Dec. 23, 1958 W. R. FOWLIE ET AL 2,865,289

GRIPPER CONSTRUCTION FOR DUPLICATORS

Filed Oct. 3, 1956 3 Sheets-Sheet 1

FIG. 1

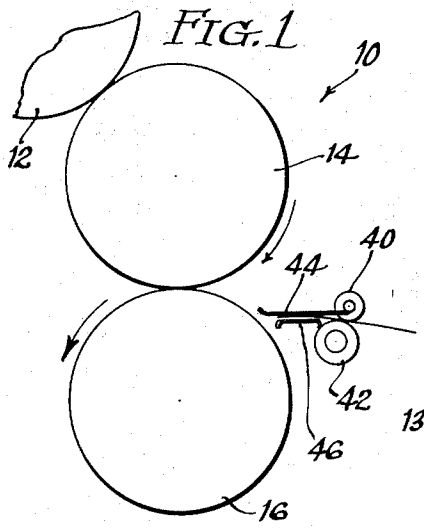


FIG. 2

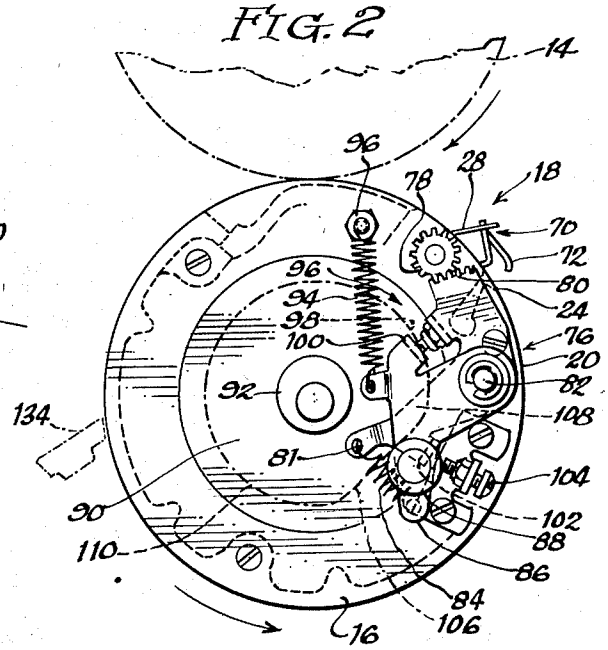
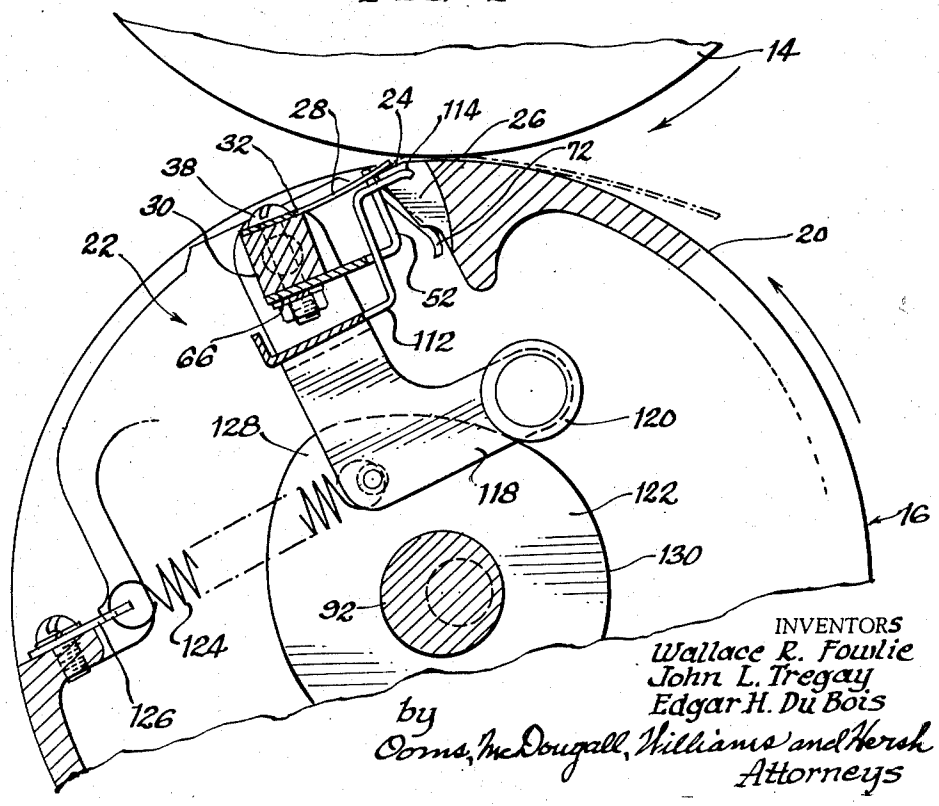


FIG. 4



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Filed Oct. 3, 1956 3 Sheets-Sheet 2

FIG. 3

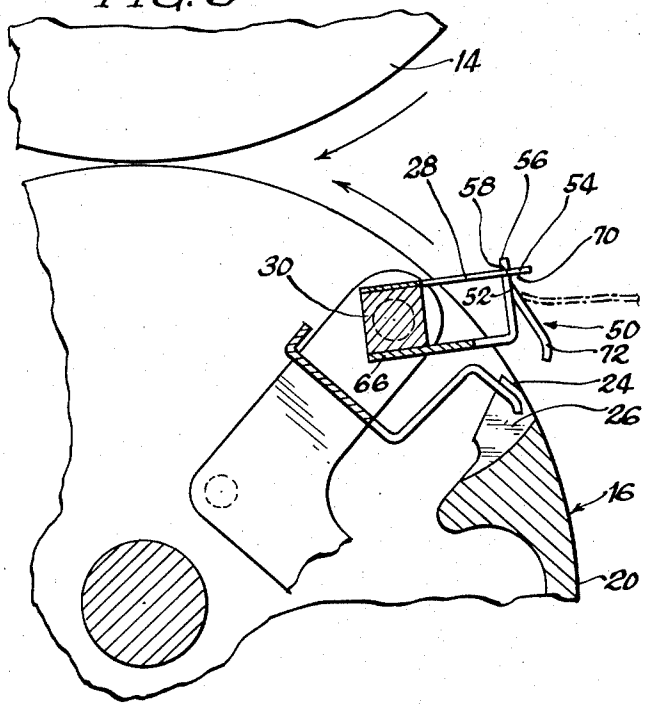


FIG. 5

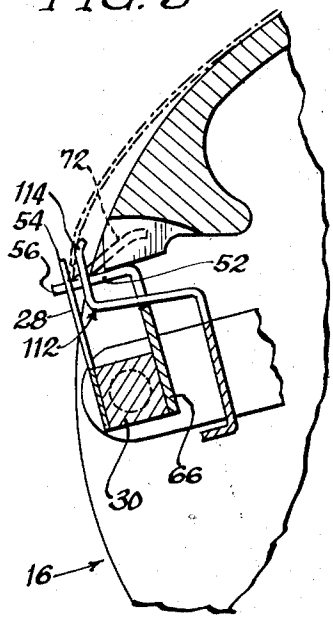
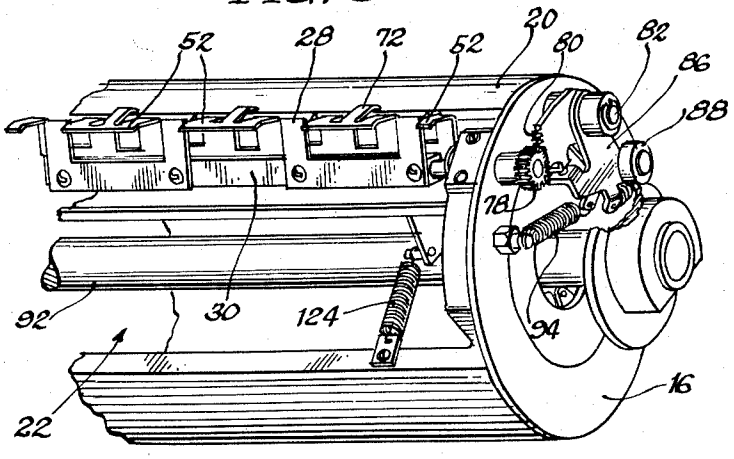


FIG. 6



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GRIPPER CONSTRUCTION FOR DUPLICATORS

Filed Oct. 3, 1956 3 Sheets-Sheet 3

FIG. 7

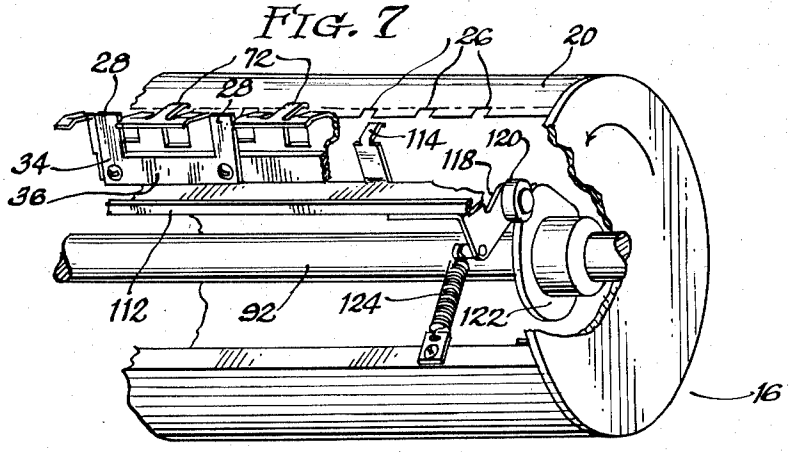
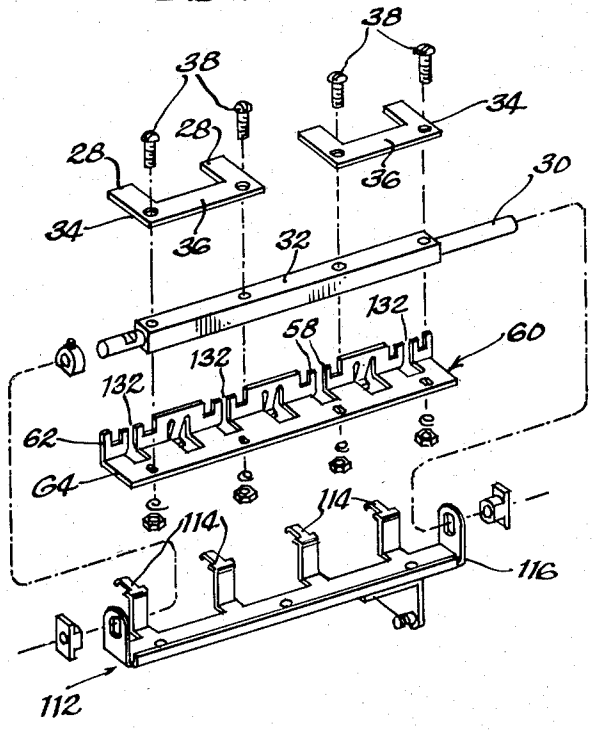


FIG. 8



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2,865,289

GRIPPER CONSTRUCTION FOR DUPLICATORS

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Application October 3, 1956, Serial No. 627,529

5 Claims. (Cl. 101—409)

This invention relates to duplicators or other printing machines, and pertains particularly to gripper constructions for securing the leading edges of paper sheets to a printing cylinder.

One object of the present invention is to provide a new and improved gripper construction having stop means whereby the leading edge portion of the sheet to be printed is accurately and positively located and positioned with respect to the printing cylinder, so that the printed matter will be accurately registered on the sheet with respect to the leading edge thereof.

A further object is to provide a new and improved gripper construction in which sheet-guiding elements are secured to the gripper fingers and are arranged to extend at an acute angle thereto to define an acutely angled crotch therebetween, so that the sheets to be printed will slide along the guiding elements into the crotch and will be positively located therein.

It is another object to provide a new and improved gripper construction having individually flexible and resilient gripper fingers, with stop fingers disposed therebetween and having portions extending at an acute angle to the gripper fingers to define a paper receiving crotch therebetween.

A further object is to provide a new and improved gripper construction in which the gripper fingers are moved against an anvil portion on the cylinder and are flexed a controlled amount so as to clamp the successive paper sheets between the fingers and the anvil portion.

It is a further object to provide a new and improved gripper construction which is highly effective yet is reasonably simple and low in cost.

Further objects and advantages of the present invention will appear from the following description, taken with the accompanying drawings, in which:

Fig. 1 is a diagrammatic side elevational view of a three cylinder printing machine equipped with a gripper mechanism constituting an illustrative embodiment of the present invention.

Fig. 2 is an enlarged side elevational view showing the gripper mechanism.

Figs. 3, 4 and 5 are fragmentary enlarged cross sectional views showing successive positions of the grippers.

Fig. 6 is a fragmentary perspective view showing the gripper mechanism, as embodied in the impression cylinder of the printing machine shown in Fig. 1.

Fig. 7 is a fragmentary perspective view, similar to Fig. 6 but with portions of the impression cylinder broken away.

Fig. 8 is an exploded view showing components of the gripper mechanism.

It will be understood that the present invention may be applied to all types of duplicators and printing machines. Thus, it is merely by way of example that the drawings illustrate a three cylinder offset printing machine **10** having a plate or master cylinder **12**, a blanket or offset cylinder **14**, and an impression cylinder **16**. The master cylinder **12** is adapted to hold a master printing sheet or plate, usually of the lithographic type, on which an ink image is formed. The image is transferred to the offset cylinder **14** and then is again transferred to successive sheets of paper or the like fed between the offset cylinder **14** and the impression cylinder **16**.

The printing machine or duplicator **10** is provided with a gripper mechanism **18** whereby the leading edges of the successive sheets are carried into the nip between the offset and impression cylinders **14** and **16**. In this case, the gripper mechanism **18** is mounted on the impression cylinder **16**.

It will be seen that the impression cylinder **16** has a cylindrically curved outer surface **20** which is adapted to receive and back up the paper sheets as they are printed by the offset cylinder **14**. The cylindrical portion **20** of the cylinder **16** is interrupted by a gap or slot **22** in the cylinder. At one end of the cylindrical surface **20**, adjacent the gap **22**, the cylinder **16** is provided with a longitudinally extending anvil portion **24** against which the leading edges of the paper sheets are adapted to be clamped. It will be seen that the anvil portion angles inwardly or recedes from the curve of the cylindrical portion **20**. The anvil portion **24** is interrupted by a plurality of slots or notches **26**, for a purpose that will be described in greater detail shortly.

Gripper elements **28** are adapted to engage the anvil portion **24** so as to clamp the paper sheets to the impression cylinder **16**. It will be seen that the gripper elements **28** are swingable toward and away from the anvil portion **24**, between the open and closed portions of Figs. 3 and 4.

The grippers **28** may be varied in construction, but in this case they take the form of thin, flat blades or fingers secured to a gripper shaft **30** which is rotatably mounted on the impression cylinder **16**. The illustrated grippers **28** are made of spring sheet metal and are flexible and resilient. In this case, the gripper shaft **30** is square in cross section. The gripper blades **28** are clamped or otherwise secured against one flat face **32** of the shaft **30**. From Figs. 6 and 8, it will be seen that the grippers **28** are formed in pairs on two sheet metal parts **34**. On each part **34**, the gripper blades **28** extend laterally from a body portion **36** which is secured to the gripper shaft **30** by bolts **38** or other suitable fasteners. Thus, the sheet metal parts **34** are generally C-shaped.

It will be understood that the successive sheets to be printed are fed to the impression cylinder **16** when the grippers **28** are open, as illustrated in Fig. 3. The sheets may be fed by an suitable means, such as the upper and lower forwarding rollers **40** and **42** shown in Fig. 1. In this arrangement, the forwarding rollers propel the sheets toward the impression cylinder **16** between upper and lower generally horizontal guide plates **44** and **46**. The sheets are directed toward the impression cylinder **16** in a generally horizontal direction so that the sheets will reach the cylinder **16** at a point somewhat below the nip betwen the blanket and impression cylinders **14** and **16**.

The operation of the gripper mechanism **18** is timed so that the grippers **28** are open fully, as shown in Fig. 3, when the sheets are fed to the cylinder **16**. In order to insure accurate positioning of the leading edge of each sheet, the gripper mechanism **18** is provided with stop means **50** which are carried by the gripper shaft **30** and are rotatable with the gripper blades **28**. The illustrated stop means **50** comprise a plurality of stop fingers or blades **52** which extend generally at right angles to the gripper blades **28**. The stop blades **52** intersect the plane defined by the undersides of the gripper fingers at points spaced inwardly a short distance from the extreme outer ends of the gripper fingers **28**. Thus, the gripper fingers **28** have portions **54** which extend out-

wardly beyond the stop fingers **52**, while the stop fingers **52** have portions **56** which extend upwardly between the gripper fingers **28**. The stop fingers or blades **52** have shoulder portions **58** which face upwardly under the gripper fingers **28** and are adapted to be engaged by the undersides of the gripper fingers when the grippers are open, as shown in Fig. 3.

In the illustrated construction, the stop fingers or blades **52** are formed on a single sheet metal member **60** which is generally angle-shaped in cross section. Thus, the member **60** has two flanges **62** and **64** which are generally at right angles to each other. All of the stop fingers **52** are formed on the angle **62**. The flange **64** is clamped or otherwise secured to the gripper shaft **30**. It will be seen that the shaft **30** has a flat face **66** which is diametrically opposite from the flat face **32**. The bolts **38** may be employed to clamp the flange **64** against the flat face **66** of the shaft **30**. Thus, the flange **64** extends generally parallel to the gripper blades **28**, while the flange **62** extends upwardly toward the gripper blades, generally at right angles thereto.

It will be seen that a crotch **70** is defined between the outer portions **54** of the gripper blades **28** and the stop fingers **52**. In order to guide the leading edge of each paper sheet into the crotch **70**, the stop fingers **52** are provided with sheet-guiding elements **72** which extend downwardly from the plane defined by the undersides of the gripper blades **28**. The sheet guiding elements **72** angle outwardly, with respect to the stop fingers **52**, and extend at an acute angle to the outer portions **54** of the gripper blades **28**. In this case, the sheet guiding elements **72** are formed as tongues struck out of the angle member **60** on which the stop fingers **52** are formed. Because of the outward angling of the sheet-guiding tongues **72**, the paper-receiving crotch **70** is acutely angled.

As already indicated, the sheets may be fed horizontally to the impression cylinder **16** at a point somewhat below the nip between the blanket and the impression cylinders **14** and **16**. The leading edge of the sheet strikes the sheet-guiding tongues **72** somewhat below the outer portions **54** of the gripper fingers. Because of the outward angling of the tongues **72**, the edge of the sheet is deflected upwardly along the tongues and into the crotch **70**. Thus, the position of the sheet is positively and accurately determined by the crotch **70**. As the grippers **28** close, the leading edge of the sheet remains in the crotch. Thus, the sheets are positioned peripherally with respect to the impression cylinder **16** with a high degree of accuracy and reproducibility. Accordingly, the registration of the printed matter with respect to the head of the sheet is maintained and controlled with great accuracy.

It has already been indicated that the gripper blades **28** are opened fully (Fig. 3) to receive the paper sheets and then are closed to clamp the successive sheets against the anvil portion **24** so that the sheets will be carried through the nip between the blanket and impression cylinders **14** and **16** (Fig. 4). The grippers **28** are then opened sufficiently to release the sheets, as shown in Fig. 5.

These movements are imparted to the grippers **28** by an operating mechanism **76** (Figs. 2 and 6). In the illustrated mechanism, a pinion **78** is secured to the gripper shaft **30** and is arranged to mesh with a sector gear **80** formed on a lever **81** which is swingable about a pivot **82** on the cylinder **16**. A coil spring **84** is tensioned between the sector gear lever **81** and a cam follower arm **86** which carries a roller **88** adapted to engage a cam **90**. In this case, the cam **90** is stationary while the cam follower arm **86** rotates with the impression cylinder **16**. The cam **90** is secured to the mechanical frame. A coil spring **94** is tensioned between the cam follower arm **86** and an anchor **96** on the cylinder **16** so as to bias the roller **88** against the cam **90**.

The cam follower arm **86** is adapted to be swung counterclockwise by the positive action of the cam **90**, while being swung clockwise by the spring **94**. When the cam follower arm **86** is swung counterclockwise or outwardly, the spring **84** tends to swing the sector gear lever **81** counterwise so as to close the grippers **28**.

The cam follower lever **86** may also impart clockwise motion to the sector gear lever **81** by virtue of a one-way lost motion connection **96**, between the arm **86** and the lever **81**. It will be seen that the lost motion connection **96** comprises relatively adjustable, interengageable stop elements **98** and **100** on the lever **81** and the arm **86**. In this case, the stop **98** takes the form of an adjustable screw, while the stop **100** comprises a flange or lug on the arm **86** and adapted to be engaged by the screw **98**.

The counterclockwise or closing movement of the sector gear lever **81** is limited by relatively adjustable stop elements **102** and **104** on the lever **81** and the cylinder **16**. In the illustrated arrangement, the stop **102** comprises a flange or lug on the lever **81**, while the stop **104** takes the form of an adjustable screw carried by the cylinder **16**.

In the illustrated case, the gripper cam **90** has a low portion **106** adapted to permit the spring **94** to open the grippers **28**. When the roller **88** engages the low portion **106**, the spring **94** swings the arm **86** clockwise or inwardly. The interengaging stop elements **98** and **100** swing the gear sector **80** clockwise, with the result that the pinion **76** and the grippers **28** are swung counterclockwise to their open position.

The cam **90** has a high portion **108** adapted to close the grippers **28**. As the roller **88** passes over the high portion **108**, the arm **86** is swung counterclockwise or outwardly. The spring **84** swings the gear sector **80** counterclockwise so as to rotate the grippers **28** clockwise toward the anvil portion **24** on the cylinder **16**. To provide firm clamping pressure between the gripper blades **28** and the anvil portion **24**, so that the sheets will be securely clamped therebetween, the gripper shaft **30** may be rotated clockwise sufficiently to flex the gripper fingers **28**, as illustrated in Fig. 4. The gripper closing movement of the sector gear lever **81**, and hence that of the gripper shaft **30**, is limited by the relatively adjustable stops **102** and **104** on the lever **81** and the cylinder **16**. Thus, the position of the adjustable stop screw **104** determines the extent to which the grippers **28** are flexed. During the closing of the grippers **28**, the one-way lost motion connection **96** permits overtravel of the cam follower arm relative to the gear sector lever **81**. Such overtravel causes the stop flange **100** to move away from the stop screw **98**. At the same time, the spring **84** is stretched.

The cam **90** has a portion **110** of intermediate height, extending for the major portion of the periphery of the cam. The height of the portion **110** is such as to open the grippers **28** partially, so as to release the leading edge of the sheet, as shown in Fig. 5.

The released sheet is pushed away from the anvil portion **24** on the impression cylinder **16** by ejector means **112** taking the form of a plurality of ejector fingers **114** formed on a member **116** which is rotatable independently of the gripper shaft **30**, but about the same axis. A cam follower arm **118** is mounted on the member **116** and is provided with a roller **120** which is engageable with a cam **122**. The arm **118** rotates with the cylinder **16**, while the cam **122** is secured to the cylinder shaft **92** and is essentially stationary. A coil spring **124** is stretched between the arm **118** and an anchor **126** on the cylinder **16**, so as to hold the roller **120** against the cam **122**.

The cam **122** has a high portion **128** adapted to swing the arm **118** and the ejector fingers **114** in a counterclockwise direction, so that the ejector fingers will push the leading edge of the sheet away from the anvil portion **24**, as illustrated in Fig. 5. The ejector fingers **114**

are movable through some of the slots **26** in the anvil portion **24**. More specifically, the ejector fingers **114** and the sheet-guiding tongues **72** are positioned alternately in the slots **26**.

The ejector cam **122** has a low portion **130** which extends for the major part of the periphery of the cam and permits the spring **194** to move the ejector fingers **114** to their retracted position, as shown in Fig. 4.

It will be apparent from Figs. 7 and 8 that the ejector fingers **114** are aligned with the gripper fingers **28**, or, in other words, are positioned directly under the gripper fingers. The ejector fingers **114** are movable through slots **132** defined between the stop fingers **52**.

The operation of the gripper mechanism may be summarized by again noting that the sheets to be printed are fed toward the impression cylinder **16** so that they will engage the sheet-guiding tongues **72** which are rotatable with the grippers **28**. The underside of the sheet makes an acute angle with the sheet-guiding tongues **72**. Thus, the sheet is deflected upwardly so that it will slide along the tongues **72** into the crotch **70** between the stop fingers **52** and the outer portions **54** of the grippers **28**. Thus, the acutely angled guiding tongues **72** insure that the sheet will be positively located in the crotch **70**. The forwarding rollers **40** and **42** may be arranged to propel the sheet to a slightly greater extent than is normally necessary to seat the leading edge of the sheet in the crotch **70**. The overtravel of the sheet is taken up by slight buckling of the sheet.

The grippers **28** are closed as they travel with the cylinder toward the nip between the blanket and impression cylinders **14** and **16**. The closing movement of the grippers **28** is brought about by the high portion **108** of the cam **90**, which swings the cam follower lever **86** counterclockwise. The spring **84** imparts corresponding counterclockwise movement to the gear sector **80**. As a result, the pinion **78** and the grippers **28** are swung clockwise. In this case, the sector gear **80** has a considerably greater radius than the pinion **78**, with the result that the movement of the grippers **28** is magnified with respect to the movement of the sector gear **80**. The grippers **28** clamp the leading edge of the sheet against the anvil portion **24**, as shown in Fig. 4. In order to flex the gripper fingers **28** and thereby provide for firm clamping pressure between the fingers and the anvil portion **24**, the gripper shaft **30** may be rotated slightly beyond the portion in which the gripper fingers move into clamping relation with the sheet. Such overtravel of the gripper shaft **30** is controlled by the adjustable stop screw **104**, which limits the gripper closing movement of the sector gear lever **81**. Any additional overtravel of the cam follower lever **84** results in separation between the stops **98** and **100** and stretching of the spring **84**.

After the grippers **28** pass the nip between the blanket and impression cylinders **14** and **16**, the roller **88** encounters the intermediate portion **110** of the cam **90**, with the result that the spring **94** swings the cam follower arm **86** clockwise. The stops **98** and **100** transmit the clockwise movement to the sector gear **80**. Accordingly, the grippers **28** are swung counterclockwise away from the anvil portion **24**, as shown in Fig. 5.

The high portion **128** of the ejector cam **122** swings the arm **118** and the ejector fingers **114** counterclockwise so that the fingers will push the leading edge of the sheet outwardly away from the cylinder **16**. The sheet is then pealed off the impression cylinder **16** by stationary stripper elements **134** (Fig. 2).

As the grippers **28** approach the position in which the paper is fed to the cylinder **16**, they are opened fully by the engagement of the roller **88** with the low portion **106** on the cam **90**. The spring **94** swings the arm **86** and the sector gear **80** in a clockwise direction, so that the pinion **78** and the grippers **28** will be rotated counterclockwise. Thus, the sheet-guiding tongues **72** on the stop fingers **52** are swung outwardly beyond the periphery of the cylinder **16** so that the paper sheets will impinge upon the guide tongues **78** as the sheets are fed toward the cylinder **16**.

It will be appreciated that the gripper construction of the present invention is effective and dependable in operation, yet is reasonably simple and low in cost. The angularity of the guide elements carried by the grippers insures that the leading edges of the sheets will be properly positioned relative to the printing cylinder.

Various modifications, alternative constructions, and equivalents may be employed without departing from the true spirit and scope of the invention as exemplified in the foregoing description and defined in the following claims.

We claim:

1. In a printing machine, the combination comprising a printing cylinder having a cylindrically curved surface portion for receiving a sheet to be printed, an anvil portion extending longitudinally of said cylinder adjacent one end of said surface portion, a gripper shaft rotatably mounted on said cylinder adjacent said anvil portion, said shaft having diametrically opposite flat faces thereon, a plurality of flat spring sheet metal gripper blades fixed on said gripper shaft against one of said faces and having outer end portions swingable into and out of engagement with said anvil portion for clamping a sheet therebetween, an angle shaped stop member having a pair of flanges thereon extending generally at right angles to each other, one of said flanges being fixed to said gripper shaft against the opposite flat face thereon, said one flange extending from said shaft under said gripper blades and generally parallel thereto, the other flange on said stop member having notches therein receiving said gripper blades and portions defined by the said notches and extending between said gripper blades generally at right angles thereto, said stop member having a plurality of sheet guiding tongues struck therefrom and extending outwardly from said other flange and downwardly relative to said gripper blades at an acute angle thereto, said tongues defining an acutely angled crotch between said tongues and said gripper blades for receiving and positioning the leading edges of the sheets to be printed.

2. In a printing machine, the combination comprising a printing cylinder for receiving successive sheets to be printed, said cylinder having an anvil portion against which the leading edge of each sheet is adapted to be clamped, a gripper shaft rotatably mounted on said cylinder adjacent said anvil portion, a plurality of flat, flexible, resilient gripper fingers secured to said shaft and swingable into and out of engagement with said anvil portion for clamping the leading edge of each sheet therebetween, a plurality of stop fingers secured to said shaft and extending between said gripper fingers generally at right angles thereto, a plurality of sheet-guiding elements fixed on said stop fingers and extending downwardly from the underside of said gripper fingers, said gripper fingers having outer portions extending beyond said stop fingers, said sheet-guiding elements on said stop fingers extending at an acute angle to said outer portions of said gripper fingers and defining an acutely angled crotch therebetween for receiving and positioning the leading edge of each successive sheet to be printed, a pinion secured to said gripper shaft, a gear sector meshing with said pinion and mounted on said cylinder for swinging movement about a predetermined axis, a nonrotatable cam coaxial with said cylinder, a cam follower arm swingable on said cylinder about said predetermined axis and having a roller engageable with said cam, a first spring connected between said cylinder and said cam follower arm for biasing said roller against said cam, a second spring connected between said follower arm and said gear sector and operative to swing said gear sector in a first direction in response to outward movement of said follower arm by said cam, said movement of said gear sector in said first direction being operative to swing said gripper

fingers against said anvil portion, said second spring being yieldable to provide for outward overtravel of said cam follower arm, relatively adjustable stop elements on said cylinder and said gear sector for limiting movement of said gear sector in said first direction, and relatively adjustable stop elements on said follower arm and said gear sector for swinging said gear sector in a second opposite direction in response to inward movement of said cam follower arm for swinging said gripper fingers away from said anvil portion.

3. In a printing machine, the combination comprising a printing cylinder having a cylindrically curved surface portion for receiving a sheet to be printed, an anvil portion extending longitudinally of said cylinder adjacent one end of said surface portion, a gripper shaft rotatably mounted on said cylinder adjacent said anvil portion, a plurality of flat spring sheet metal gripper blades fixed on said gripper shaft and having outer end portions swingable into and out of engagement with said anvil portion for clamping a sheet therebetween, a stop member fixed to said gripper shaft and having a flange thereon with notches therein receiving said gripper blades and defining finger portions extending between said gripper blades generally at right angles thereto, said stop member having a plurality of sheet guiding tongues struck from said finger portions and extending outwardly therefrom and downwardly relative to said gripper blades at an acute angle thereto, said tongues defining an acutely angled crotch between said tongues and said gripper blades for receiving and positioning the leading edges of the sheets to be printed.

4. In a printing machine, the combination comprising a printing cylinder for receiving successive sheets to be printed, said cylinder having an anvil portion against which the leading edge of each sheet is adapted to be clamped, a gripper shaft rotatably mounted on said cylinder adjacent said anvil portion, a plurality of flat, flexible, resilient gripper fingers secured to said shaft and swingable toward and away from said anvil portion for clamping the leading edge of each sheet therebetween, a plurality of stop fingers secured to said shaft and extending between said gripper fingers generally at right angles thereto, a plurality of sheet-guiding elements fixed on said stop fingers and extending downwardly from the level of the underside of said gripper fingers, said gripper fingers having outer portions extending beyond said stop fingers, said sheet-guiding elements on said stop fingers extending at an acute angle to said outer portions of said gripper fingers and defining an acutely angled crotch therebetween for receiving and positioning the leading edge of each successive sheet to be printed.

5. In a printing machine, the combination comprising a printing cylinder for receiving successive sheets to be printed, said cylinder having an anvil portion against which the leading edge of each sheet is adapted to be clamped, a gripper shaft rotatably mounted on said cylinder adjacent said anvil portion, a plurality of gripper fingers secured to said shaft and swingable into and out of engagement with said anvil portion for clamping the leading edge of each sheet therebetween, stop means secured to said shaft and extending transversely to said gripper fingers to define a crotch therebetween for receiving and positioning the leading edge of each successive sheet to be printed, a pinion secured to said gripper shaft, a gear sector meshing with said pinion and mounted on said cylinder for swinging movement, a nonrotatable cam coaxial with said cylinder, a cam follower arm swingable on said cylinder and having a roller engageable with said cam, a first spring connected between said cylinder and said cam follower arm for biasing said roller against said cam, a second spring connected between said follower arm and said gear sector and operative to swing said gear sector in a first direction in response to outward movement of said follower arm by said cam, said movement of said gear sector in said first direction being operative to swing said gripper fingers against said anvil portion, said second spring being yieldable to provide for outward overtravel of said cam follower arm, stop elements on said cylinder and said gear sector for limiting movement of said gear sector in said first direction, and stop elements on said follower arm and said gear sector for swinging said gear sector in a second opposite direction in response to inward movement of said cam follower arm for swinging said gripper fingers away from said anvil portion.

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