

Aug. 22, 1961

C. O. SIEBKE
GRIPPER MECHANISM

2,997,157

Filed Feb. 10, 1958

2 Sheets-Sheet 1

Fig. 1.

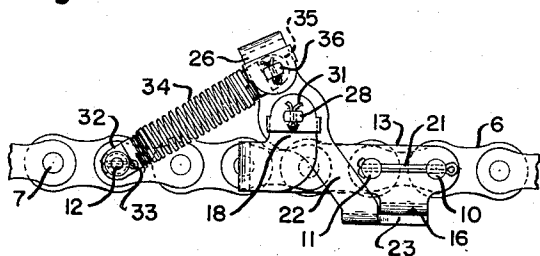


Fig. 3.

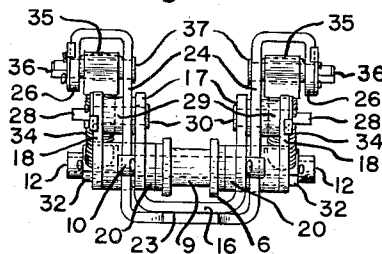


Fig. 2.

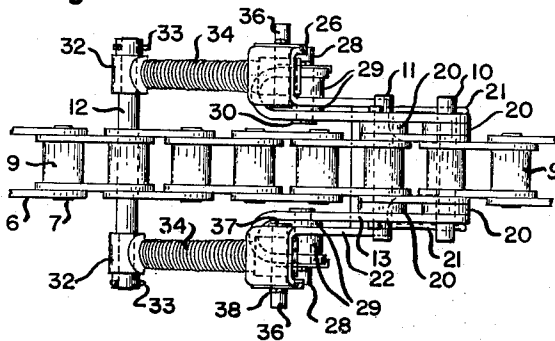


Fig. 4.

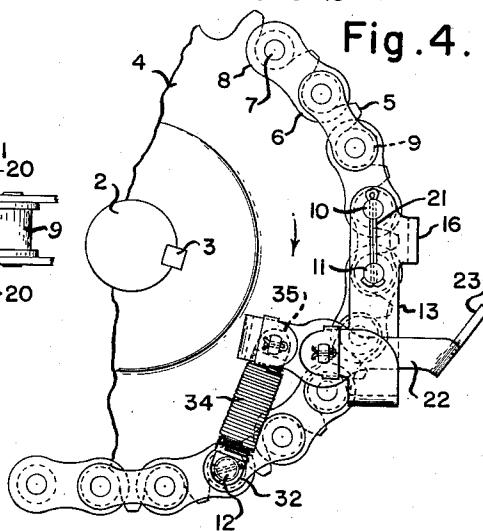


Fig. 5.

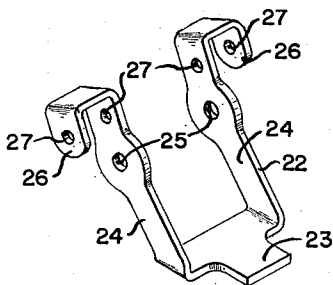


Fig. 6.

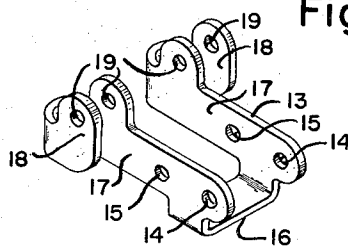
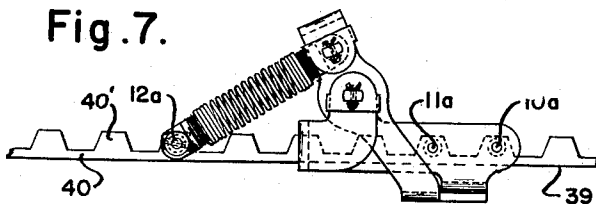


Fig. 7.



INVENTOR
Carl O. Siebke

By Hoppe Leonard & Duff
his attorneys

C. O. SIEBKE
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Fig. 8

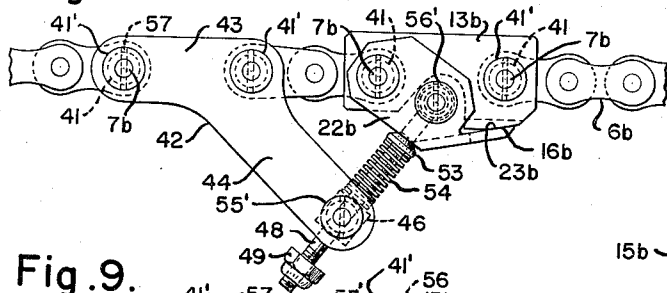


Fig .9.

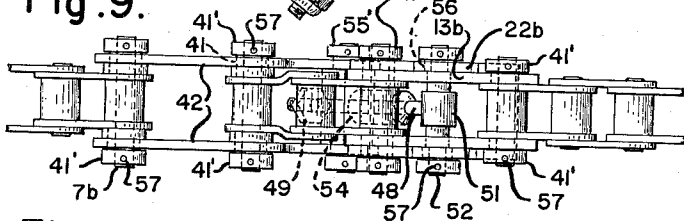


Fig.10.

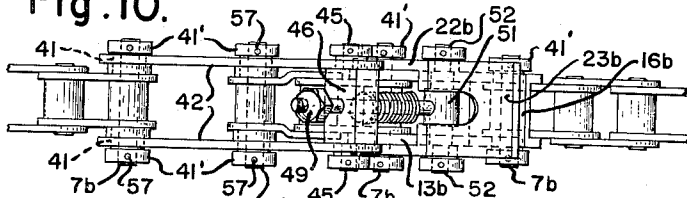


Fig.11.

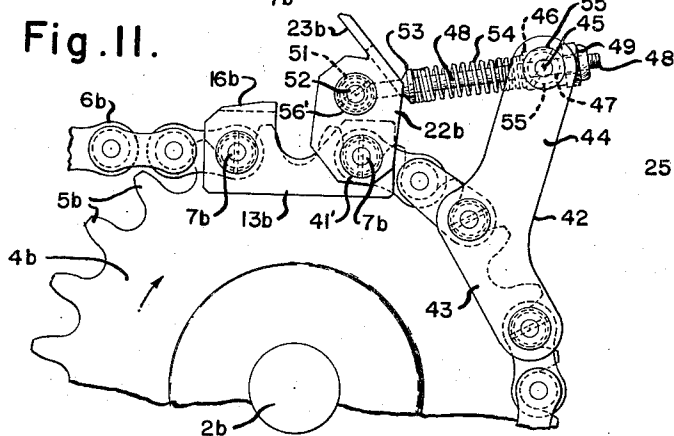


Fig. 12.

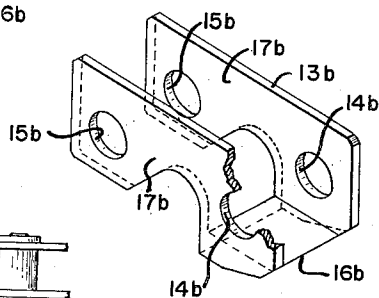


Fig.13.

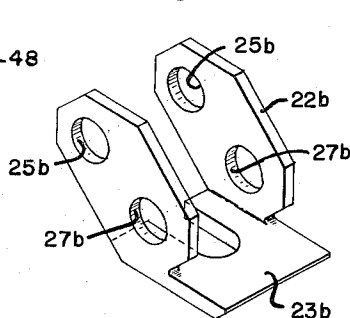
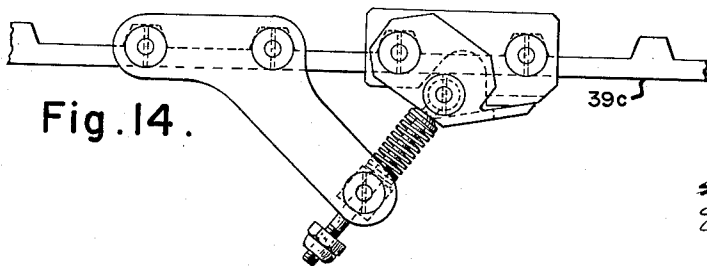


Fig.14.



INVENTOR

Carl O. Siebke

By Hoopes, Leonard & Buell
his attorneys

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2,997,157 GRIPPER MECHANISM

Carl O. Siebke, Allison Park, Pa., assignor to Miller Printing Machinery Co., Pittsburgh, Pa., a corporation of Pennsylvania

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8 Claims. (Cl. 198—180)

This invention relates to gripper mechanism and particularly to gripper mechanism which is cyclically operable to grip and release articles. The gripper mechanism will be described by way of example as gripper mechanism for gripping and moving sheets, for example, in connection with a printing press or the like.

While my invention may be otherwise variously embodied it has especial utility in connection with the gripping and advancing of sheets one after the other as is done in the printing art in sheet feeding and delivery mechanisms used on connection with presses. The mechanisms shown in the drawings are for gripping and advancing sheets of paper in a sheet delivery mechanism but they may be adapted for gripping and advancing sheets of metal or other material or even articles of other forms in a wide variety of mechanisms.

My gripper mechanism operates upon a different principle than gripper mechanisms heretofore developed. Guiding means are provided defining a path having a relatively curved portion and a relatively straight portion. The guiding means may assume various forms, for example, a pair of sprockets one or both of which may be driven. The sprockets define a path of elongated shape with rounded ends having relatively curved portions at its ends and relatively straight portions intermediate its ends. Carrier means are provided which are movable along the defined path. When the path is defined by two sprockets or the like it is an endless path and the carrier means in such case will normally also be endless. In the forms shown in the drawings the carrier means is shown as either a sprocket chain or a flexible cogged belt, both the sprocket chain and the flexible cogged belt being trained about spaced apart sprockets and driven thereby in predetermined timed relationship thereto.

Opposed gripper elements are carried by the carrier means and means are connected with the gripper elements maintaining the gripper elements in cooperative gripping relationship when they are moving along one part of the path and maintaining the gripper elements out of cooperative gripping relationship when they are moving along another part of the path. Thus the opening and closing of the gripper elements is determined by their position along the path, although the precise points along the path at which the gripper elements open and close may be adjusted by means presently to be described; and no separate detent or similar mechanism is required for opening and closing the gripper elements. I desirably provide means for altering the connection of the last mentioned means with the gripper elements whereby to change the part of the path along which the gripper elements are moving while they are in cooperative gripping relationship. The gripper mechanism is relatively simple and foolproof and economical to manufacture. It is less likely to become out of order than conventional gripper mechanisms and requires a minimum of maintenance.

The gripper mechanism may be designed so that the opposed gripper elements are either in or out of cooperative gripping relationship at part of the path largely including the relatively curved portion thereof and are either out of or in cooperative gripping relationship at another part of the path largely including the relatively straight portion thereof. However, since it is normally desired to move articles in a relatively straight path,

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particularly in connection with the handling of sheets to and from printing presses and the like, I prefer to employ in my gripper mechanism means connected with the gripper elements maintaining the gripper elements out of cooperative gripping relationship when they are moving along part of the path largely including the relatively curved portion thereof and maintaining the gripper elements in cooperative gripping relationship when they are moving along another part of the path largely including the relatively straight portion thereof.

I prefer to mount a first gripper element in predetermined position on the carrier means and to mount a second gripper element on the carrier means for movement into and out of cooperative gripping relationship with the first gripper element, and I provide means connecting the gripper elements maintaining the second gripper element in cooperative gripping relationship with the first gripper element when the gripper elements are moving along one part of the path and maintaining the second gripper element out of cooperative gripping relationship with the first gripper element when the gripper elements are moving along another part of the path. Preferably the gripper elements are urged toward cooperative gripping relationship by resilient means. In the structures shown in the drawings resilient means are provided which normally urge the gripper elements toward cooperative gripping relationship when the gripper elements are moving along part of the path largely including the relatively straight portion thereof and means are provided which render inoperative the resilient means and maintain the gripper elements out of cooperative gripping relationship when they are moving along another part of the path largely including the relatively curved portion thereof. The resilient means may act either in tension or in compression. In the structures shown in the drawings compression coil spring means are used in certain cases to urge the gripper elements toward cooperative gripping relationship and tension coil spring means are used for the same purpose in other cases. When, for example, resilient means are utilized which normally urge the gripper elements toward cooperative gripping relationship when the gripper elements are moving along part of the path largely including the relatively straight portion thereof together with means rendering inoperative the resilient means and maintaining the gripper elements out of cooperative gripping relationship when they are moving along another part of the path largely including the relatively curved portion thereof. I desirably provide means for altering the effect of the resilient means on the gripper elements when the resilient means are operative to predeterminedly alter the part of the path along which the gripper elements are moving while they are in cooperative gripping relationship.

The second gripper element may be pivotally connected with the carrier means, and preferably with the first gripper element, for pivotal movement into and out of cooperative gripping relationship with the first gripper element, resilient means may be provided which normally urge the second gripper element in its pivotal movement toward cooperative gripping relationship with the first gripper element when the gripper elements are moving along part of the path largely including the relatively straight portion thereof and means may be provided rendering inoperative the resilient means and maintaining the second gripper element out of cooperative gripping relationship with the first gripper element when the gripper elements are moving along another part of the path largely including the relatively curved portion thereof.

The carrier means are preferably elongated flexible carrier means movable along the predetermined path and the first gripper element is preferably mounted in predetermined position on the carrier means, the second gripper

per element being preferably pivotally connected with the first gripper element for pivotal movement into and out of cooperative gripping relationship with the first gripper element, and means are preferably provided which are connected with the carrier means at a point removed from the first gripper element and also connected with the second gripper element and including resilient means operable when the carrier means is substantially straight for urging the second gripper element in its pivotal movement toward cooperative gripping relationship with the first gripper element, such means being constructed and arranged to maintain the second gripper element out of cooperative gripping relationship with the first gripper element when the carrier means is disposed in a curve at at least part of the relatively curved portion of the path.

In a preferred form my gripper mechanism comprises guiding means defining a path having a relatively curved portion and a relatively straight portion, elongated flexible carrier means movable along the path, a first gripper element mounted in predetermined position on the carrier means, a second gripper element pivotally connected with the first gripper element for pivotal movement into and out of cooperative gripping relationship with the first gripper element and means having a first portion connected with the carrier means at a point removed from the first gripper element, a second portion pivotally connected with the second gripper element and resilient means interposed between said first and second portions whereby when the carrier means is substantially straight the second gripper element is urged in its pivotal movement toward cooperative gripping relationship with the first gripper element and when the carrier means is disposed in a curve at at least part of the relatively curved portion of the path the second gripper element is maintained out of cooperative gripping relationship with the first gripper element.

Other details, objects and advantages of the invention will become apparent as the following description of certain present preferred embodiments thereof proceeds.

In the accompanying drawings I have shown certain present preferred embodiments of the invention in which

FIGURE 1 is a side elevational view of gripper mechanism embodying my invention, the gripper elements being shown as being mounted on a sprocket chain and in cooperative gripping relationship with tension coil spring means urging the gripper elements toward cooperative gripping relationship;

FIGURE 2 is a plan view of the mechanism shown in FIGURE 1 viewed from above;

FIGURE 3 is an end view of the mechanism shown in FIGURE 1 viewed from the right;

FIGURE 4 is a side elevational view of the mechanism shown in FIGURES 1, 2 and 3 passing around a sprocket, the gripper elements being shown out of cooperative gripping relationship;

FIGURE 5 is an isometric view of one of the gripper elements of the gripper mechanism shown in FIGURES 1-4;

FIGURE 6 is an isometric view of the other gripper element of the gripper mechanism shown in FIGURES 1-4;

FIGURE 7 is a view similar to FIGURE 1 but showing the gripper mechanism mounted on a flexible cogged belt instead of on a sprocket chain;

FIGURE 8 is a view similar to FIGURE 1 but of a mechanism embodying compression coil spring means urging the gripper elements toward cooperative gripping relationship;

FIGURE 9 is a top plan view of the mechanism shown in FIGURE 8;

FIGURE 10 is a bottom plan view of the mechanism shown in FIGURE 8;

FIGURE 11 is a view similar to FIGURE 4 but of the gripper mechanism of FIGURES 8-10;

FIGURE 12 is an isometric view with a portion broken.

away of one of the gripper elements of the gripper mechanism shown in FIGURES 8-11;

FIGURE 13 is an isometric view of the other gripper elements of the gripper mechanism shown in FIGURES 8-11; and

FIGURE 14 is a view similar to FIGURE 8 but showing the gripper mechanism mounted on a flexible cogged belt instead of on a sprocket chain.

Referring now more particularly to the drawings and first to FIGURES 1-6, the gripper mechanism shown in those figures comprises guiding means defining a path having a relatively curved portion and a relatively straight portion, the guiding means consisting of two parallel shafts carrying coplanar sprockets or cog wheels. The shafts are spaced apart a distance such as to cause the gripper mechanism to advance sheets substantially in a straight line from a predetermined pick-up station to a predetermined delivery station. Only one of the shafts and sprockets is shown, the other being identical therewith. The shaft which is shown appears in FIGURE 4 and is designated 2. Keyed to the shaft 2 by a key 3 is a sprocket 4 having teeth 5. One of the two coplanar sprockets is driven. The sprocket 4 turns in the clockwise direction viewing FIGURE 4. While either of the two shafts may be driven, normally the other shaft (the one not shown in the drawings) will be driven to insure maintaining the operative lower reach of the chain taut; or both shafts may be driven.

Trained about the sprockets is a sprocket chain designated generally by reference numeral 6. The chain apart from the portion thereof to which the gripper mechanism is connected consists of pintles 7 pivotally connecting links 8 as is conventional in sprocket chains. Rollers 9 are disposed about the pintles to fit between the teeth of the sprockets and to minimize friction. The ends of the pintles 7 may be slightly enlarged by upsetting to maintain them in place.

At three points in the sprocket chain 6 the normal pintles 7 are replaced with special pins. The special pins are of greater length than the pintles 7 and serve not only as pintles of the sprocket chain but also as mounting means for the gripper mechanism. The three pins are designated respectively 10, 11 and 12. The pins 10 and 11 are for the purpose of mounting on the sprocket chain 6 the gripper element designated generally by reference numeral 13 and shown in FIGURE 6 and which may be designated the first gripper element. The pin 10 passes through holes 14 in the gripper element 13 and pin 11 passes through holes 15 in the gripper element 13. The gripper element 13 comprises a pad portion 16 which is the active gripping portion of the gripper element 13.

As clearly shown in FIGURE 6, the gripper element 13 has opposed generally parallel arms 17 each having a versely turned extremity 18 forming a yoke having a hole 19 in each of the opposed portions thereof. Washers 20 are interposed between the chain and the arms 17 of the gripper element 13 and cotter pins 21 extend through the pins 10 and 11 outside the arms 17 of the gripper element 13 to maintain the assembly. Roll pins may be substituted for cotter pins.

The second gripper element is shown in FIGURE 5 and is designated generally by reference numeral 22. It comprises a pad portion 23 which is the active gripping portion of the gripper element 22 and opposed generally parallel arms 24 connected with the pad portion 23 each having a hole 25 therein and each having a reversely turned extremity 26 forming a yoke having a hole 27 in each of the opposed portions thereof. The gripper element 22 is pivotally connected to the gripper element 13 by pins 28 which pass through the holes 19 of the gripper element 13 and the holes 25 of the gripper element 22. Washers 29 are interposed between the respective portions of the gripper elements 13 and 22. The pins

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28 are headed at one end at 30 and cotter or roll pins 31 pass through the opposite ends of the pins to maintain the assembly

The pin 12 is considerably longer than the pins 10 and 11. It carries near its outer ends sleeves 32, and cotter or roll pins 33 pass through the extremities of the pin 12 outside the sleeves 32 to maintain the assembly. Threaded onto each of the sleeves 32 is a coil spring 34 adapted to act in tension as will presently be described. The opposite end of each of springs 34 is threaded onto a sleeve 35 disposed between one of the yokes of the gripper element 22 and fastened thereto by a pin 36 passing through the sleeve and through the two holes 27 of the yoke. Each pin 36 is headed at one end at 37 and a cotter pin or other suitable pin 38 passes through the opposite end of the pin to maintain the assembly.

The parts are proportioned so that when the portion of the chain 6 to which the gripper mechanism is connected is at a relatively straight portion of its path the pintles 7 and pins 10, 11 and 12 are aligned in a straight line as shown in FIGURE 1. This places the springs 34 under tension and those springs cause the gripper pad 23 of the gripper element 22 to be resiliently tightly pressed against the gripper pad 16 of the gripper element 13 whereby the gripper elements are maintained in cooperative gripping relationship to grip a sheet appropriately presented thereto. When, however, the portion of the chain 6 to which the gripper mechanism is connected is at a relatively curved portion of its path the pintles 7 and pins 10, 11 and 12 are disposed in a curved line as shown in FIGURE 4. This relieves the springs 34 of tension, permitting the gripper pad 23 to move to inoperative position out of cooperative gripping relationship with the gripper pad 16. Movement of the gripper 22 out of cooperative relationship with the gripper 13 may be assisted by the springs 34 being substantially completely collapsed with their coils in contact with each other and acting in compression as shown in FIGURE 4 to positively open the grippers.

The point in the path at which the grippers close may be adjusted by threading the springs 34 onto the sleeves 32 and 35 to different extents or by substituting springs of different lengths. Such adjustment also, of course, changes the point at which the grippers open. The critical point in the cycle is the point at which the grippers close to take the sheets being delivered by an impression cylinder or other means in a press or the like. The point at which the grippers open to release the sheet is less critical and may be varied to conform to the desired point of closing of the grippers without adversely affecting the operation of the mechanism. The grippers may be caused to close somewhat before the gripper pads 16 and 23 reach the straight portion of the path; in other words, the sheets may be taken by the grippers while the gripper pads are still moving along the last part of the curved portion of the path preceding the straight portion of the path along which the sheets are to be moved. FIGURE 7 is simply to illustrate gripper mechanism which to all intents and purposes is the same as that of FIGURES 1-6 but mounted on a flexible cogged belt 39 instead of the sprocket chain 6. Flexible cogged belts like the belt 39 shown in FIGURE 7 are well known to those skilled in the art. They take the place of sprocket chains, having a body portion 40 from which extend projections or cogs 40 which fit between the teeth of the sprocket much as do the rollers 9 of the sprocket chain 6. The belt 39 is made of resilient material such as plastic or rubber-like material and is preferably endless like the chain. It functions in all respects equivalently to the chain. Since the gripper mechanism of FIGURE 7 is virtually identical with that of FIGURES 1-6 it will not be redescribed. It is connected with the flexible cogged belt 39 by pins 10a, 11a and 12a which function analogously to the pins

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10, 11 and 12 of the form of structure shown in FIGURES 1-6, and the operation of the gripper mechanism of FIGURE 7 is the same as that of the gripper mechanism of FIGURES 1-6.

FIGURES 8-14 show gripper mechanisms which are virtually the equivalent in function of the gripper mechanisms of FIGURES 1-7 but rely upon spring compression rather than spring tension to maintain the gripper elements in cooperative gripping relationship. FIGURE 11 shows a shaft 2b analogous to the shaft 2 having keyed thereto a sprocket 4b about which extends a sprocket chain 6b analogous to the sprocket chain 6. However, the sprocket chain 6b has special links one of which includes one of the gripper elements and the other of which includes operating mechanism for operating the other gripper element. One of the special links is shown in FIGURE 12 and is designated 13b, constituting the first gripper element and having a gripper pad 16b. It has opposed arms 17b connected to the opposite ends of the gripper pad 16b with holes 14b and 15b in the respective arms. The special link 13b is made a part of the sprocket chain 6b by passing pintless 7b of the chain therethrough. The holes 14b and 15b are larger than the holes 14 and 15 of the gripper mechanism of FIGURES 1-6 because in the gripper mechanism of FIGURES 8-14 flanged bushings 41 each having a flange 41' are provided about the pintless 7b and are disposed within the holes 14b and 15b. However, in general the parts are assembled analogously to the manner in which they are assembled in the gripper mechanisms of FIGURES 1-7 so we shall not describe in detail all of the minutia of the gripper mechanisms of FIGURES 8-14.

Pivoted to the special link or first gripper element 13b by one of the pintless 7b is a lever 22b shown in FIGURE 13 constituting the second gripper element and having a gripper pad 23b. The pintless passes through holes 25b in the lever 22b. The lever or second gripper element 22b is adapted to pivot about the axis of the pintless 7b which passes through the holes 25b between operative position with the gripper elements 13b and 22b in cooperative gripping relationship as shown in FIGURE 8 and inoperative position with the gripper elements 13b and 22b out of cooperative gripping relationship as shown in FIGURE 11.

The second special link is designated by reference numeral 42, and actually comprises two identical separate opposed link members each having a body portion 43 connected into the chain 6b and a projecting portion 44 projecting away from the chain in the same direction in which the gripper pad 23b extends when the second gripper element 22b is in inoperative position as shown in FIGURE 11. A pin 45 passes through a flanged bushing 44 having a flange 55' in the outer end of each of the projecting portions 44 and at its central portion is formed to enlarged substantially square cross section at 46 serving to space apart the portions 44. The spacing portion 46 has a bore 47 therethrough and a pin 48 extends through that bore and has an elastic self-locking nut 49 applied to its extremity outside the spacer 46. The opposite end of the pin 48 is connected with an enlarged central portion 51 of a pin 52 extending through flanged bushings 56 each having a flange 56' disposed in holes 27b in the second gripper element 22b. The pin 48 has thereon an abutment portion 53, and a coil spring 54 adapted to act in compression is disposed between abutment portion 53 and the spacer 46. Each flanged bushing is held in place on the pin or pintless passing through it by a pin 57. When the pintless and pins of the chain 6b are disposed in a straight line as shown in FIGURE 8 the spring 54 is placed under compression and resiliently presses the gripper pad 23b against the gripper pad 16b, the nut 49 being spaced from the spacer 46 as shown in FIGURE 8. When the pintless and pins of the chain 6b

are arranged in a curve as shown in FIGURE 11 the nut 49 abuts the spacer 46 and the pin 48 positively opens the gripper mechanism, the spring 54 at that time being under compression between the abutment portion 53 and the spacer 46 but having no effect on the gripper mechanism.

The point in the path at which the grippers close may be adjusted by adjusting the position of the nut 49 on the threaded end portion of the pin 48. By proper adjustment of the nut 49 the grippers may be accurately adjusted to close at a desired point at or near the beginning of the straight portion of the path, which point may be either in the curve approaching the straight portion or in the straight portion itself. FIGURE 14 is analogous to FIGURE 7 in that it shows the gripper mechanism of FIGURES 8-13 applied to a resilient cogged belt 39c. What has been said above regarding the resilient cogged belt 39 of FIGURE 7 applies to the belt 39c of FIGURE 14. The gripper mechanism of FIGURE 14 is the same as that of FIGURES 8-13 and functions in the same manner.

All of the forms of gripper mechanism shown in the drawings operate through the effect of the curvature of the chain or resilient cogged belt as described above, no detent or similar mechanism being required to operate the gripper mechanism. While the gripper mechanisms shown are for the handling of sheets, as in a delivery mechanism used in connection with a printing press, such mechanisms may readily be modified to handle other articles while embodying my invention.

While I have shown and described certain present preferred embodiments of the invention it is to be distinctly understood that the invention is not limited thereto but may be otherwise variously embodied within the scope of the following claims.

I claim:

1. Gripper mechanism comprising guiding means defining a path having a relatively curved portion and a relatively straight portion, carrier means movable along the path, a first gripper element carried by the carrier means, a second gripper element pivoted to the carrier means and adapted for turning movement about its pivotal connection with the carrier means into and out of gripping relationship with the first gripper element and means for operating the second gripper element to turn the second gripper element about its pivotal connection with the carrier means, such operating means being connected with the second gripper element at a part of the second gripper element spaced from its pivotal connection with the carrier means and being connected with the carrier means at a part of the carrier means spaced from the pivotal connection of the second gripper element with the carrier means, said parts of the second gripper element and the carrier means being spaced apart a different distance when they are disposed at a relatively curved portion of said path than when they are disposed at a relatively straight portion of said path so that passing thereof from one to the other of said portions of said path turns the second gripper element from gripping relationship with respect to the first gripper element to non-gripping relationship with respect to the first gripper element.

2. Gripper mechanism as claimed in claim 1 having spring means pressing the gripper elements together when they are in gripping relationship.

3. Gripper mechanism as claimed in claim 1 having tension coil spring means pressing the gripper elements together when they are in gripping relationship.

4. Gripper mechanism as claimed in claim 1 having compression coil spring means pressing the gripper elements together when they are in gripping relationship.

5. Gripper mechanism as claimed in claim 1 in which the operating means comprise tension coil spring means

pressing the gripper elements together when they are in gripping relationship but acting in compression when the gripper elements are in non-gripping relationship.

6. Gripper mechanism comprising guiding means defining a path having a relatively curved portion and a relatively straight portion, carrier means movable along the path, a first gripper element carried by the carrier means, a second gripper element pivoted to the carrier means and adapted for turning movement about its pivotal connection with the carrier means into and out of gripping relationship with the first gripper element and means for operating the second gripper element to turn the second gripper element about its pivotal connection with the carrier means, such operating means being connected with the second gripper element at a part of the second gripper element spaced from its pivotal connection with the carrier means and being connected with the carrier means at a part of the carrier means spaced from the pivotal connection of the second gripper element with the carrier means, said parts of the second gripper element and the carrier means being closer to each other when they are disposed at a relatively curved portion of said path than when they are disposed at a relatively straight portion of said path so that passing thereof from a relatively straight portion of said path to a relatively curved portion of said path turns the second gripper element from gripping relationship with respect to the first gripper element to non-gripping relationship with respect to the first gripper element.

7. Gripper mechanism comprising guiding means defining a path having a relatively curved portion and a relatively straight portion, carrier means movable along the path, a first gripper element carried by the carrier means, a second gripper element pivoted to the carrier means and adapted for turning movement about its pivotal connection with the carrier means into and out of gripping relationship with the first gripper element and means for operating the second gripper element to turn the second gripper element about its pivotal connection with the carrier means, such operating means being connected with the second gripper element at a part of the second gripper element spaced from its pivotal connection with the carrier means and being connected with the carrier means at a part of the carrier means spaced from the pivotal connection of the second gripper element with the carrier means, said parts of the second gripper element and the carrier means being farther from each other when they are disposed at a relatively curved portion of said path than when they are disposed at a relatively straight portion of said path so that passing thereof from a relatively straight portion of said path to a relatively curved portion of said path turns the second gripper element from gripping relationship with respect to the first gripper element to non-gripping relationship with respect to the first gripper element.

8. Gripper mechanism comprising guiding means defining a closed path having at least one relatively curved portion and at least one relatively straight portion, an endless carrier chain movable along the path, a first gripper element carried by the endless carrier chain, a second gripper element pivoted to the endless carrier chain and adapted for turning movement about its pivotal connection with the endless carrier chain into and out of gripping relationship with the first gripper element and means for operating the second gripper element to turn the second gripper element about its pivotal connection with the endless carrier chain, such operating means being connected with the second gripper element at a part of the second gripper element spaced from its pivotal connection with the endless carrier chain and being connected with the endless carrier chain at a part of the endless carrier chain spaced from the pivotal connection of the second gripper element with the endless carrier chain, said parts of the second gripper element and the

endless carrier chain being spaced apart a different distance when they are disposed at a relatively curved portion of said path than when they are disposed at a relatively straight portion of said path so that passing thereof from one to the other of said portions of said path turns the second gripper element from gripping relationship with respect to the first gripper element to non-gripping relationship with respect to the first gripper element.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 2,997,157

August 22, 1961

Carl O. Siebke

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

Column 4, line 55, for "versely" read -- reversely --;
column 5, line 7, for "maintan" read -- maintain --; line 66,
for "40" read -- 40' --; column 6, line 22, for "pintless"
read -- pintles --; column 8, line 24, for "staight" read
-- straight --; line 26, for "vurved" read -- curved --.

Signed and sealed this 23rd day of January 1962.

(SEAL)

Attest:

ERNEST W. SWIDER

Attesting Officer

DAVID L. LADD

Commissioner of Patent