

[54] **HIGH SPEED IN-LINE PAPER INSERTING APPARATUS AND METHOD**

3,809,384 5/1974 Zugel..... 270/54

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[57] **ABSTRACT**

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Apparatus and method for high speed in-line paper inserting, primarily for insertion of supplements and the like into newspapers, wherein newspaper jackets and inserts are advanced and manipulated in a straight line motion. The system includes means for rectilinearly conveying a folded newspaper jacket and placement thereof in a pocket, where the jacket is opened by an edge gripping mechanism, and an insert is impelled into the so opened jacket at a higher speed than that of the advancing jacket, the jacket then being released by the gripping mechanism to close with the insert therein, and the assembled newspaper, including insert, is then removed from the jacket for further conveying and processing.

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[52] U.S. Cl. .... **270/55; 270/57**  
 [51] Int. Cl.<sup>2</sup> ..... **B65H 5/30**  
 [58] Field of Search ..... **270/54-58**

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**9 Claims, 17 Drawing Figures**

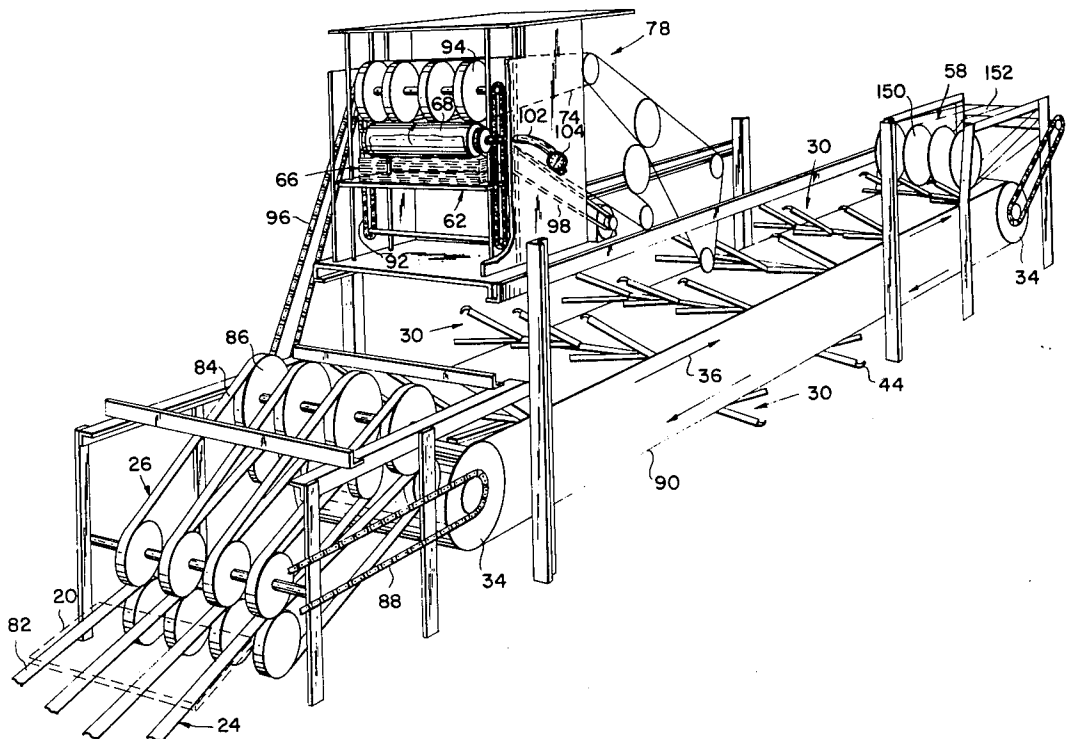
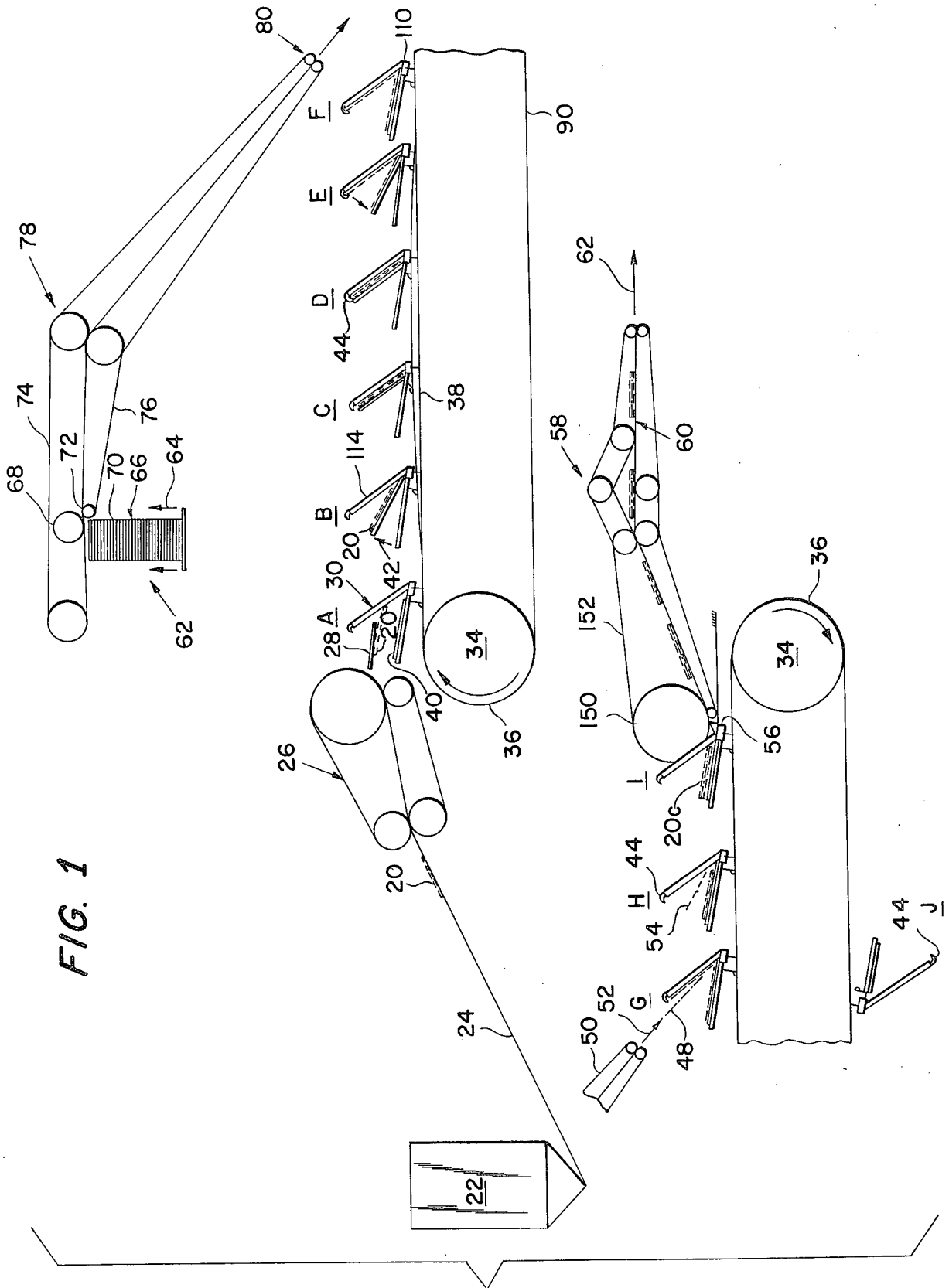


FIG. 1



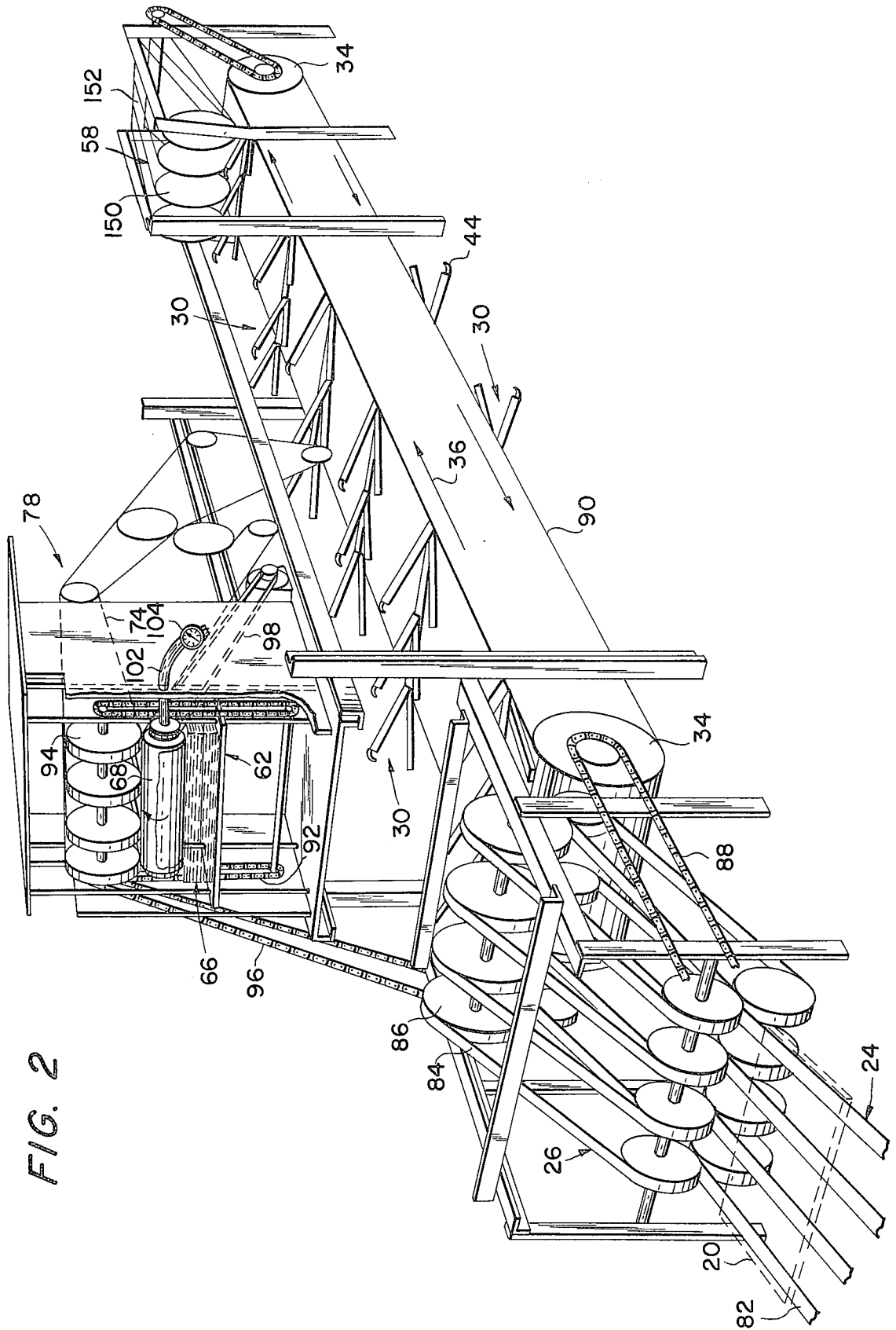
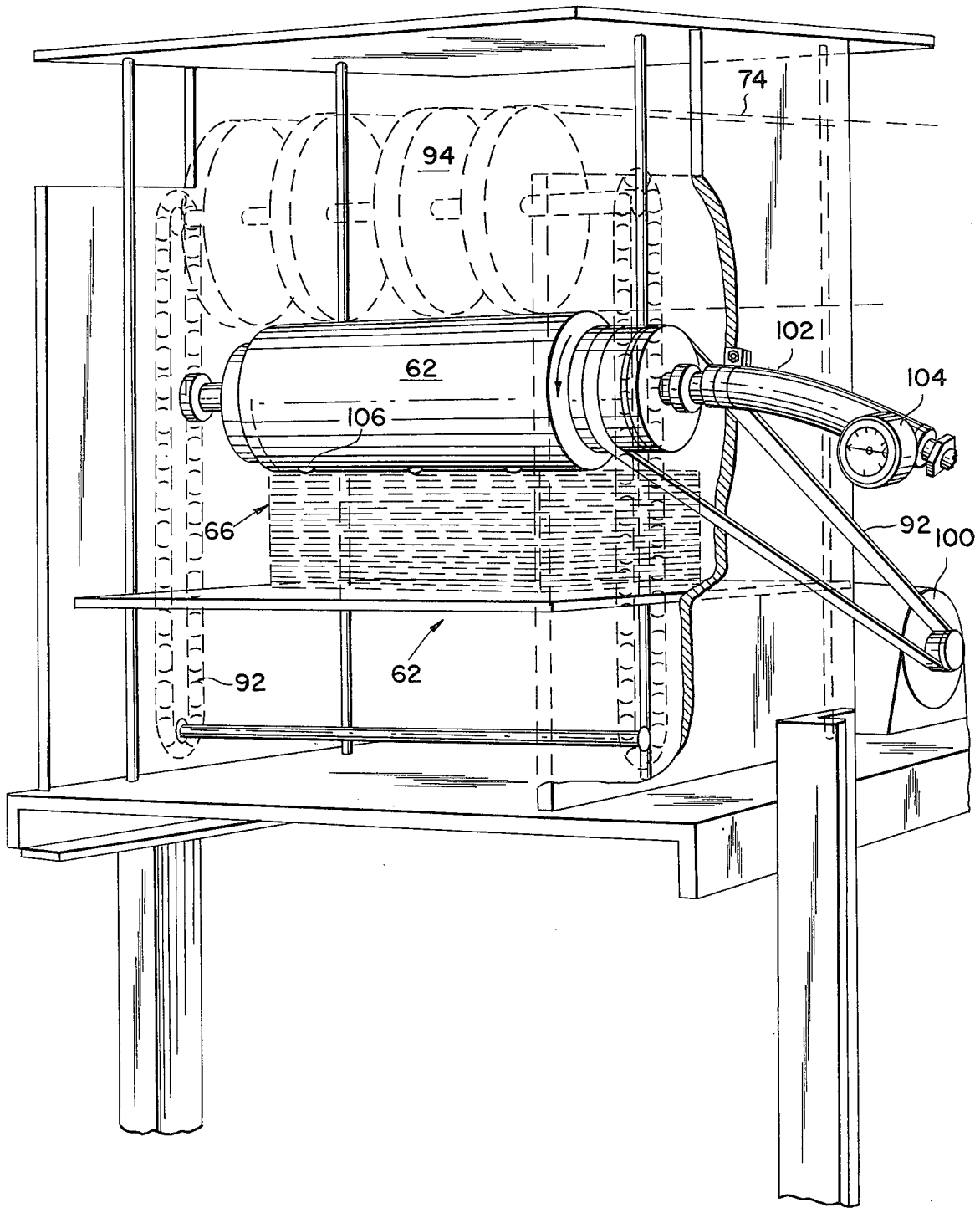


FIG. 2

FIG. 3



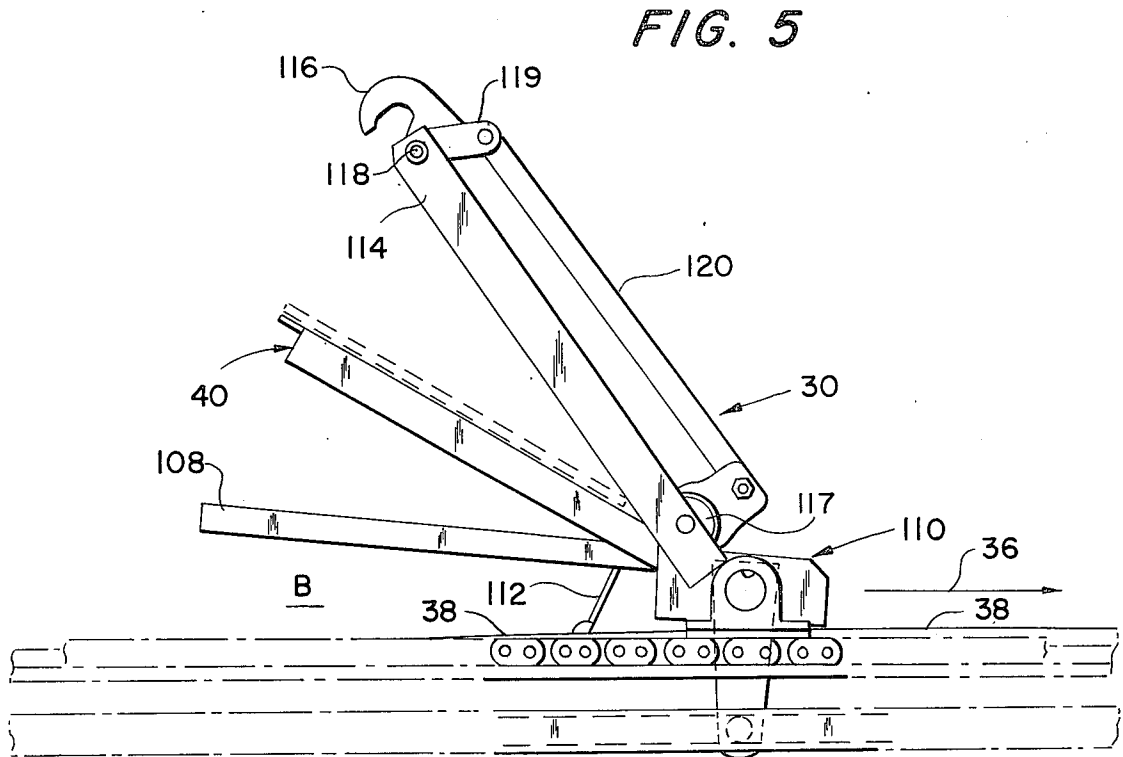
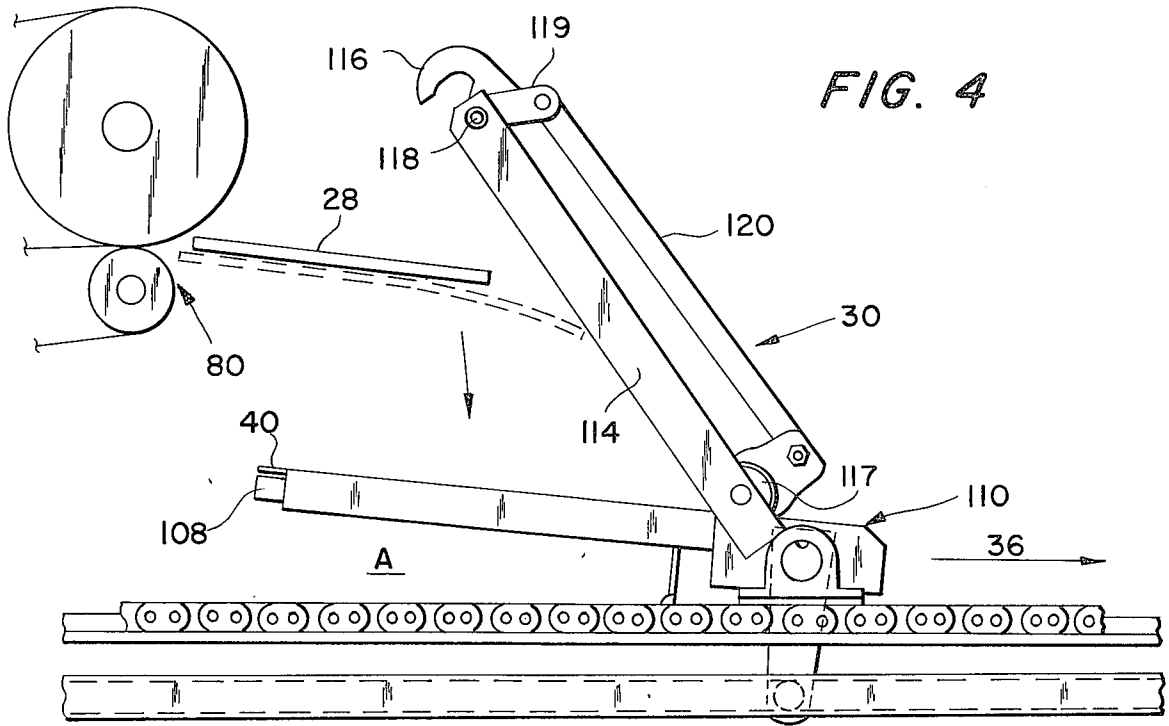


FIG. 6

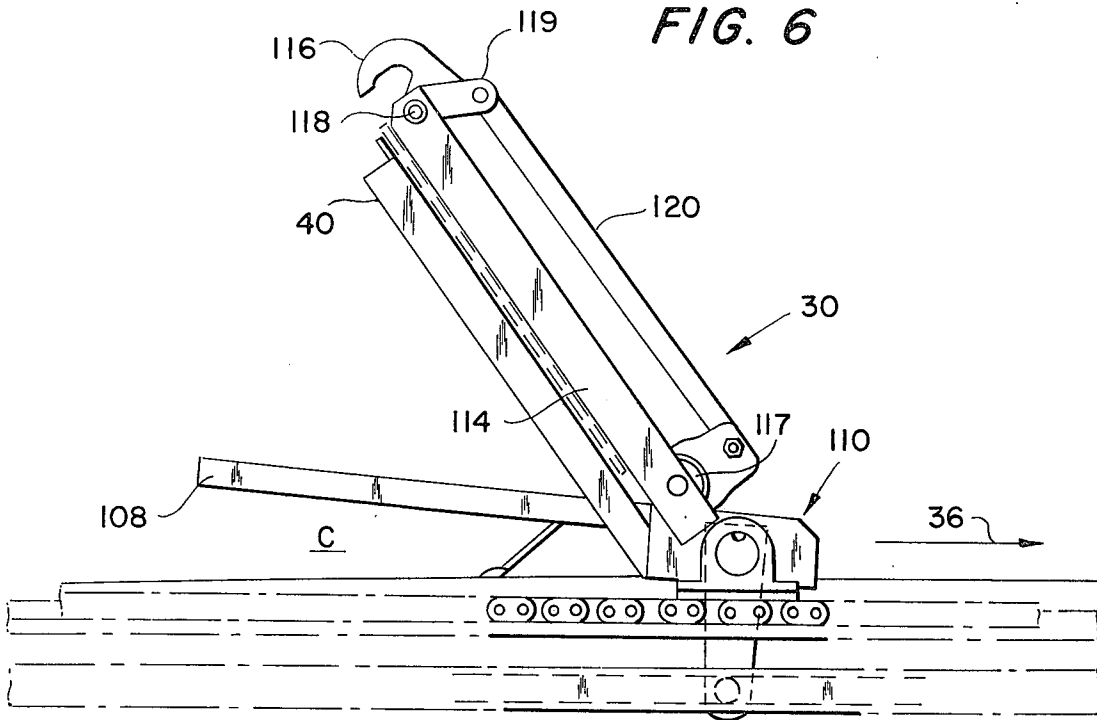


FIG. 7

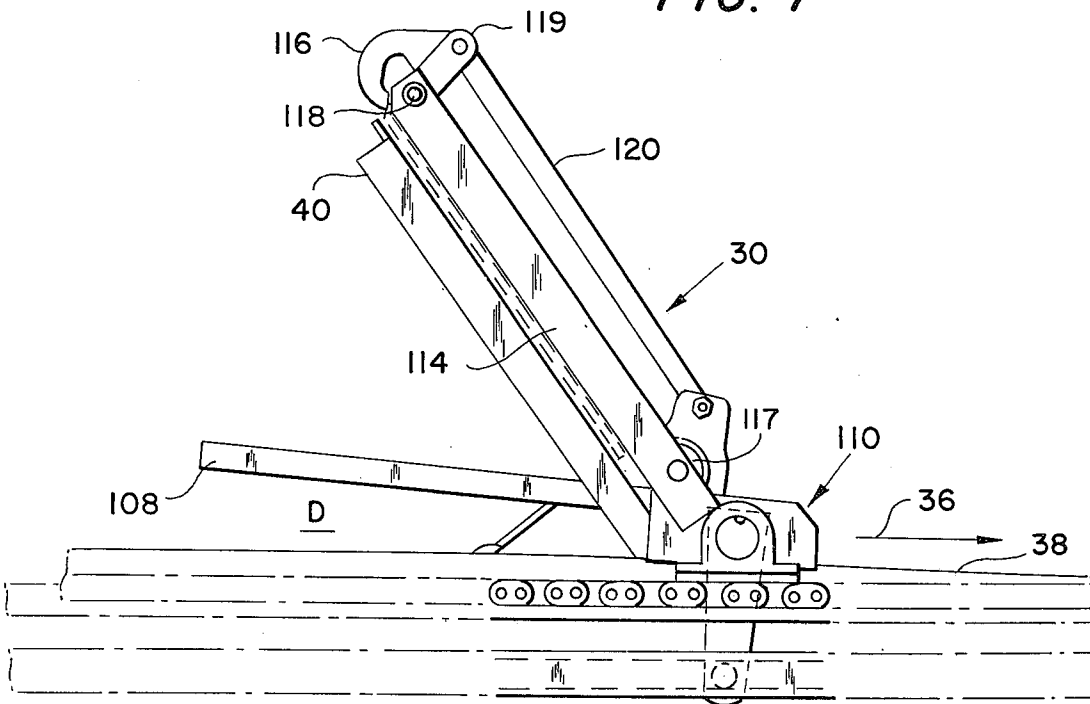


FIG. 8

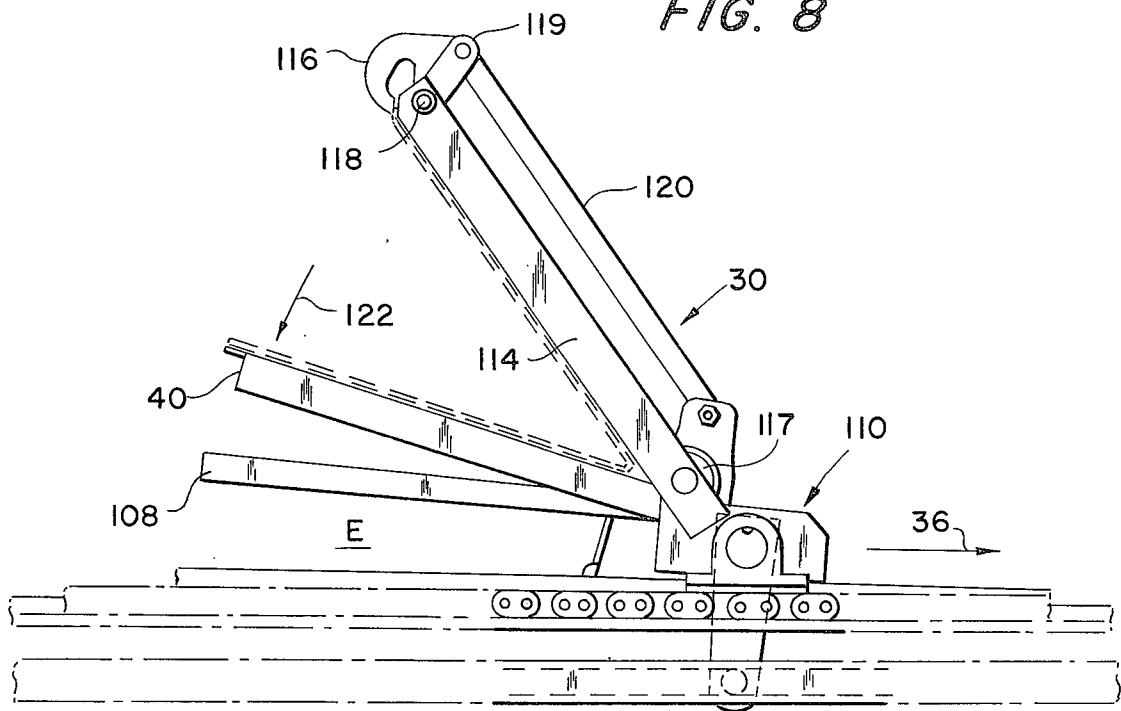


FIG. 9

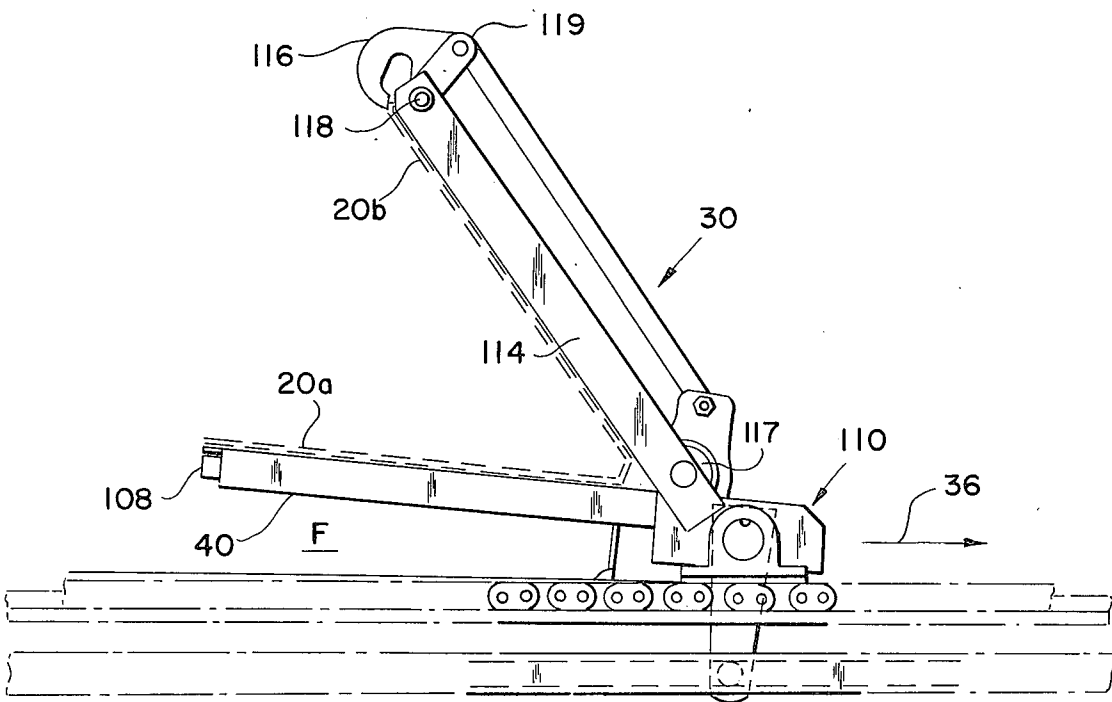






FIG. 12

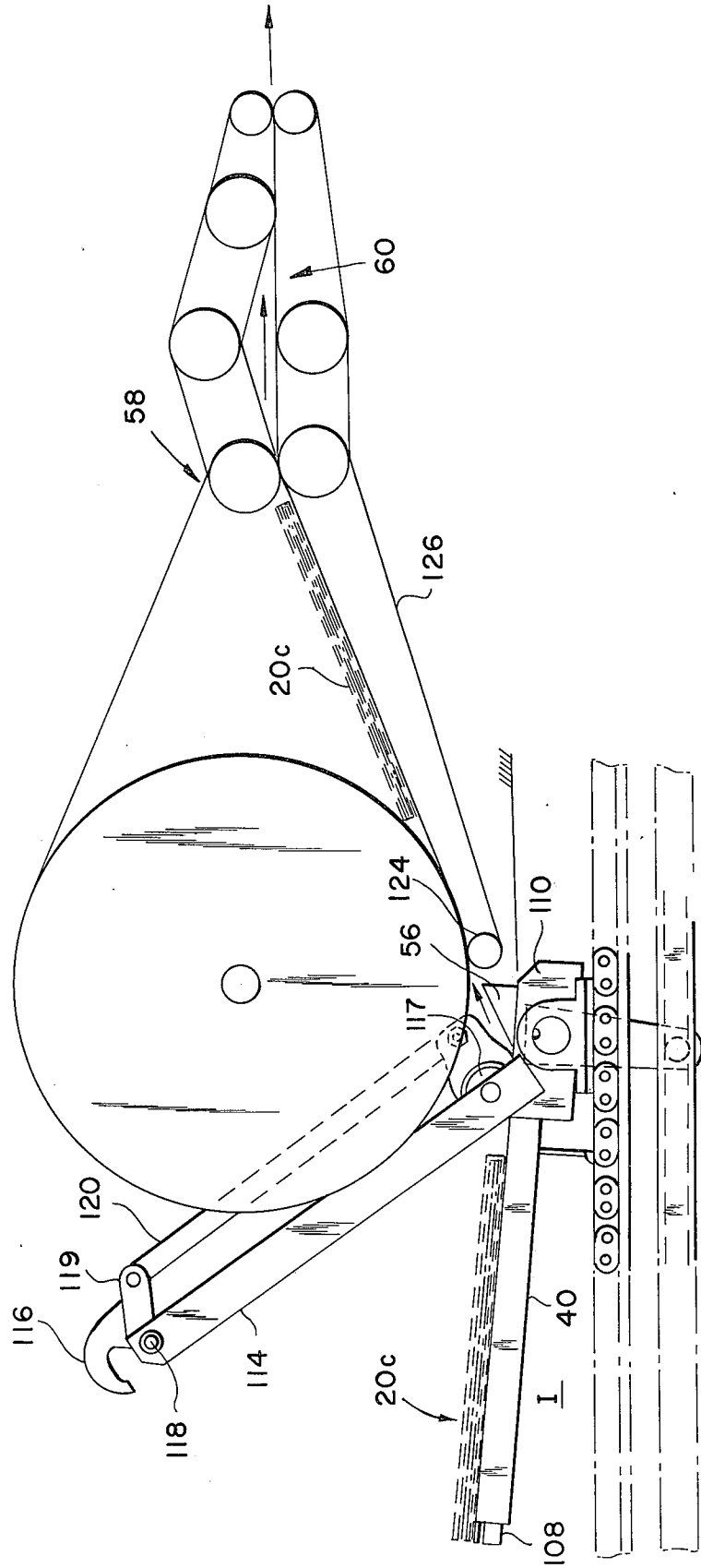


FIG. 13

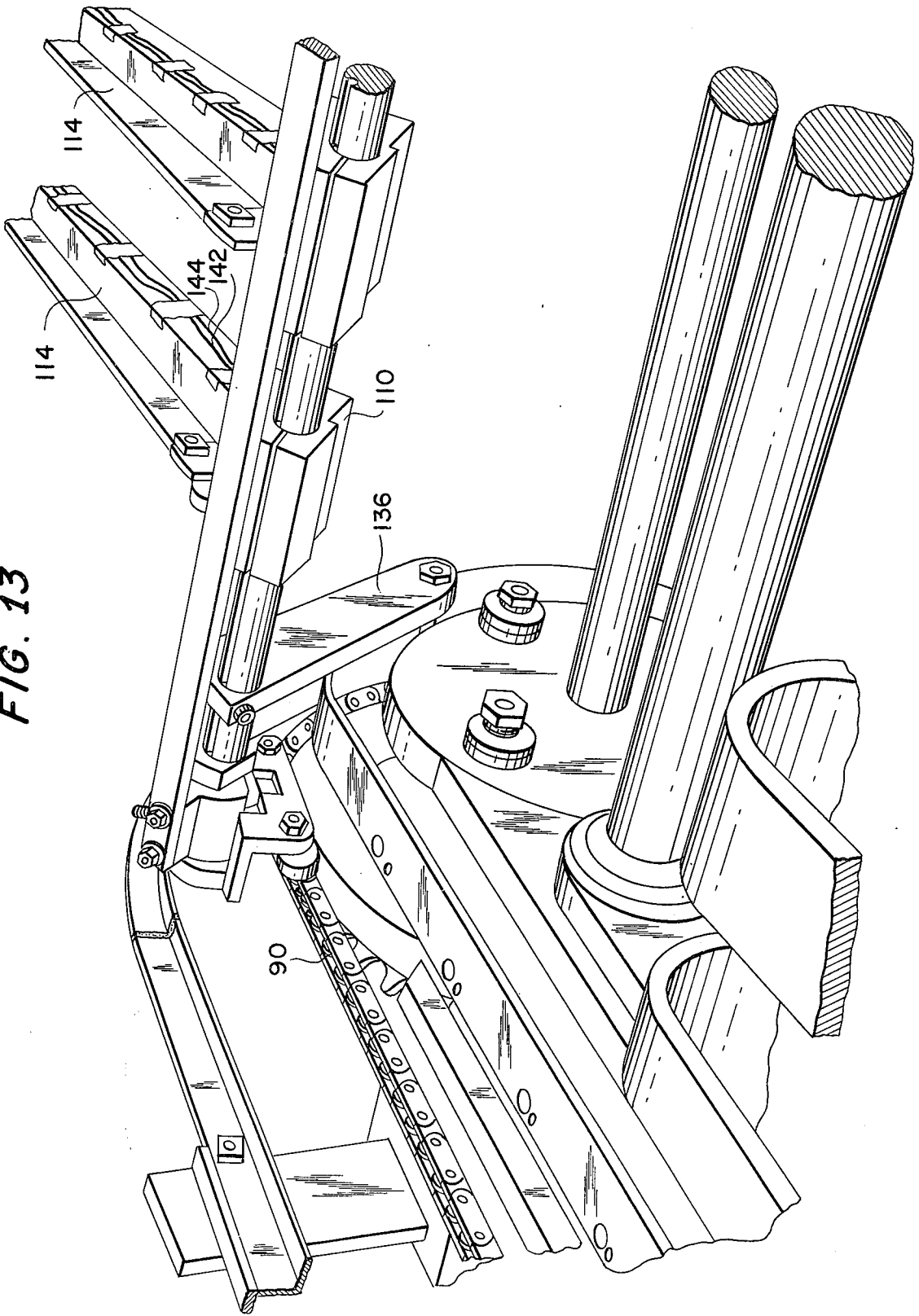


FIG. 14

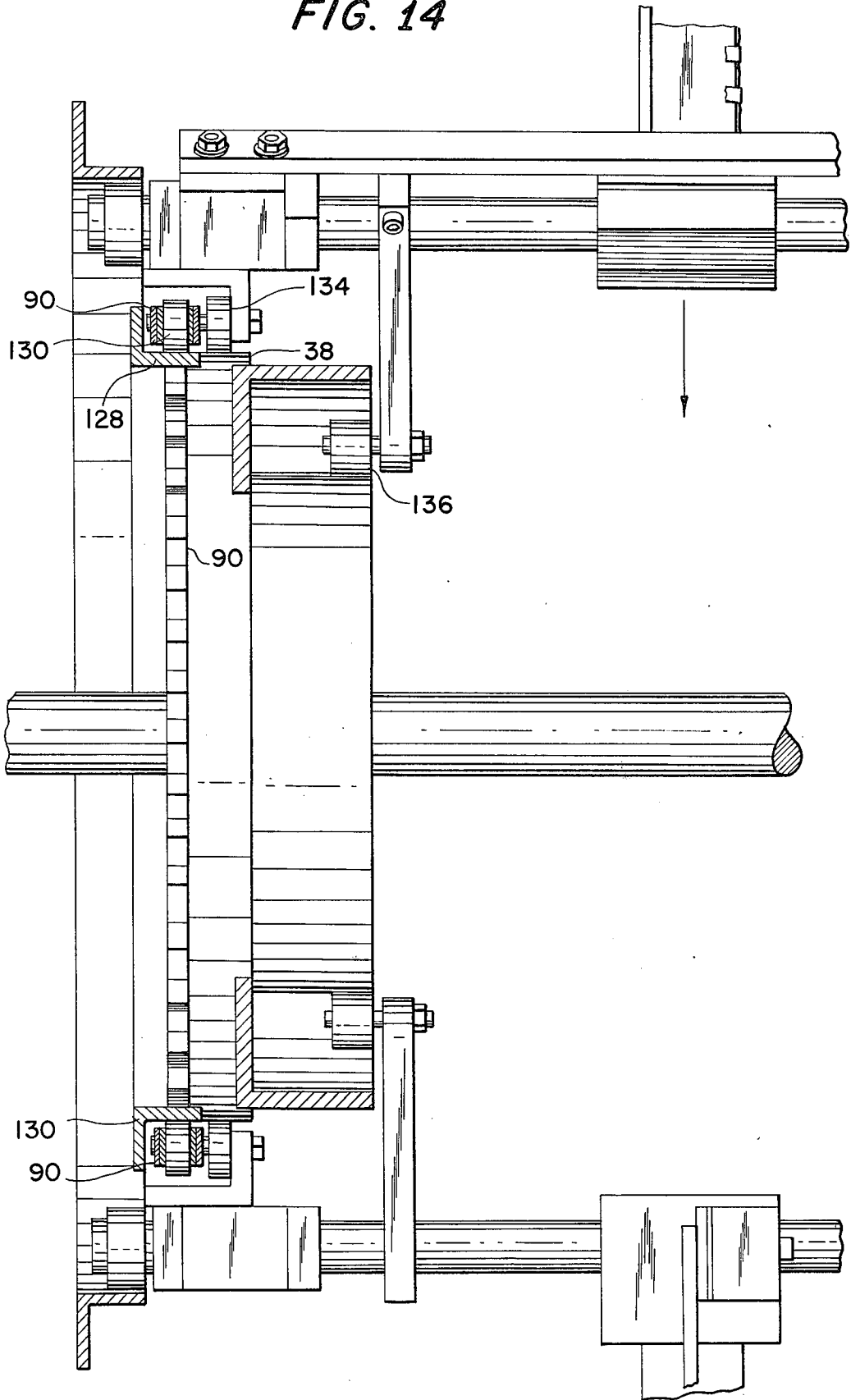


FIG. 15

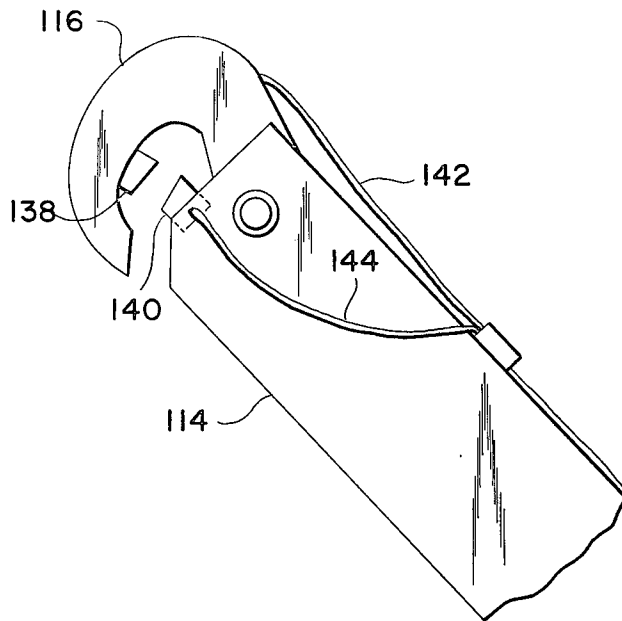


FIG. 16

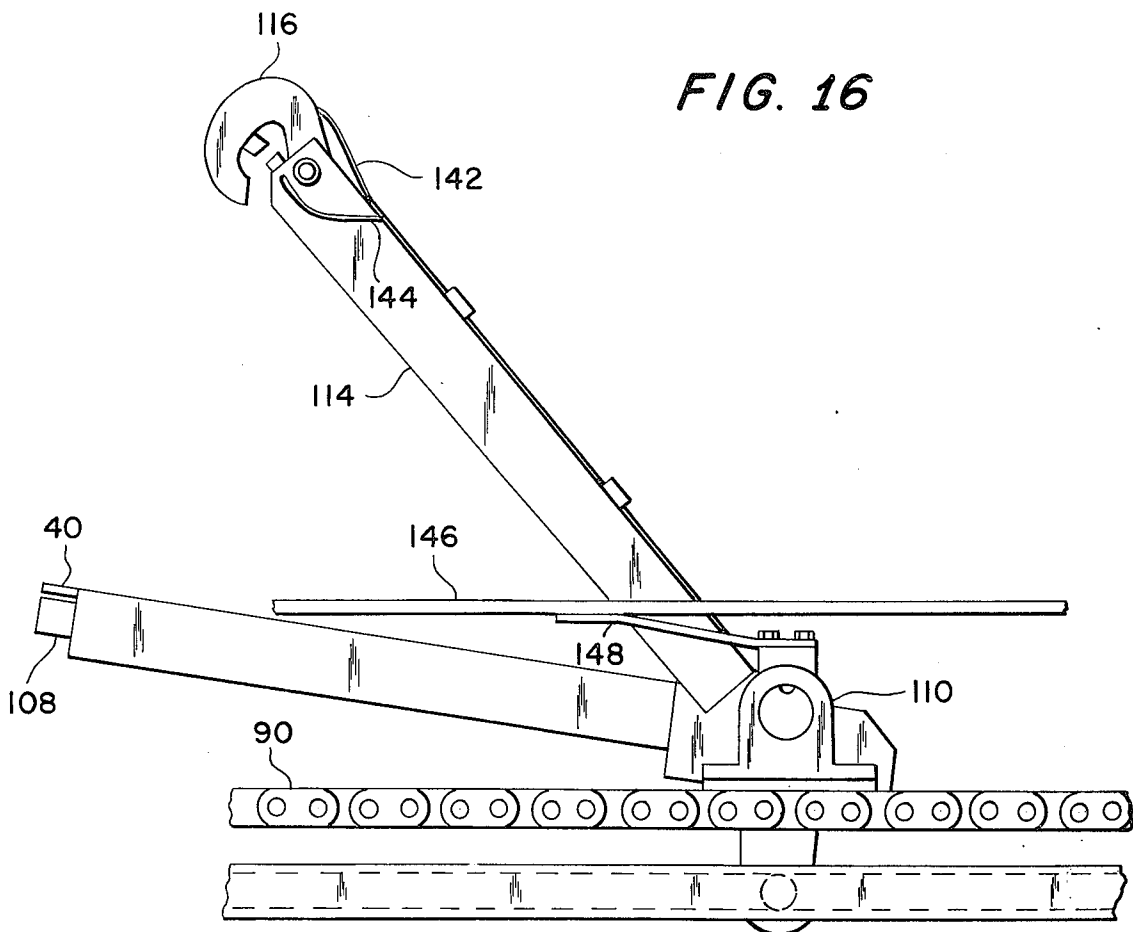
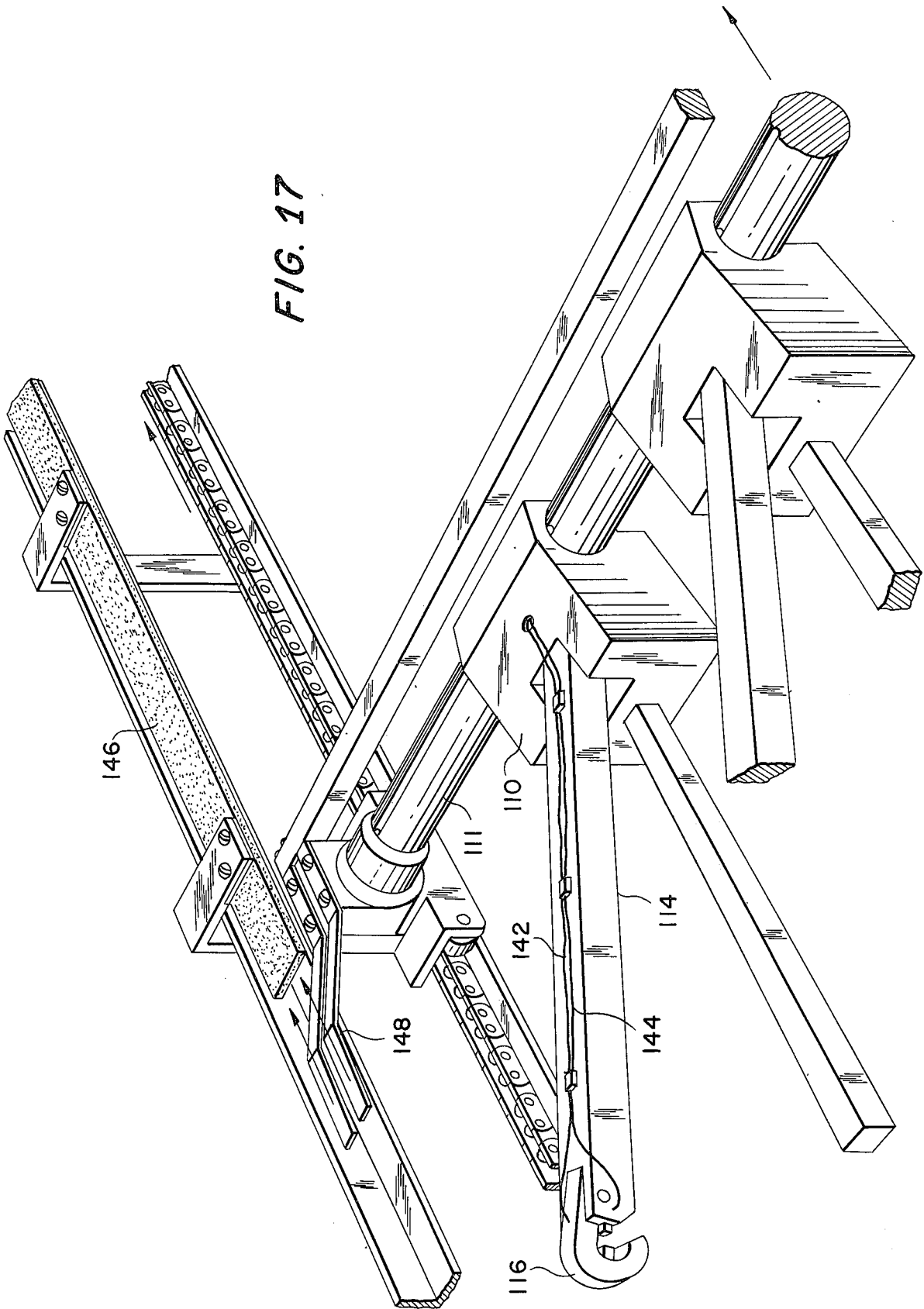


FIG. 17



## HIGH SPEED IN-LINE PAPER INSERTING APPARATUS AND METHOD

### BACKGROUND OF THE INVENTION

There has been a continuing and successful effort in the newspaper industry to increase press speeds of papers being printed and processed for distribution. Press speeds have increased substantially and there has resulted an increased need for method and apparatus which will commensurately permit increasing the speed of insertion of supplements and the like into newspapers.

The present invention provides method and apparatus which to a great degree solve this existing need for higher speed of insertion of supplements and the like into newspapers commensurate with the increased speed of the presses.

### BRIEF DESCRIPTION OF THE INVENTION

The present invention is directed to a high speed in-line inserting machine adapted for operation and press speeds of modern machines in the region of 40,000 - 80,000 papers per hour. In order to accomplish this, it has been found necessary that the apparatus and method handle the jackets and the inserts in a straight line motion without changing direction as is the case with most presently known and used machines. This straight line motion permits a higher speed of operation.

In accomplishing the desired operation, the newspaper is folded in a folder so that it has a  $\frac{1}{2}$  inch lap on the top half and it is then moved along a conveyor that has the lead edges of the newspaper spaced, for example, 20 inches apart. The jacket runs into a speed-up mechanism which increases its speed by a factor of greater than three. The newspaper is ejected from the speed-up mechanism and, with the aid of guides, is shot or impelled into a pocket which is rectilinearly moving. The paper is lifted and, by means of grippers, the lap of the top half of the newspaper is so gripped and manipulated as to open the jacket into a condition ready to receive the insert. The insert is then impelled or shot into the jacket at a speed of approximately 4 to 1 greater than the speed of the pockets. After the supplement insert, the grippers release the top half of the newspaper which then falls to a closed position and the newspaper with the insert is then stripped out of the pockets and the completed product is then moved to a conveyor system which re-shingles them for a later folded edge stacker acceptance.

The inserts are manipulated by means of a vacuum drum and belts to move them to an insert speed-up mechanism which accelerates the insert to the speed greater than the moving pockets.

The apparatus also includes speed and implement correlating means for varying operating conditions.

Additional objects, advantages and features of the invention will be more readily apparent from the following detailed description of an embodiment thereof when taken together with the accompanying drawings in which:

FIG. 1 is a schematic view of an overall system incorporating the present invention;

FIG. 2 is a perspective schematic view of the apparatus;

FIG. 3 is a fragmentary perspective view of an insert pick-up station;

FIG. 4 is a fragmentary side elevational view of a newspaper receiving pocket for a folded newspaper from the delivery mechanism subsequent to the press;

FIG. 5 is a view similar to FIG. 4 showing a subsequent step preliminarily to opening of the jacket;

FIG. 6 is a view similar to FIG. 5 of a subsequent step in the jacket opening sequence;

FIG. 7 is a view similar to FIG. 6 showing a subsequent step including gripping of an extended edge of the newspaper jacket;

FIG. 8 is a view similar to FIG. 7 showing the next sequential step in which the jacket is partially opened;

FIG. 9 is a view similar to FIG. 8 disclosing the jacket in fully opened position for reception of an insert therein;

FIG. 10 is a side elevational view disclosing the jacket in opened position and the step of inserting a supplement thereinto;

FIG. 11 is a view similar to FIG. 10 showing a subsequent step of release of the jacket following the insertion step for closing of the jacket;

FIG. 12 is a fragmentary side elevational view of a newspaper including jacket and insert pick-up and delivery mechanism;

FIG. 13 is a fragmentary perspective view disclosing details of pick-up mechanism for opening the jacket and control mechanism therefor;

FIG. 14 is a fragmentary cross sectional view through one side of the apparatus disclosing control mechanism for the jacket opening mechanism;

FIG. 15 is a fragmentary elevational view of jacket edge gripping mechanism;

FIG. 16 is a fragmentary side elevational view of the jacket edge gripper mechanism of FIG. 15 and operating mechanism therefor; and

FIG. 17 is a fragmentary perspective view of the mechanism of FIG. 16 in association with the overall apparatus.

Referring now in greater detail to the drawings, there is shown in FIG. 1 a schematic of the overall apparatus wherein a newspaper, hereinafter referred to as a jacket, shown at 20 has been folded in folder 22 so that it has a  $\frac{1}{2}$  inch lap on the top half and is moved along a conveyor 24 with the lead edges of the jackets or newspapers spaced approximately 20 inches apart. The jacket runs into a speed-up mechanism 26 which increases its speed by a little more than a factor of three. The jacket is ejected from the speed-up mechanism, and with the aid of guides 28, shot into a pocket generally designated 30, a plurality of which are spaced along a chain drive system generally designated 32 which includes spaced chains, hereinafter described, entrained over main drive sprockets 34 driven as indicated by arrows 36 in such a manner that the pockets 30 are moved to the right on the upper run and after passing around the right hand sprocket 34 in the lower return run move from right to left.

The overall function will be described with reference to a plurality of stations A-J of the pockets 30. The jacket is shot or impelled into pocket 30 at station A. A cam 38 causes a paper lift arm 40 to raise the jacket partially as indicated by arrow 42 at station B and by station C the paper lift arm is held against the upper half of the pocket with the top and bottom half of the newspaper jacket positioned thereinbetween. These steps therefore ensure that the folded edge remains forwardly and downwardly as the folded jacket is rectilinearly conveyed while being pivoted forwardly be-

tween stations A - C. At station D, grippers generally designated 44 are activated and grip on the 5/8 inch lap on the top half of the newspaper jacket. At stations E and F the paper lift arm 40 gradually lowers the bottom half of the jacket by simply backwardly pivoting only the bottom of the folded jacket there is defined a rearwardly and upwardly opening pocket which is rectilinearly conveyed past stations E and F with only the grippers 44 on the distal end of the fixed upper arm needed to maintain the pocket open. The jacket or newspaper is now ready for the insert. At station G the insert in the nature of a supplement 48 is shot or impelled into the jacket from insert delivery mechanism 50 as indicated by arrow 52 at a speed approximately 4 to 1 greater than the speed of the pockets. When the pocket reaches station H the grippers 44 release the top half of the jackets indicated at 54 and which at station I is contacted over and encompassing the insert. At station I the newspaper with the insert is stripped out of the pockets by a stripper mechanism generally designated 56. The completed product is then moved to a conveyor system 58 which serves to re-shingle the completed product as shown at 60 and thence are delivered as indicated by arrow 62 for further disposition such as folded edge stacker acceptance.

During this sequence of operations, an insert lift platform generally designated 62 is moved upwardly as indicated by arrows 64 carrying the stack of inserts 66 to a vacuum drum pick-up 68. The folded edges of the inserts are positioned at the right side of the stack at 70. The vacuum drum 68, as will appear hereinafter, has ports which open and close by controlled methods. The drum sucks an insert up and forces the folded edge first into primary nipping rollers 72 and the insert is then moved along by belts 74, 76 to an insert speed-up mechanism 78 which serves to accelerate the insert to a speed four times greater than the speed of the moving pockets. The speed-up mechanism at ejection end 80 shoots or impels the inserts from the inserter 50 as shown by arrow 52 at station G.

Basically, the inserter is designed for in-line operation with a press necessitating probable speeds of some 70,000 papers per hour (pph). In an operating embodiment the apparatus, as an example only, is designed for speeds of 40,000 pph. At 40,000 pph, the pockets are moving at a speed of 630 ft/min. or about 14 mph. Consequently, the insert belts will be moving at a speed of roughly 60 mph. At press speeds of 70,000 pph, the pockets will be in a speed range in excess of 25 mph while the inserts will be exceeding 100 mph. These speeds are greater than anything heretofore possible in the industry. The vacuum drum picks up one paper each revolution when the press is running collect and two papers each revolution when the press is running straight. At a speed of 40,000 pph, the vertical lift rate of the inserts is 26 in/min. and at 70,000 pph, the vertical lift rate would be 48 in/min. These factors are for purposes of example only and the ultimate speeds and rates will be determined for the overall machine.

The overall machine is shown in perspective in FIG. 2. As shown, the conveyor 24 includes a plurality of belts 82 for conveying the folded newspaper 20 to the speed-up mechanism 26 including a plurality of belts 84 entrained around pulleys 86 and driven from chain 88 operatively driven from sprockets 34 around which additionally chains 90 are engaged for proper speed relationship drive of the various components.

The insert lift mechanism 62 is shown in greater detail in FIGS. 2 and 3. The lift platform 62 is mounted for operation through drive chains 92 which are engaged operatively with pulleys 94 around which are entrained belts 74 and the mechanism is interconnected for drive purposes with the remainder of the mechanism by chains as at 96. The vacuum drum 68 is operatively driven through belt 98 and drive mechanism 100. The interior of the drum 68 is hollow and a vacuum pulled thereon through vacuum line 102 with vacuum being indicated and controllable through related gage 104. The drum 68 is provided with a plurality of spaced pick-up nipples 106 which are engageable with the upper surface of the uppermost insert in the insert stack 64. As an insert is engaged by nipples 106, an insert is lifted from the top of the stack and fed into insert speed-up mechanism 78 by belts 74, 76. The speed relationship of these various items are intercorrelated one with another for proper functioning.

The pockets 30 and related mechanism for opening of the jacket to permit the inserts to be placed therein will be more apparent from a study of FIGS. 4-12 inclusive which correspond respectively with stations A to I of FIG. 1. The pockets as previously mentioned are connected to chains 90 entrained around sprockets 34 and move with the chains in the direction shown in 36. Each of the pockets includes a base arm 108 which has a fixed relationship on mounting bracket 110 attached to shafts 111. The newspaper lift arm 40 is pivotally mounted to bracket 110 and has operatively attached thereto a cam follower arm 112 which operatively engages with the upper surface of cam 38 which, as seen in FIG. 5 has a beveled leading edge so that as the pockets translate along the apparatus, the arm 112 rides onto the cam which extends downwardly to station E along the run of the machine. Therefore, as the pockets 30 move, the arms 40 are raised by coaction of arm 112 and cam 38 as indicated by arrow 42 at station B, carrying the newspaper jacket 20 therewith to an operative engaging position at station D with an upper arm 114 which also has a fixed angular position by means of the bracket mounting at 110. When arriving at station D, the grippers 44 are actuated. These grippers include gripper hooks 116 pivotally mounted at 118 on arms 114 and are actuatable through pivot arm 119 attached to the hook and which in turn is pivotally moved through arm 120 as hereinafter described. At station D, the gripper hook 116 engages with and about the extended edge of the folded newspaper as hereinbefore described and secures this portion of the folded newspaper with respect to arm 114. This relationship is shown in FIG. 7 which corresponds with station D. Subsequent to station D, the cam 38 bevels off and permits arm 40 to descend as shown by arrow 122 in FIG. 8 to its original position as shown in FIG. 9 with the lower half of the folded newspaper resting thereon as shown at 20A in FIG. 9 and the gripped upper half of the newspaper shown at 20B so that the newspaper is in a fully opened position adapted to receive the insert 48 from insert mechanism 50 as shown in FIG. 10 corresponding to station G.

Subsequently, in the line of travel the gripper hook is released as shown in FIG. 11 corresponding with station H, permitting the upper half of the newspaper 20B to fall downwardly and, as shown in FIG. 12, the then assembled newspaper and insert combination 20C is ready for removal from the apparatus for further pro-

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cessing. This condition in FIG. 12 corresponds with station I of FIG. 1.

At this point, the stripper mechanism 56 engages under the composite newspaper and insert 20C which is conveyed upwardly by conveyor system 58 of the takeoff mechanism, which includes nipping rollers 124 and belt 126, and carried to the re-shingler at 60 for subsequent disposition as shown by arrow 62 in FIG. 1.

As shown in FIGS. 13 and 14, the mounting and drive mechanism for the pockets 30 include upper and lower guides or guide channels 128 and 130 which are operatively engaged by rollers 130 which serve as a track for chains 90 and support brackets 110 mounting pockets 30. The path of travel of the chains and pockets is shown in FIG. 2. It will be seen that subsequent to station I, the pockets are carried around the aft sprocket 34 from the upper chain run to the lower chain run as shown at station J. The cam and cam follower mechanism are shown in FIGS. 13 and 14. The cam follower arm includes roller 134 which engages with the upper surface of cam 38. A cam follower mechanism generally designated 136 serves to maintain the mechanism in appropriate relationship and the arm detail and cam follower to maintain in place are shown in FIG. 13 whereas in the cross sectional view of FIG. 14 showing one side, the cam follower of FIG. 13 and the top arm are ready to come down to the lower run to return to the initial position at station A in the path of travel.

One form of operating mechanism for the gripper hooks is shown in FIGS. 15-17. The gripper hook 116 and fixed arm 114 respectively mount magnetic heads 138 and 140, which are wired as shown at 142 and 144 respectively to a conductor strip 146 appropriately electrically connected and spring finger arms 148, adapted for engagement in sliding contact with conductor strip 146. Conductor strip 146 is mounted beneath the track and extends from station D through station G, thereafter terminating prior to station H. The finger arms 148 during their period of contact with conductor strip 146 actuate the gripper hooks 116 to a closed position and thereafter the hooks are released as shown at station H to release the top portion of the paper. While magnetically actuated means have here been shown for operating the gripper hooks, manifestly other type of actuating mechanism can be used such as shown, for example, in FIGS. 4-12.

In FIGS. 4-12 the actuating mechanism for the gripper hooks includes an electrically operated rotary solenoid 117 mounted at the base of arm 114. Upon actuation, solenoid 117 moves arm 120, and through pivot arm 119, pivots gripper hook 116 to open and closed positions.

It is to be noted that a plurality of arms are laterally spaced across the run of the chains with a plurality of gripping hooks as shown in FIG. 2. This insures adequate gripping of the edge of the newspaper for opening to implement insertion of the insert or supplement in the so opened jacket. At the takeoff position, a plurality of pulleys 150 are interleaved between the arms and mount a plurality of belts 152 for removal of the composite newspaper and insert as previously described.

The construction and operation of the apparatus will be apparent from the foregoing detailed description. Manifestly, however, changes in details of construction can be effected without departing from the spirit and

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scope of the invention as defined in and limited solely by the appended claims.

We claim:

1. A method of high speed in-line inserting of a supplement insert into a newspaper comprising the steps of:
  - A. folding a newspaper to provide an extending lap on the top half of said folded newspaper with respect to the bottom half, conveying said folded newspaper as a folded jacket with the folded edge forwardly disposed to a speed up station, and
  - B. accelerating said folded jacket forwardly and downwardly for a rectilinear series of steps wherein said folded edge is rectilinearly conveyed forwardly and downwardly with respect to said extended lap, said rectilinear conveying steps further comprising in sequence:
    - i. forwardly pivoting said folded jacket relative to said folded edge while rectilinearly conveying and,
    - ii. maintaining the top half of said jacket in said pivoted position, while rectilinearly conveying and,
    - iii. backwardly pivoting only said bottom half of said jacket to thereby define a rearwardly and upwardly opening pocket which is rectilinearly conveyed, and
  - C. impelling an insert forwardly and downwardly into said rearwardly opening pocket, said insert impelling speed being substantially greater than the rectilinearly conveying speed of said jacket to thereby seat said insert into said pocket, and;
  - D. backwardly pivoting said top half of said jacket onto said bottom half and rectilinearly conveying a folded composite of said jacket and said supplement insert.
2. A method as claimed in claim 1, wherein subsequent to impelling said insert into said pocket, the gripped lap is released thereby permitting gravitational lowering of the top half of said newspaper onto said insert to form said composite jacket and supplement insert.
3. A method as claimed in claim 1, wherein said step of impelling said insert downwardly and forwardly is at a speed of approximately four times greater than the rectilinear speed of said jacket to facilitate the insert seating.
4. A method as claimed in claim 1, wherein said impelling step further comprises the steps of positioning said inserts as a stack, the stack being raised incrementally and sequentially in time with movement of the conveyed folded jacket, the insert being folded with the folded edge forwardly disposed, lifting an insert from the top of the stack by vacuum and feeding to an inserter which serves to impel the insert into said pocket.
5. Apparatus for high speed in-line inserting of a supplement insert into a newspaper comprising, in sequence:
  - A. A newspaper folding mechanism including means to provide a folded newspaper having an extending lap on the top half with respect to the bottom half and to convey said folded newspaper as a folded jacket with the folded edge forwardly disposed to a speed-up mechanism,
  - B. Said speed-up mechanism including means to accelerate said conveyed jacket forwardly and downwardly onto a rectilinearly moving conveyor,



C. Said rectilinearly moving conveyor comprising an endless conveyor, a plurality of folded newspaper jacket receiving means operatively connected to said conveyor in linearly spaced successive positions thereon, wherein each of said jacket receiving means comprises:

- i. an angularly movable lower arm adapted to support and rectilinearly carry said jacket with its folded edge maintained forwardly and downwardly with respect to said extending lap, and
- ii. a fixed upper arm angularly disposed from said movable arm, said fixed upper arm together with said movable lower arm positioned to define a rearwardly and upwardly openable pocket which is rectilinearly conveyed upon said conveyor, and
- iii. newspaper top half edge gripping means mounted upon the distal end of said fixed upper arm to selectively maintain only said top half of the newspaper jacket against said fixed upper arm, and
- iv. means disposed along the rectilinear path of travel of said each newspaper jacket receiving means to coact with said movable lower arm to selectively pivot the newspaper jacket thereon supported forwardly into contact with said fixed upper arm whereby said gripping means are operable to selectively grip said extending lap while allowing said bottom half to be selectively rearwardly pivoted by said lower movable arm, thereby defining a rearwardly and upwardly opening pocket in said jacket which is rectilinearly conveyed, and;

C. Means for impelling an insert downwardly and forwardly into said jacket pocket as it is rectilinearly conveyed therepast, wherein said insert is impelled downwardly and forwardly at a speed substantially greater than the rectilinear speed of said conveyor, and;

D. Means for releasing said gripping means from said lap thereby closing said jacket with the insert therein as a folded composite.

6. Apparatus as claimed in claim 5, wherein the gripping means comprise pivotally mounted gripping hooks on the ends of said upper fixed arms of said pockets, and means for rotating said hooks in timed sequence with movement of said pockets on said conveyor when said lower arms have contacted said newspaper with said upper arms to thereby grip the overlapped edge of

said newspaper and subsequently, after insertion of said supplement insert, to release said hooks to permit the upper half of the newspaper to gravitationally lower onto the lower newspaper half and insert to form said composite.

7. Apparatus as claimed in claim 5, including an insert lift platform adapted to support a stack of inserts, means for upwardly moving said lift platform incrementally and sequentially in timed relationship to movement of said conveyor and said pockets thereon, a vacuum drum pick-up positioned above said stack of inserts on said lift platform, ports in said vacuum drum, means for controlling opening and closing of said ports for suctionally picking up an insert from the top of said stack and feeding the inserts folded edge first from the stack, to said insert speed-up mechanism for receiving the presented inserts and accelerating speed of the inserts for subsequent ejection therefrom and insertion into said rearwardly open pockets in said newspapers.

8. Apparatus as claimed in claim 7, said conveyor mounting said pockets including endless chains operationally entrained over drive sprockets at the entrance and discharge ends of the conveyor, laterally extending shafts operatively connected between spaced said chains, brackets mounting said arms comprising said pockets with a plurality of sets of said arms being laterally spacedly mounted on said shafts to form laterally extending pockets, said arms being movable together with said chains on an upper run from the entrance end to the discharge end, around the rear sprocket and along the lower conveyor run, thence around the entrance end in a continuous cycle.

9. Apparatus as claimed in claim 8, including composite newspaper and insert stripping means at the rear end of said conveyor, said stripper means including a primary segmental pointed nose probe positioned in the line of travel of the newspaper composite spaced intermediately of said laterally spaced arms forming said pockets and engageable under the leading edge of newspaper composites being conveyed, and conveyor means including a plurality of belts entrained over pulleys and laterally spaced and positioned between said laterally spaced arms forming said pockets to receive newspaper composites stripped from said pockets for conveying and re-shingling the newspaper composites for presentation to a later folded edge stacker acceptance.

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