understood that for continuous operation the simple roller stands here shown at 72 (FIGURE 1) and 76, or more usually the latter, may be replaced by more elaborate stands carrying multiple paper rolls which facilitate roll change. Moreover, if the punch press follows a printing press line, the roller stand at 72 is eliminated entirely, and the input shaft 88 (FIGURE 6) is connected to both the punch press and the printing press line.

A modified form of the invention which embodies some additional improvements may be described with reference to FIGURES 7 through 13 of the drawing.

Referring first to FIGURE 7, a continuously moving web 90 is fed by a continuous feed roller 92. A first eccentric idler 94 forms a generally upright loop 96 ahead of the die 100. A second eccentric idler 102 forms another generally upright loop 104 following the die 100. The web then goes to a pull roller 106. The pressure roller 108 for feed roller 92 and the pressure roller 110 for pull roller 106 are mounted on arms 112 pivoted at 114 and spring pressed by means of compression springs 116. The pressure may be relieved by rods 118 connected to eccentrics on shafts 120 which may be turned by handles 122. These may be swung from the "on" position shown at lock 124 to an "off" position indicated at lock 126, thereby releasing the pressure rollers to facilitate threading of a web through the machine.

The main shaft of the punch press is shown at 128. This carries eccentrics 130 and connecting rods 132 extending upward to the upper head or bolster 134 of the punch press.

Referring now to FIGURE 10, the main shaft 128 with its eccentrics 130 and connecting rods 132 is connected to pins 136, and through them to the bolster 134. This carries the upper die 100 while the lower die 101 is mounted on the lower bolster 140 of the punch press.

The eccentrics 130 and also the mass of the connecting rods and head, are partly counter-balanced by means of counter-weights 142 secured to main shaft 128. They are additionally counter-balanced by gears 144 and 150 which are cut away at 145 and 151. Any residual unbalance in the punch press is vertical, and inertia force in that direction is less important because it may be transmitted directly to the floor. The other motions may be completely balanced because they are rotative motions.

The main shaft 128 carries a gear 144. This is not shown in FIGURE 7, but constitutes the middle gear of a gear train like that marked 28, 30, 32, 36 and 38 in FIGURE 1, the gear 144 in FIGURE 10 corresponding to the gear 32 in FIGURE 1. It is preferred to make the machine symmetrical and to drive both ends of the eccentric rollers so that they can be crank mounted, and in FIGURE 10 there is a similar spur gear 150 on the opposite side of the press. This again forms the mid gear of a train of five gears, the end ones of which serve to turn the eccentric rollers.

The main shaft 128 carries a flywheel 146. If the web is supplied from a roll, as shown in FIGURE 1, the main drive may be belted directly to the flywheel 146, its periphery being grooved with multiple V grooves 148 to receive a multiple V belt drive.

The main shaft 128 further carries a bevel gear 152 for use when the drive goes also to a printing press line. The troughs 156 and ducts 158 are connected to suitable suction means for the removal of the scrap or waste punched from the web by the die.

Referring now to FIGURE 8, which is a vertical section through the eccentric roller 102 following the die, the roller is freely rotatable on a shaft 160 carried by cranks 162. The crank shafts 164, 165, run in bearings carried by the main side frames 166 of the machine. Shaft 164 is turned by a gear 168 which corresponds to gear 28 in FIGURE 1. Shaft 165 is turned by a gear 170 which constitutes the corresponding end gear of the matching gear train on the opposite side of the machine. To facilitate timing of the eccentric rollers, the gears 168 and 170 are adjustable (by means of bolts 172) relative to the hubs 174, which are keyed to the shafts 164, 165. For fine adjustment, oppositely rotatable set screws 176 (FIGURES 8 and 14) may be employed, these fitting on opposite sides of bolts 172 as is better shown in FIGURE 14.

The radius or "throw" of eccentric roller 102 is preferably made adjustable, and for this purpose the cranks 162 have radially movable slides 178 which carry the shaft 160. The position of a slide is adjustable by means of a radially disposed screw 180. The roller 102 is counter-balanced by means of counter-weights 182, and the throw of these weights is changed when the throw of the roller is changed. This is preferably accomplished by the same screw 180 which, for that purpose, is given left hand and right hand thread portions.

This mechanism is better shown in FIGURES 11 and 12, referring to which the roller shaft is carried in a split bearing or holder 184. This forms a part of slide 178 which is radially adjustable on crank 162 by means of slots 186 through which the fastening bolts 188 pass. In somewhat similar fashion, the counter-weight 182 is radially adjustable by means of bolts 190 passing through slots 192. The screw 180 has a square end to receive a wrench, and a left hand thread portion 194 engages slide 178 while a right hand thread portion 196 engages counterweight 182. The screw 180 is itself held against axial movement by an integral collar 198. It will be evident that by loosening the bolts 188 and 190 and turning the screw 180, the eccentric roller and its counterweight are moved toward or away from the axis of shaft 164, and when these parts have been moved the desired amount, the bolts 188 and 190 are again tightened. FIGURE 12 shows how the slidable parts may be additionally fitted together with a tongue and groove relation as shown at 200.

If the counter-weights are lighter than the idler but are used at a larger radius, the pitch of the LH and RH threads will differ correspondingly. In the particular case shown the LH thread is sixteen to the inch and the RH thread is ten to the inch, so that the ratio of travel is 8 to 5, the counter-weights having an effective mass of ⅝ that of the idler being balanced.

Referring now to FIGURE 9, feed roller 92 and pull roller 106 are geared together as previously described, there being bevel gears at 202 leading to shaft 154, the other end of which has bevel gearing 204 leading to pull roller 106. The shaft of the pull roller is extended at 206 to receive the input or drive. In FIGURE 9, shaft 206 is driven by a suitable registering drive including a change gear box shown schematically at 214, and corresponding to box 84 in FIGURE 6. The input to the registering drive is from shaft 212 driven by pulley 146 and shaft 128. FIGURE 8 shows shafts 212 and 206 but omits the change gear box. The bevel gear 152 on the main shaft 128 of the punch press meshes with a bevel gear 208 carried on a shaft 210. This is horizontal, and runs longitudinally of the press line. It is connected to the main line drive shaft when the present device follows a printing press line or other machinery operating on the web. The punch drives the printing press.

Referring now to FIGURE 13, the input and output shafts are shown at 212 and 206 respectively. Box 214 houses change gears and a differential unit. The change gears usually include compound gearing, but for simplicity the gear train here shown simply has gear 215, 216, and 217 driving gear 218 which leads into the bevel gear 219 (FIGURE 15) of a differential. The spider and gear cluster or planet bevel gears 220 are carried by the output shaft 206 previously described. The opposite bevel gear 221 is secured to a worm gear 222, which is also shown in FIGURE 13. This feeds in corrective motion.

To make gear selection less critical, an infinitely variable drive 223 is employed. This is driven by bevel gearing 224 and timing belt 225. Disregarding differential 226, the output goes through timing belt 227 to worm 228 and worm gear 222. The ratio in unit 223 is shown varied manually by a hand wheel 231. In effect, the change gear box is made infinitely variable within the designed range. The drive 223 may be a "Graham" drive.

In addition there is an "electric eye" scanning correction for "print to punch" registration. The scanning head is shown at 229 in FIGURE 7. It leads to suitable electronic circuitry, and then to a correction motor 230 (FIG. 13) which is reversible and which feeds motion to the differential unit 226, thereby advancing or retarding the rate of travel of timing belt 227, to maintain print to punch registration.

As an additional refinement, hand wheel 231 may itself be replaced by a correction motor, controlled as taught in U.S. Patent 2,812,938, previously referred to.

One refinement in the present machine is the provision of means to compensate for angularity of the loops. Referring to FIGURES 2–5 it will be seen that in FIGURES 3 and 5 the loop is upright, but in FIGURE 2 the loop has been moved somewhat to the right, and in FIGURE 4 it has been moved somewhat to the left. In many cases the difference in web length resulting from this angularity was found to be negligible. With a large eccentricity it may become noticeable. It may be compensated, if desired, as for example when dealing with exceptionally delicate materials. Referring to FIGURE 7, the guide rollers 236 and 238, instead of being idle, may be positively driven, and may be slightly eccentrically mounted in such a manner as to compensate for the aforesaid angularity.

Referring now to FIGURE 8, the roller 238 is fixed on a shaft 240 carrying a sprocket gear 242. This is driven by a sprocket gear 244 mounted on loop-forming roller shaft 164, it being understood that a sprocket chain 246 extends between gears 242 and 244, the chain being kept taut by an adjustable idle sprocket 248. The gear ratio is 2 to 1, so that angularity is compensated twice in each revolution of the roller 102, as it should be. This chain drive is also shown in FIGURE 7 at 246.

The other compensating roller 236 (FIGURE 7) could be driven in similar fashion from the shaft of the eccentric roller ahead of the die. However, in the present case the second compensating roller 236 is driven from the first compensating roller 238, and this is done through helical gears 250 (FIGURE 9) driving a shaft 252 which in turn drives helical gears 254 leading to the shaft 256 of compensating roller 236. At roller 238 the upper helical gear is shown, and at roller 236, the upper helical gear is broken away to show the lower helical gear. Some of these parts are more clearly shown in FIGURE 8, referring to which, shaft 240 carries a helical gear 250 meshing with a helical gear 251 on shaft 252. This shaft 252 is also shown in FIGURE 10. The compensating rollers are driven in one to one ratio.

FIGURE 1 shows a different form of drive for the compensating rollers. In this case a chain 260 runs in a generally triangular path, and is driven by a drive sprocket wheel 262 on idle gear 30. It engages sprocket wheels on the shafts of guide rollers 64 and 66. These have half the diameter of sprocket wheel 262. It will be understood that rollers 64 and 66 are eccentrically mounted when being used for compensation, and not when angularity of the loops is being disregarded. The rollers in both forms turn freely on their driven eccentric shafts.

So far the use of a web rather than sheets has been described. However, the web may be replaced by endless conveyor chains or belts carrying pushers or grippers for handling sheets. Referring to FIGURE 16, the punch 280, the eccentric idlers 282 and 284, the drive sprocket wheel 286 or 288, and the idle sprockets 290 and 292, all correspond to similar parts previously described. The idlers 282 and 284 form generally upright loops, as shown. As before, idlers 282 and 284, and punch shaft 294 are driven together, and idlers 286 or/and 288 are driven in proper speed ratio. The conveyor chains are indicated at 296, and have pushers (or grippers) 298 for feeding sheets from a stack 300 (or from a supply belt) to station 280, and thence to delivery to delivery belts 302, with stacking at 304 if desired. Chain slack may be taken up at 306 or at 308 or both, as by the use of springs as shown, or air cylinders, or the like. No scanning mechanism is needed.

The sides of the loop may be kept parallel, instead of convergent as shown in FIGURES 1 and 7. In fact this is preferable when room is available for appropriate spacing between the upper rollers which help form the upper end of the loop.

It is believed that the construction and operation of our improved web stopping mechanism, as well as the advantages thereof, will be apparent from the foregoing detailed description.

It will be understood that the web may be paper, paper backed foil, cardboard, cellophane, cellulose acetate or other plastic films, and so on. The web may be roll fed, as shown in FIGURE 1, or it may come from other machines, typically a printing press line. The punch press may be used to perforate, notch, score, or crease.

Moreover, the station at which the web is cyclically stopped may serve some other and wholly different purpose, as for example, the loading of small hardware parts or food products, etc. on to a web where the parts are enclosed by another web or by individual pockets.

Except for the vertical motion of the punch press, all of the motions are rotary and therefore are readily balanced. The vertical inertial force of the punch press is partially counter-balanced, and any residual is applied to the floor mounting which may be made suitably heavy. The punch press itself may be of an improved type which is fully balanced.

The crank throw is surprisingly small. If the blank or pitch length is, say, 12 inches, the motion needed is that divided by pi, or less than 4 inches, and this is divided by two because each loop has a descending as well as ascending web portion, and the result is again divided by two, thus computing a radius of less than one inch for a 12 inch blank. This pitch length is varied by adjustment of the eccentricity or throw of the roller, and its counter-weights are correspondingly adjusted to maintain balance.

The error caused by angularity of the loop is very small and far less significant than the advantage gained by continuous unidirectional rotary motion of the eccentric rollers. In most cases it may be disregarded, but even this small roller may be compensated, as by driving the shafts of slightly eccentrically mounted rollers. The guide rollers at the upper ends of the loops may be altered for this purpose. The angularity error is minimized by lengthening the loop, but it is preferred to keep this within reasonable limits, in order to stay well above floor level.

It will be understood that the loops need not be upright, although that disposition is preferred in order to save floor space. The eccentric rollers are preferably made of light weight metal and are preferably hollow to reduce their mass.

Although the loop varying rollers have been shown as idlers which are revolved eccentrically by a drive shaft, they may be made non-rotatable and given a polished surface for web slippage.

It will be understood that while we have shown and described our invention in several preferred forms, changes may be made in the structures shown without departing from the scope of the invention as sought to be defined in the following claims. In the claims the reference to the loop forming roller as an idler is not intended to exclude the use of a paper guide with web slippage rather than an idler. In the claims the term web is not intended to exclude a chain or belt driving pushers or grippers which move sheets which are to be operated on at a station.

We claim:

1. Web punching mechanism for operating on a continuously fed web, said mechanism comprising a vertically reciprocable punch press and die requiring an intermittent web feed, and means for alternately stopping and accelerating that portion of the web which is in the die, said means including a first idler near the bottom of the press cooperating with two collateral spaced direction-changing rollers thereabove at the die height to form a generally upright reverse loop of web ahead of the die, said idler being located in and forming the lower end of the loop, a second similar idler near the bottom of the press cooperating with two collateral spaced direction-changing rollers thereabove at the die height to form a second similar generally upright reverse loop of web following the die, the sides of the said loops being approximately parallel, and having a vertical dimension which is large relative to the eccentricity in order to minimize the problem of angularity as the loop is oscillated by the idler, a shaft carrying said first idler eccentrically, a shaft carrying said second idler eccentrically, means gearing said shafts together for continuous equal rotation in opposite phase so that one loop is lengthened while the other is shortened, said idlers having the same radius of eccentricity so selected that the web is stopped at desired pitch length, gearing for driving one of said direction-changing rollers ahead of the die and one following the die in two-to-one ratio relative to the rotation of the shafts carrying the eccentric loop-forming rollers, the said driven direction-changing rollers being slightly eccentrically mounted, the amount of eccentricity and the phase relation of the said driven direction-changing rollers being such as to compensate for the angularity of the loops caused during revolution of the eccentric loop-forming idlers.

2. Web punching mechanism for operating on a continuously fed web, said mechanism comprising a vertically reciprocable punch press and die requiring an intermittent web feed, a main shaft near the bottom of the press for driving the same, said main shaft extending transversely of the direction of travel of the web, and means for alternately stopping and accelerating that portion of the web which is in the die, said means including a first idler near the bottom of the press cooperating with collateral spaced direction-changing rollers thereabove at the die height to form a generally upright reverse loop of web ahead of the die, said idler being located in and forming the lower end of the loop, a second similar idler near the bottom of the press cooperating with two collateral spaced direction-changing rollers thereabove at the die height to form a second similar generally upright reverse loop of web following the die, the sides of the said loop being approximately parallel, and having a vertical dimension which is large relative to the eccentricity in order to minimize the problem of angularity as the loop is oscillated by the idler, a shaft parallel to the main shaft and carrying said first idler eccentrically, a shaft parallel to the main shaft and carrying said second idler eccentrically, means gearing said shafts together for continuous equal rotation in opposite phase so that one loop is lengthened while the other is shortened, means gearing said idler shafts to said main shaft in one-to-one ratio and in such phase that the first loop is lengthening and the second is shortening at maximum rate when the die is closed, said idlers having the same radius of eccentricity so selected that the web is stopped at desired pitch length, gearing for driving one of said direction-changing rollers ahead of the die and one following the die in two-to-one ratio relative to the rotation of the shafts carrying the eccentric loop-forming rollers, the said driven direction-changing rollers being slightly eccentrically mounted, the amount of eccentricity and the phase relation of the said driven direction-changing rollers being such as to compensate for the angularity of the loops caused during revolution of the eccentric loop-forming idlers.

References Cited in the file of this patent

UNITED STATES PATENTS

938,452	Ball	Oct. 26, 1909
969,418	Staude	Sept. 6, 1910
1,679,425	Houston	Aug. 7, 1928
1,941,597	Cavagnaro	Jan. 2, 1934
1,954,349	Dewey	Apr. 10, 1934
2,021,560	Lira	Nov. 19, 1935
2,311,451	Maurer	Feb. 16, 1943
2,655,098	Dutro	Oct. 13, 1953
2,667,924	Dutro	Feb. 2, 1954
2,762,255	Anderson	Sept. 11, 1956
2,932,508	Tennler	Apr. 12, 1960

FOREIGN PATENTS

578,542	France	July 5, 1924
453,163	Great Britain	Sept. 7, 1936