Feb. 16, 1965 P. ZERNOV 3,169,456

DRIVE MECHANISM FOR CARTON BLANK FORMING PRESS

Filed Feb. 4, 1963 4 Sheets-Sheet 1

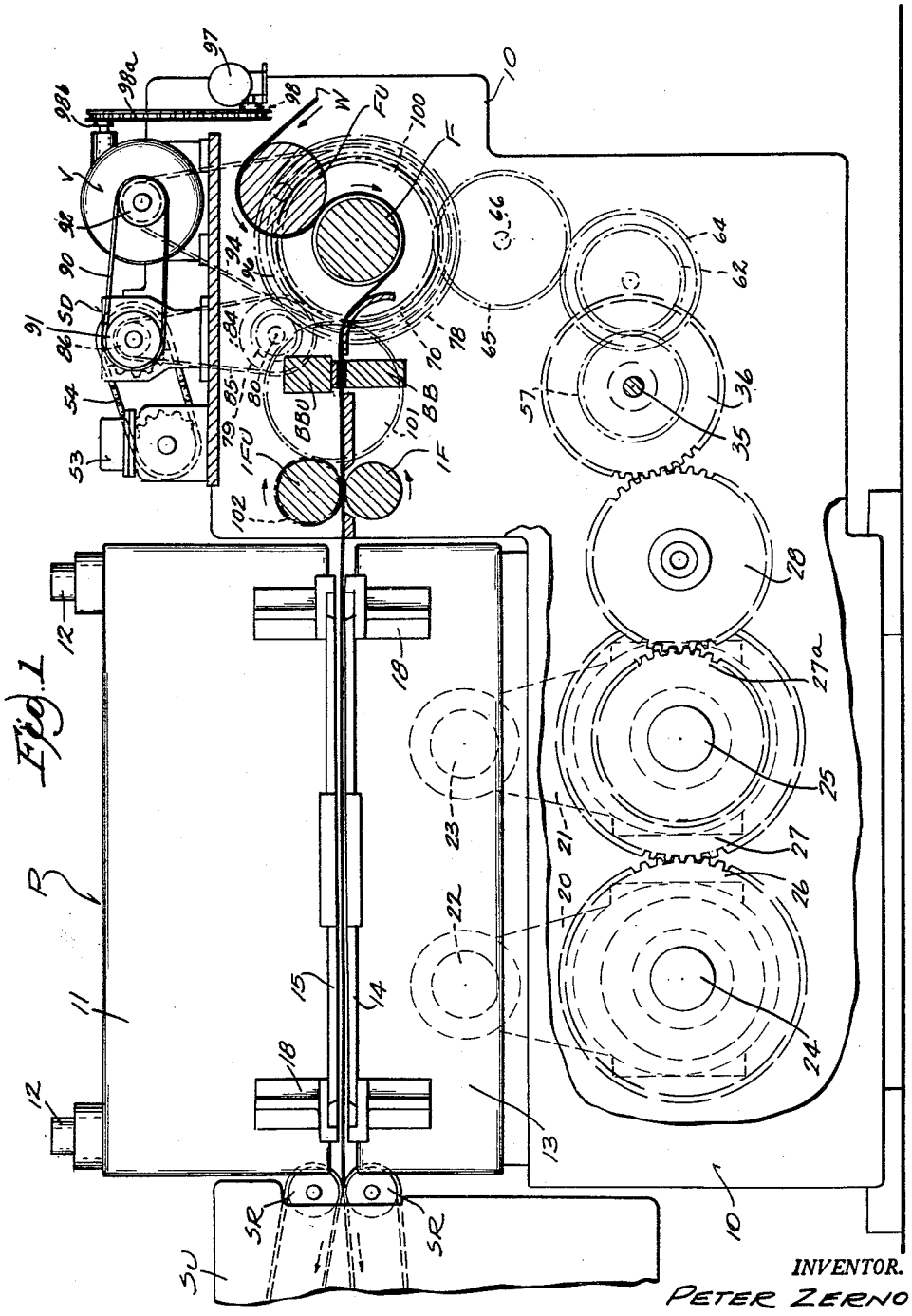


Fig. 1

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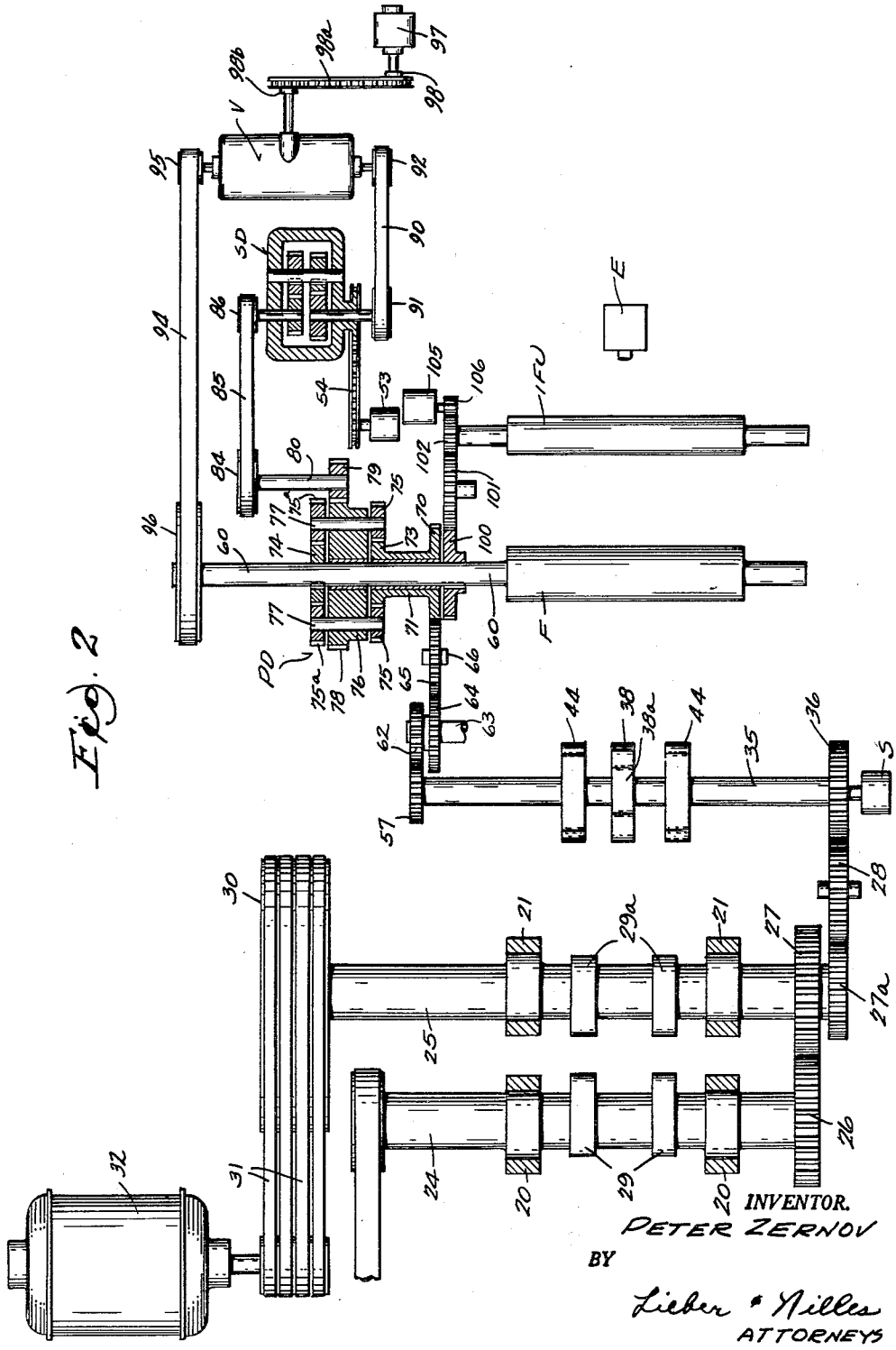


Fig. 2

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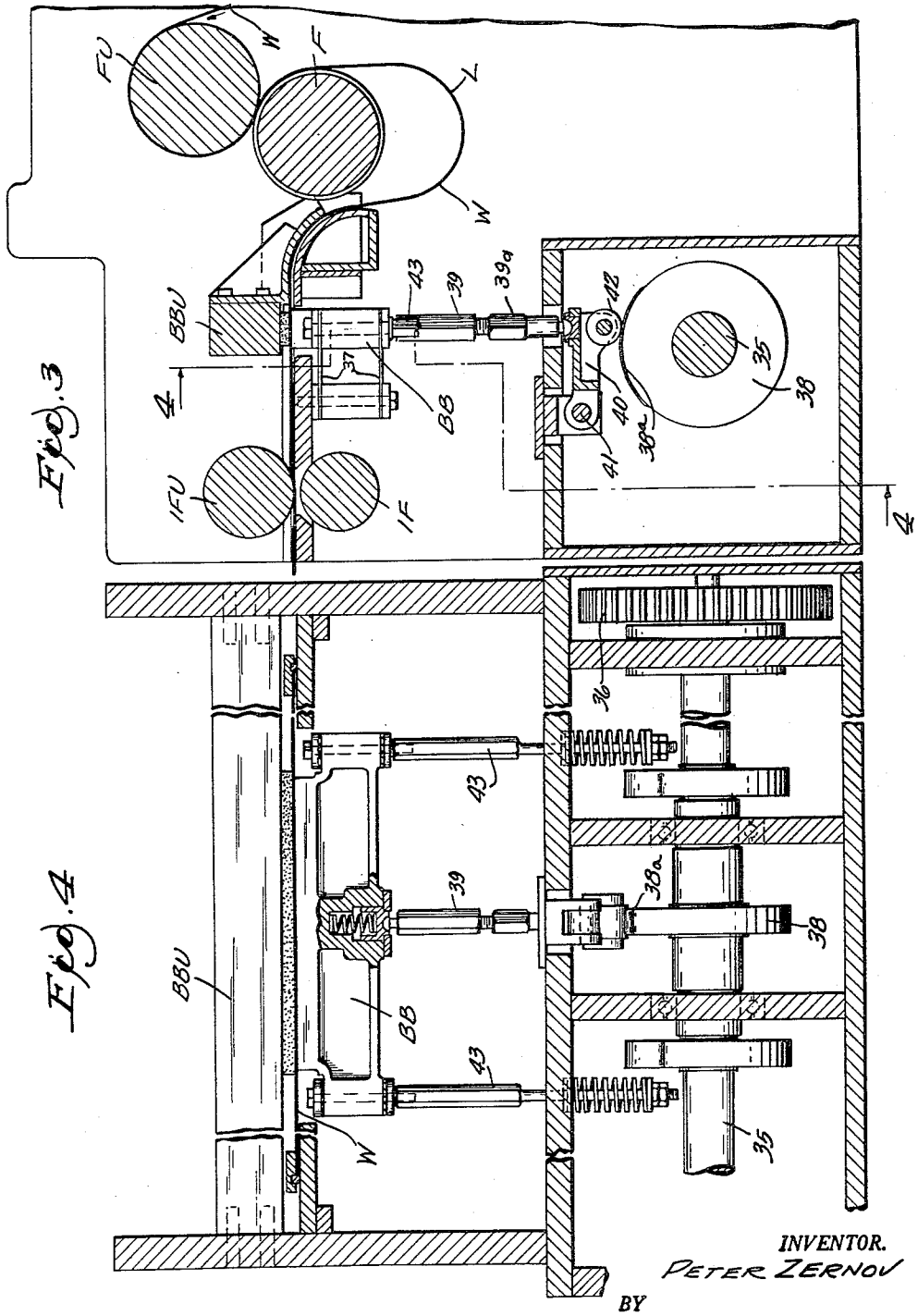


Fig. 3

Fig. 4

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Fig. 5

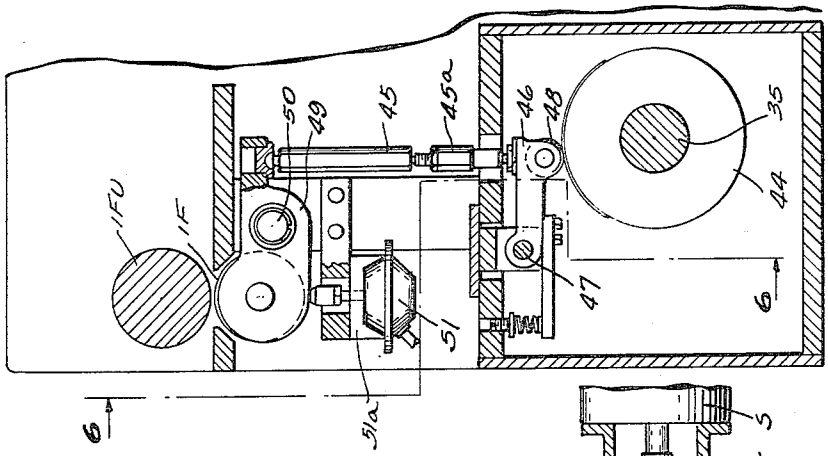
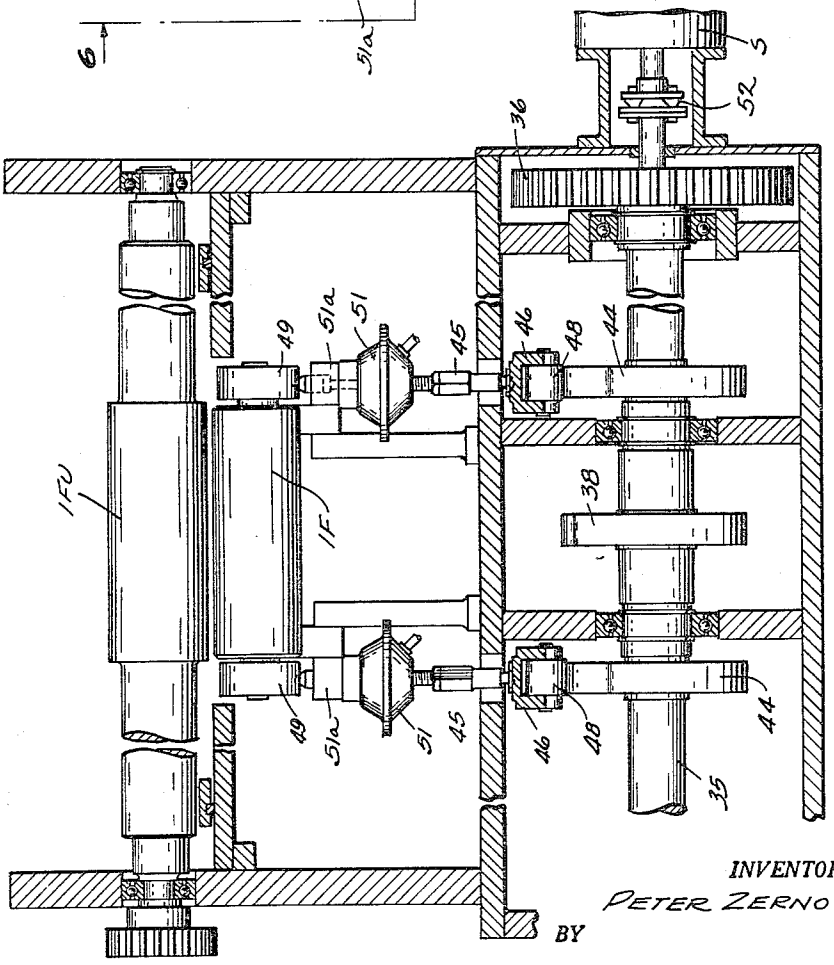


Fig. 6



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DRIVE MECHANISM FOR CARTON BLANK FORMING PRESS

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8 Claims. (Cl. 93—58.3)

The present invention relates generally to carton blank forming presses of the type in which a web is intermittently fed into and out of a creasing and cutting or blank forming press. Such a press has a pair of continuously active metering feed rolls which feed the web to a pair of intermittently active feed rolls; a brake bar is also provided between the pairs of feed rolls to arrest the travel of the web and build up a loop therein between the pairs of rolls during each carton forming stroke of the press.

According to the present invention, an improved drive mechanism and arrangement are provided for a press of the above type, and in which a common cam shaft is used as a single reference point for causing feeding action of the intermittent feed rolls, actuating the brake bar, and driving the mechanical gear drive to one of the intermittent feed rolls.

A more specific aspect of the invention provides the above mechanism with correction control apparatus if a pre-printed web is to be formed, wherein a selector switch is referenced directly to and connected with the cam shaft for synchronization with correction motors of said apparatus, to thereby furnish corrections to a differential gear unit in said gear drive.

Another aspect of the invention relates to the direct gear drive between the cam shaft and one of the metering rolls which utilizes a minimum number of gears for the functions obtained; this mechanical drive is always in the same direction, and as a result there are no reversal of forces but instead the drive is always in the same direction, and any correction is made directly to the feed rolls.

Another aspect of the present invention relates to a blanking press having improved actuating mechanism between a common cam shaft and the intermittently operating feed rolls and brake bar. The improved actuating mechanism is such that the web is located extremely accurately with respect to the brake bar, and it is possible to obtain very close and accurate timing between the closing of the brake bar and the opening of the intermittent feed rolls.

Generally, the press provided by the present invention is capable of exceptionally high speed and accuracy.

These and other objects and advantages will appear later as this disclosure progresses, reference being had to the accompanying drawings, in which:

FIGURE 1 is a side elevational view, taken from the operator's side, of a carton blank press made in accordance with the present invention, certain parts being shown as broken away, removed, or in section;

FIGURE 2 is a schematic and "spread out" view of the drive means between the various parts;

FIGURE 3 is a longitudinal sectional view of part of the press shown in FIGURE 1, but on an enlarged scale, and showing, inter alia, the mechanical connection between the common cam shaft and the brake bar;

FIGURE 4 is a transverse and vertical sectional view taken generally along the line 4—4 in FIGURE 3;

FIGURE 5 is another longitudinal sectional view of a portion of the press shown in FIGURE 1, but on an enlarged scale, and showing, inter alia, the actuating mechanism between the common cam shaft and the intermittent feed rolls;

FIGURE 6 is an elevational view, partially in section and taken generally along the line 6—6 in FIGURE 5.

General

Before a detailed explanation of the mechanism is commenced, a statement as to the very general organization may be helpful. The web W passes through the cutter and creaser press P in the direction indicated by the arrow in FIGURE 1. The web comes from preliminary equipment (not shown), such as a decurl unit, hot melt applicator or other mechanism. As the web enters the press, it passes through the metering feed rolls F and FU, only the roll F being positively driven. These rolls are continuously active to feed the web at a precise and constant rate.

The web next passes through a pair of brake bars BB and BBU, the lower bar BB being vertically reciprocal for intermittent clamping engagement with the fixed upper bar BBU, to thereby alternately stop the web when the cutting and creasing of the web occurs, and then release the web for another length of feed by the intermittently acting feed rolls IF and IFU.

The lower feed roll IF is mounted for swinging into and out of nipping engagement with the upper roll IFU. This upper roll is positively driven while the lower roll is driven only by the web, and as a result a certain amount of slip may occur between them when the web is too tight, in other words, the speed between the rolls IF and IFU may vary slightly at times.

A loop L (FIG. 3) in the web is formed, during each operation of the press, between the continuously acting feed rolls and the brake bar, as when the brake bar is holding the web.

As they leave the press, the blanks are engaged by the stripper nip rolls SR (FIG. 1) for conveyance by the stripper unit SU.

Press in general

Referring in greater detail to FIGURE 1, the base frame structure 10 supports the upper, fixed platen 11 on the four vertical corner supports 12 and the lower platen 13 which is vertically reciprocal on these vertical supports. One of the platens carries the cutting and creasing dies while the other carries a base plate, these parts being referred to by numerals 14 and 15, and held in place by brackets 18.

The vertically movable platen 13 is reciprocated by two pairs of eccentrically driven connecting rods 20 and 21 which are journalled at their upper ends on shafts 22 and 23, respectively, carried by the platen 13. The lower ends of these rods are mounted on crankshafts 24 and 25 mounted in the base structure and drivingly connected together by their respective gears 26 and 27. Another gear 27*a* is fixed to gear 27 and meshes with an idler gear 28 secured to the base structure at the operator's side. Pairs of counterweights 29 and 29*a* (FIG. 2) are secured to crankshafts 24 and 25, respectively.

A large pulley 30 is fixed to one end of crankshaft 25 and is driven by multiple belts 31 from an electric motor 32, and shaft 25 constitutes the main drive shaft of the machine.

Cam shaft

The base structure 10 of the apparatus also rotatably supports a common cam shaft 35 having a gear 36 fixed to its end which meshes with idler gear 28. Means are connected directly with the cam shaft for shifting the brake bar into clamping engagement with the web while the press forms the blank and the intermittent feed rolls are inactive, as follows.

Brake bar actuating means

A single center ram 38 (FIGURES 3 and 4) is secured to shaft 35 and has a rise 38*a* of about .045 of an inch for about 90 degrees. This cam is for raising the brake bar BB which is shiftably mounted by a pair of leaf springs 37. More specifically, the cam operates through

a rigid push rod 39, which is adjustable in length by its threaded portion 39*a*. The lower end of the push rod is seated in the free end of a bracket 40 pivoted at 41 and which bracket has a cam follower 42 in engagement with the peripheral edge of the cam 38.

The upper end of the push rod 39 is seated against the underside of the vertically shiftable bar BB to urge it into clamping engagement with the upper, fixed bar BBU. Adjustable spring-strut units 43 act to resiliently bias the lower bar downwardly to the web unclamped position.

Intermittent feed roll actuating means

Second means are connected directly to the cam shaft for rendering the intermittent feed rolls inactive while a loop is built up in the web, as follows.

A pair of cams 44 (FIGURES 5 and 6) is also secured at spaced locations on the cam shaft 35 and act through their respective push rods 45 to urge the lower intermittent feed roll IF away from its fixed upper intermittent feed roll IFU. Rods 45 are adjustable in length by means of their threaded sleeves 45*a* to insure even nipping pressure across the width of the web. The lower ends of rods 45 are seated in their brackets 46 which are pivotally mounted on pins 47 and which carry a cam follower 48 on their free end for engagement by cams 44. Cams 44 have a rise for about one-third of their circumference, the maximum rise of which occurs at the same time in the cycle as does the maximum rise on cam 38.

The movable feed roll IF is mounted on two spaced brackets 49 secured intermediate their length to the ends of pivot shaft 50. The upper ends of the push rods 45 bear against one end of these brackets, and the roll IF is mounted in the other ends.

Air cylinder units 51 mounted on stationary brackets 51*a* act on the brackets to bias the roll IF into the feeding position.

Thus, the intermittent action of the brake bar and the intermittent feed rolls IF and IFU are timed with and connected directly to the cam shaft 35.

Selector switch

A selector switch S (FIGURES 2 and 6) is connected directly to the cam shaft at the operator's side of the machine by means of a coupling 52. In other words, the shaft 35 operates the selector switch which is thereby timed to the cutter creaser press. The selector switch is synchronized with an electric eye scanning head E which scans the preprinted web W and together actuate a correction motor 53 which is connected by an endless flexible drive chain 54 to a secondary differential gear unit SD. The selector swtich gives a signal at a given rotary position of the cam shaft and this signal is compared with another signal which is given by the electric eye scanning head as a mark goes by on the web. If these two signals are in phase, then no correction occurs. If the signals are out of phase, a correction impulse is sent to the correction motor 53 in the direction and in proportion to the amount the signals are out of phase. This control system will be referred to more fully hereinafter.

Drive from cam shaft

As shown clearly in FIGURES 1 and 2, at the other end of the cam shaft 35, a change gear 57 is secured which meshes with another change gear 62 mounted on a shaft 63 extending from the drive side of the machine, that is the side opposite to the operator's side. The change gears 57 and 63 are mounted on fixed centers, and they can be replaced with other pairs having different ratios, and in this manner the ratio between the feed rolls and the crankshaft is effected. In order to make the ratio between the feed rolls and crankshaft infinitely variable, the "gap" between any set of change gears is bridged by a variator V, to be described.

Also fixed to shaft 63 is a gear 64 which meshes with an idler gear 65 fixed on shaft 66 at the drive side. Gear

65 feeds a primary planetary differential PD that is mounted on the metering roll shaft 60 of the lower metering roll F. More specifically, idler gear 65 meshes with gear element 70 of the compound gear 71 rotatably mounted on the shaft 60. Compound gear 71 also has a smaller gear element 73 which meshes with the circumferentially spaced planetary gears 75 mounted on the rotatable housing 76 by means of the shafts 77 on the housing. Fixed to the other ends of shaft 77 are gears 75*a* which mesh with the sun gear 74 that is keyed to shaft 60. Housing 76 is rotatable on the shaft 60 and has a large peripheral ring gear 78.

Gear 78 drives the gear 79 on the correction shaft 80 of the primary differential PD. Shaft 80 is rotatably mounted in its frame (not shown) fixed to the main frame 10, and this primary differential correction shaft drives the entire planetary unit. A timing pulley 84 on the other end of shaft 80 is connected by timing belt 85 to one side of the timing pulley 86 of the secondary differential SD.

The other side of the secondary differential is connected by a timing belt 90 and timing pulley 91 and 92, to one side of the conventonal variator V, of the "Cleveland" type. The other side of the variator V is driven by the metering roll shaft 60 through timing belt 94 and its pulleys 95 and 96.

It will be recalled that the correction motor 53 can drive the entire secondary differential by the chain 54. Thus, the selector switch S and electric eye E, through the correction motor 53, secondary differential SD, and variator V, are effective to actuate the metering roll. This electric eye E and correction motor 53 provide a correction which is proportional to the error that the electric eye E sees.

Another correction motor 97 feeds the variator V through gears 98 and 98*a* and 98*b*. The electric eye E also operates this correction motor. This second correction motor 97 thus corrects the variator ratio and acts to continuously trim the error. For example, for every five corrections, or any other predetermined number of corrections, called for by the correction motor 53, the second correction motor 97 then changes the variator setting and in this manner causes the variator to continuously trim the error and set itself to the exact repeat length of the printing.

The above described control arrangement provides two separate yet combined corrections, namely, one through the electric eye correction motor into the secondary differential, and the other as a correction setting in the variator ratio which continuously trims the error.

The metering roll shaft 60 is connected to the intermittent feed roll IF for driving the latter, by means of gear 100 fixed to shaft 60, idler gear 101, and gear 102 fixed to the end of the shaft of roll IF. Thus, the drive from the cam shaft is first through the metering rolls and then directly to the intermittent feed rolls.

The primary differential directly drives the metering feed rolls and consequently the intermittent feed rolls, and applies any correction thereto. The drive to the primary differential from the cam shaft is always in the same direction, and there are therefore no detrimental reversal of forces.

A lubricating pump 105 is provided at the end of the gear train for supplying lubrication to the machine. This pump is connected by its gear 106 to gear 102 and also serves the important function of taking up any backlash in the gear system.

Résumé

By means of the present invention a very accurate carton blank forming press has been provided in which the common cam shaft is utilized to directly and positively actuate the brake bar and the intermittent feed rolls in timed relationship with one another and with the other components of the machine. A gear drive connection from the cam shaft to the metering rolls and then directly to the intermittent feed rolls utilizes a minimum number

of gears for the numerous functions obtained; this mechanical drive is always in the same rotative direction and eliminates reversal of forces found in prior art machines; any correction necessary in the present drive mechanism is made directly to the feed rolls.

Various modes of carrying out the invention are contemplated as being within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

I claim:

1. In a carton blank forming apparatus of the type having a cutting and creasing press into which a web is fed, a pair of continuously active metering rolls and a pair of intermittent feed rolls for said web, and a shiftable brake bar located between said pairs of metering and intermittent feed rolls for intermittently engaging said web, the improvement comprising, a driven cam shaft, two separate cams on said shaft, means connected with one of said cams for shifting said brake bar into clamping engagement with said web to build up a web loop between said pairs of rolls and while said press forms a blank, other separate means connected with said other cam for rendering said intermittent feed rolls inactive while said loop is built up, and gear drive mechanism directly from said cam shaft to one of said metering rolls.

2. In a carton blank forming apparatus of the type having a cutting and creasing press into which a web is fed, a pair of continuously active metering rolls and a pair of intermittent feed rolls for said web, and a shiftable brake bar located between said pairs of metering and intermittent feed rolls for intermittently engaging said web, the improvement comprising, a driven cam shaft, thrust means directly connected with said cam shaft for shifting said brake bar into clamping engagement with said web to build up a web loop between said pairs of rolls and while said press forms a blank, other thrust means separate from said first thrust means and directly connected with said shaft for rendering said intermittent feed rolls inactive while said loop is built up, gear drive mechanism directly from said cam shaft to one of said metering rolls, and gear means for driving one of said intermittent feed rolls from and at a higher speed than said metering roll.

3. In a carton blank forming apparatus of the type having a cutting and creasing press into which a pre-printed web is fed, a pair of continuously active metering rolls and a pair of intermittent feed rolls for said web, and a shiftable brake bar located between said pairs of metering and intermittent feed rolls for intermittently engaging said web, the improvement comprising; a driven cam shaft; rigid thrust means directly connected with said cam shaft for shifting said brake bar into clamping engagement with said web to build up a web loop between said pairs of rolls and while said press forms a blank; other rigid thrust means directly connected with said shaft for rendering said intermittent feed rolls inactive while said loop is built up; gear drive mechanism directly from said cam shaft to one of said metering rolls and including a differential gear unit; and correction control apparatus connected to said differential gear unit to advance or retard the feeding action of said metering roll, said apparatus including an electric eye scanning head for said pre-printed web, a selector switch connected directly to said cam shaft for measuring the rotary position thereof, and correction motors actuated by a comparison of out of phase electric signals from said scanning head and selector switch.

4. Carton blank forming apparatus comprising, a cutting and creasing press into which a web is fed, a pair of continuously active metering rolls and a pair of intermittent feed rolls for said web, a shiftable brake bar located between said pairs of metering and intermittent feed rolls for intermittently engaging said web, a driven cam shaft, rigid thrust means directly connected with said cam shaft for shifting said brake bar into clamping engagement with said web to build up a web loop between said pairs of rolls and while said press forms a blank, other rigid thrust means directly connected with said shaft for rendering said intermittent feed rolls inactive while said loop is built up, and gear drive mechanism directly connecting said cam shaft to one of said metering rolls for rotation of the latter in one direction only, said drive mechanism including a set of ratio change gears, and gear means for driving one of said intermittent feed rolls directly from said metering roll.

5. In a carton blank forming apparatus of the type having a cutting and creasing press into which a web is fed, a pair of continuously active metering rolls and a pair of intermittent feed rolls for said web, and a shiftable brake bar located between said pairs of rolls for intermittently engaging said web, the improvement comprising, a driven cam shaft having at least two cams thereon, thrust rod means connected directly between one of said cams and said brake bar for shifting the latter into clamping engagement with said web to build up a web loop between said pairs of rolls and while said press forms a blank, and other thrust rod means connected between the other cam and one of said intermittent feed rolls for shifting said one roll and rendering said intermittent feed rolls inactive while said loop is built up.

6. In a carton blank forming apparatus of the type having a cutting and creasing press into which a web is fed, a pair of continuously active metering rolls and a pair of intermittent feed rolls for said web, and a shiftable brake bar located between said pairs of rolls for intermittently engaging said web, the improvement comprising, a driven cam shaft having at least two cams thereon, thrust rod means connected directly between one of said cams and said brake bar for shifting the latter into clamping engagement with said web to build up a web loop between said pairs of rolls and while said press forms a blank, and other thrust rod means connected between the other cam and one of said intermittent feed rolls for shifting the latter and rendering said intermittent feed rolls inactive while said loop is built up, and gear drive mechanism directly between said cam shaft and one of said metering rolls.

7. Apparatus as defined in claim 6 including, gear means for driving one of said intermittent feed rolls from and at a higher speed than said metering roll.

8. In a carton blank forming apparatus of the type having a cutting and creasing press into which a pre-printed web is fed, a pair of continuously active metering rolls and a pair of intermittent feed rolls for said web, and a shiftable brake bar located between said pairs of rolls for intermittently engaging said web, the improvement comprising, a driven cam shaft having at least two cams thereon, thrust rod means connected directly between one of said cams and said brake bar for shifting the latter into clamping engagement with said web to build up a web loop between said pairs of rolls and while said press forms a blank, other thrust rod means connected between the other cam and one of said intermittent feed rolls for shifting the latter and rendering said intermittent feed rolls inactive while said loop is built up, gear drive mechanism directly from said cam shaft to one of said metering rolls and including a differential gear unit; and correction control apparatus connected to said differential gear unit to advance or retard the feeding action of said metering roll, said apparatus including an electric eye scanning head for said pre-printed web, a selector switch connected directly to said cam shaft for measuring the rotary position thereof, and correction motors actuated by a comparison of out-of-phase electric signals from said scanning head and selector switch.

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