May 28, 1968 S. L. GUZIK 3,385,597

SHEET HOLDING AND TRANSFER APPARATUS

Filed Jan. 16, 1967 3 Sheets-Sheet 1

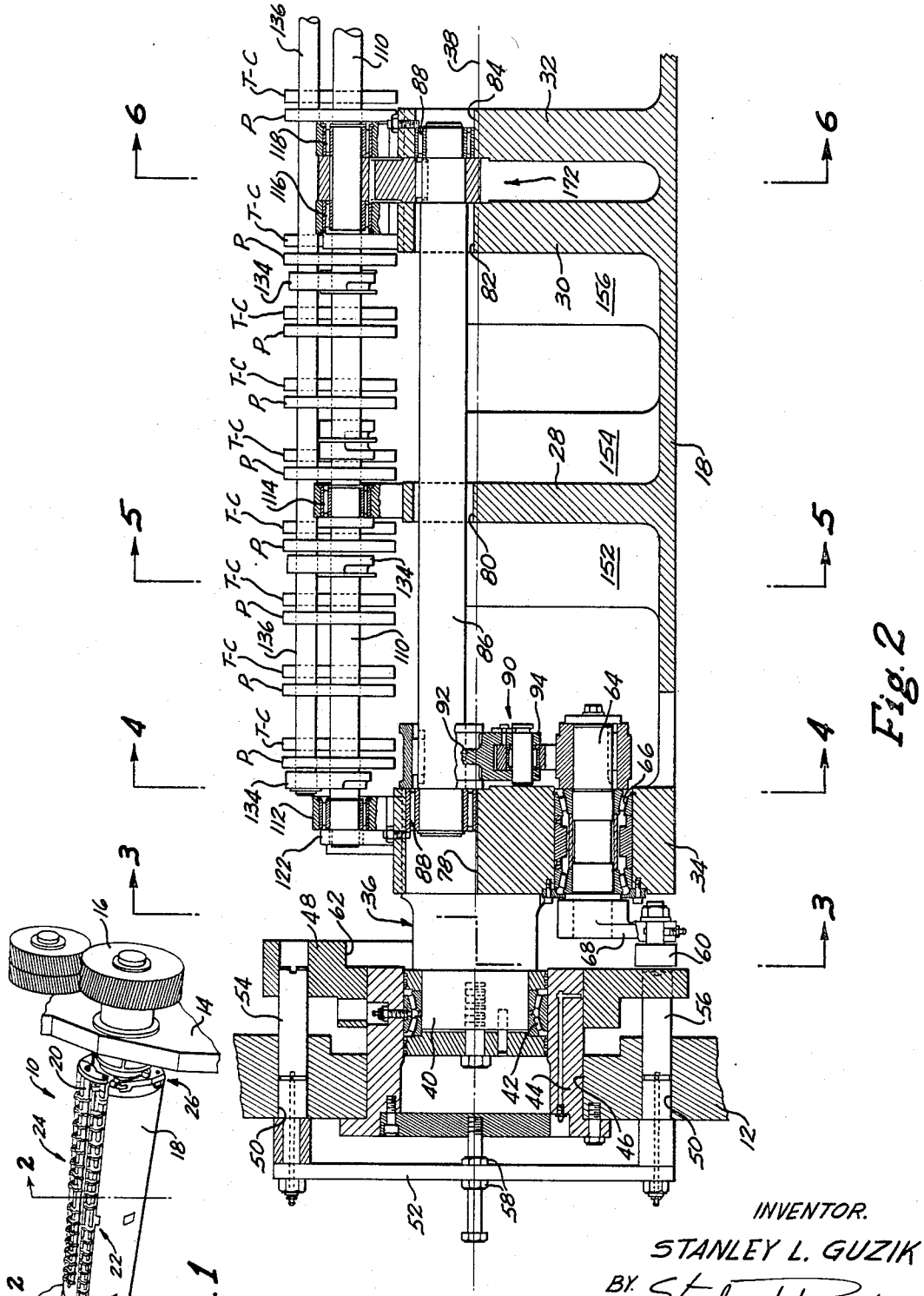

Fig. 1

Fig. 2

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SHEET HOLDING AND TRANSFER APPARATUS

Filed Jan. 16, 1967 3 Sheets-Sheet 2

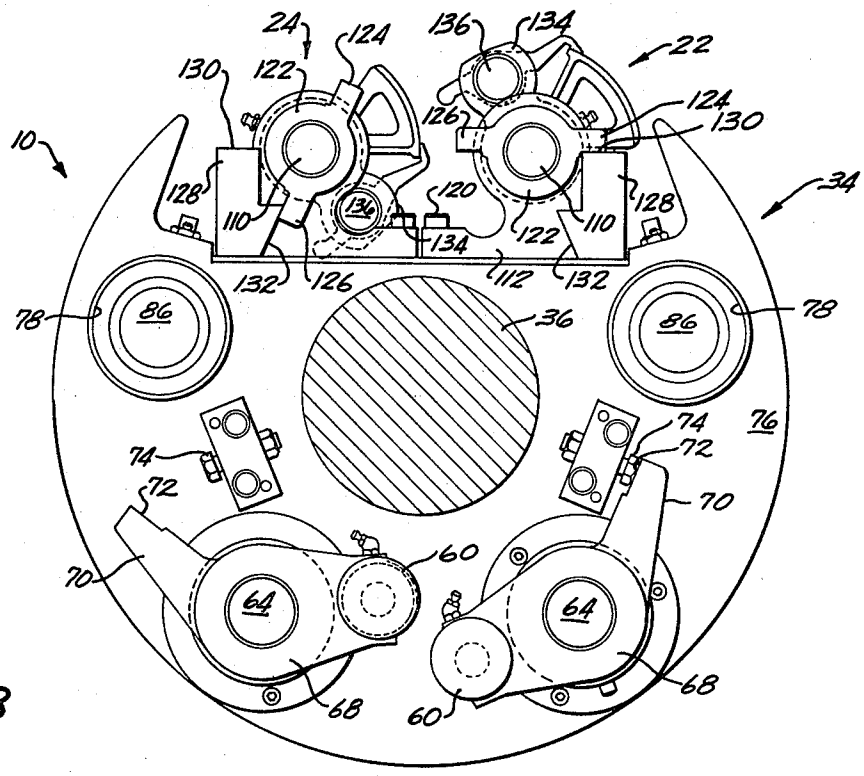

Fig. 3

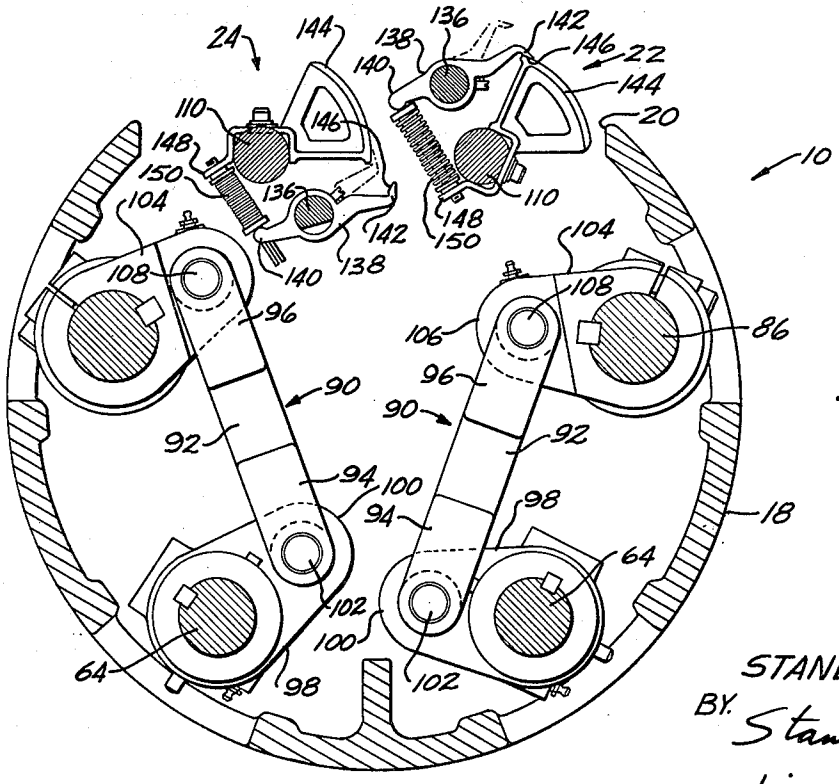

Fig. 4

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SHEET HOLDING AND TRANSFER APPARATUS

Filed Jan. 16, 1967 3 Sheets-Sheet 3

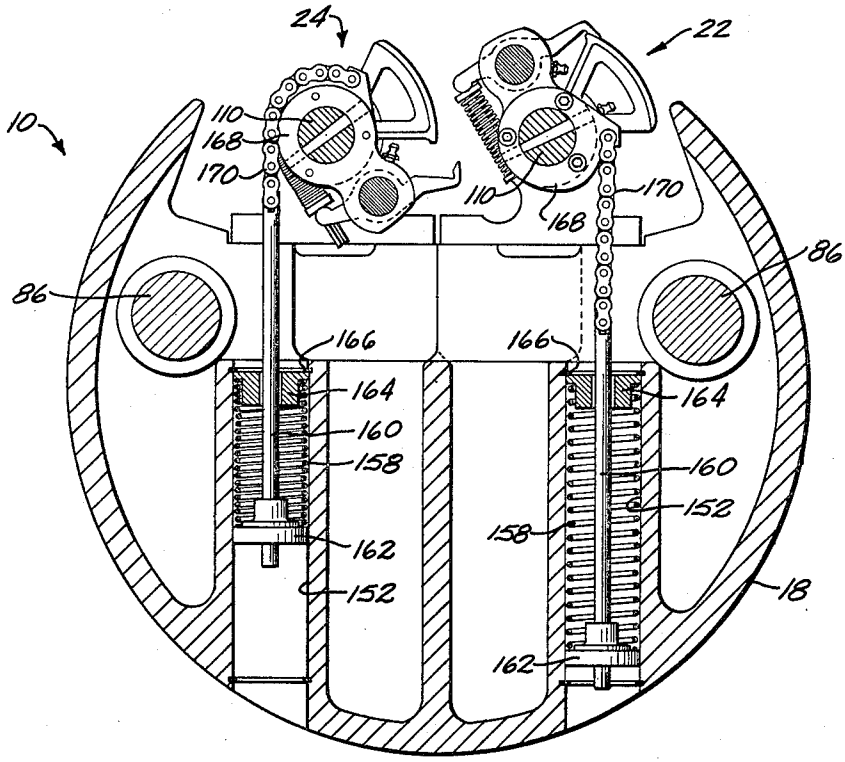

Fig. 5

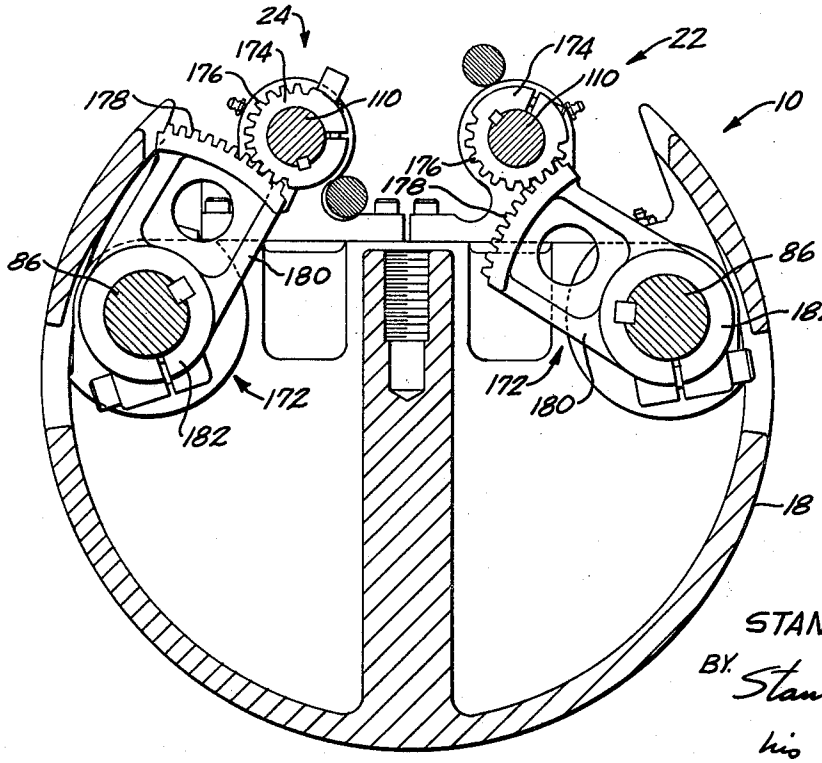

Fig. 6

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United States Patent Office 3,385,597
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3,385,597

SHEET HOLDING AND TRANSFER APPARATUS

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Filed Jan. 16, 1967, Ser. No. 609,460
9 Claims. (Cl. 271—82)

ABSTRACT OF THE DISCLOSURE

Apparatus for tumbling the gripper devices on a transfer cylinder of a perfector printing press where one or more colors are printed on two sides of a sheet of paper. An actuator shaft is journaled in the transfer cylinder and is drivingly connected to the tumbler shaft at a location intermediate the end portions of the cylinder. A drive shaft is journaled in the transfer cylinder and has one end portion connected to a cam actuated lever and the other end portion connected to the actuator shaft by a link mechanism so that rotation of the drive shaft by the cam actuated lever is transmitted through the actuator shaft to the tumbler shaft at a location intermediate the ends of the transfer cylinder to tumble the gripper devices without subjecting the tumbler shaft to torsional deflection.

BACKGROUND OF THE INVENTION

(1) *Field of the invention*

This invention relates to sheet holding and transfer apparatus and more particularly to apparatus for tumbling the gripper devices of a perfector printing press transfer cylinder.

(2) *Description of the prior art*

In Patent 2,757,610 to Gegenheimer et al. entitled "Sheet Handling Mechanism and Method for Multi-Color Perfector Press," granted Aug. 7, 1956, there is illustrated and described a sheet fed rotary printing press in which two or more printing units or couples are connected in a manner that the sheets may be printed with two or more colors. The press is so arranged that sheets may be printed on only one side or on both sides, either with the same color or different colors. The press is adjustable to be used as a multi-color press or as a perfector press. Generally speaking, a multi-color press can be considered one that prints successive colors on one side of a sheet of paper. A perfector press is one that prints one or more colors on two sides of a sheet of paper.

The perfector press is provided with a "third transfer" cylinder that is arranged to take a sheet from a "second transfer" cylinder after the sheet is printed on one side thereof in the first printing unit and reverse the leading and trailing edges of the sheet as it passes through the press so that the sheet is delivered to the next printing unit with the former trailing edge as the leading edge of the sheet.

In the Gegenheimer et al. patent, the apparatus for reversing the edges of the sheet so that it may be printed on the reverse side, includes a pair of tumbler shafts extending longitudinally along the cylinder. One of the shafts is designated a two-color tumbler shaft and the other is designated a perfector tumbler shaft. Gripper devices are secured to the respective tumbler shafts and are arranged, upon rotation of the tumbler shafts, in opposite directions, to move inwardly toward each other or outwardly away from each other.

The trailing edge of the paper sheet is engaged by the perfector gripper devices on the third transfer cylinder and as the cylinder continues to rotate, the trailing edge

of the paper sheet is transferred to the two-color gripper devices. This is accomplished by the tumbler shafts rotating in opposite directions so that the gripper devices tumble inwardly toward the axis of the third transfer cylinder. When the gripper devices have reached a preselected tumbled position, the trailing edge of the paper sheet is released by the perfector gripper devices and is engaged by the two-color gripper devices. The trailing edge of the sheet is then transferred to the second impression cylinder in the second printing unit as the leading edge of the sheet and the reverse side of the sheet is printed in the second printing unit.

The tumbler shafts on the third transfer cylinder are rotated inwardly by means of cam actuated levers located at one end of the transfer cylinder and retaining springs urge the tumbler shafts toward an untumbled position where the gripper devices are at their outermost position. In this outer position the perfector gripper devices are operable to engage the trailing edge of the sheet as it is delivered from the second transfer cylinder. The cam actuated levers are arranged to rotate the tumbler shafts and tumble the gripper devices inwardly so that the trailing edge of the sheet can be transferred from the perfector gripper devices to the two-color perfector devices. Other means are provided on the other end of the third transfer cylinder to open and close the respective perfector and two-color gripper devices.

In order to properly reverse the sheet so that the reverse side is printed in matched relation with the obverse side, it is essential that the gripper devices, both the perfector gripper devices and the color gripper devices, remain aligned longitudinally in the same horizontal plane in both an untumbled position and in a tumbled position. Misalignment of the perfector gripper devices in an untumbled position results in a skewing of the paper sheet as it is engaged by the perfector gripper devices. Misalignment of the perfector gripper devices in a tumbled position results in the gripper devices transferring the trailing edge of the sheet to the two color gripper devices in a skewed position and the printing on the reverse side is mismatched with printing on the obverse side of the paper sheet. Similarly, misalignment of the two color gripper devices in an untumbled position results in the trailing edge of the sheet being transferred to the second impression cylinder in the second printing unit in a skewed manner. Misalignment of the two color grippers in a tumbled position results in an uneven engagement of the trailing edge of the sheet by the two color gripper devices as the sheet is transferred from the perfector gripper devices.

In printing presses of relatively narrow width, the misalignment of the perfector and two color gripper devices in a tumbled position has not been a major problem because there is little torsional deflection in the relatively short tumbler shafts, minor adjustments can be made by an eccentric cam follower to force or further urge the abutments on the tumbler shaft against the stops in the tumbled position. In presses suitable for printing relatively wide sheets, the misalignment of the gripper devices is a major problem that is compounded by several factors. A plurality of resilient members are employed to urge the tumbler shaft against its stops in an outward or untumbled position. In order to rotate the tumbler shafts to tumble the gripper devices inwardly, a substantial torque must be exerted on the tumbler shafts to rotate the tumbler shafts against the biasing force of the resilient members. This substantial torque imparts a torsional deflection or longitudinal twisting in the tumbler shaft and causes substantial misalignment of the respective gripper devices in the tumbled position. It is not practical to increase the diameter of the tumbler shaft to reduce the tor-

sional deflection because the gripper devices must follow a given path to receive the edge of the sheet from the adjacent cylinder, tumble inwardly and transfer the edge of the sheet to the other grippers. If the shaft diameter were increased, it would be necessary to increase the diameter of the cylinder. This in turn would require a proportionate increase in the diameter of the other cylinders in the press to maintain the same timing between the cylinders. There is a need, therefore, especially in large printing presses, for apparatus to maintain both perfector gripper devices and the two-color gripper devices aligned and in the same plane as the respective gripper devices tumble inwardly on the transfer cylinder.

SUMMARY OF THE INVENTION

Briefly, the invention is directed to apparatus for rotating the tumbler shafts on a transfer cylinder of a printing press without imparting a longitudinal twisting or torsional deflection to the tumbler shafts so that the plurality of gripper devices connected to the tumbler shafts remained aligned longitudinally and in the same plane when the gripper devices are tumbled inwardly.

The apparatus includes a tumbler shaft rotatably journaled in the transfer cylinder and restrained from rotation in one direction by resilient biasing means. Gripper devices are secured to the tumbler shaft and are movable in an arc toward and away from the transfer cylinder axis of rotation. An actuator shaft is journaled in the third transfer cylinder and has means drivingly connecting one end thereof to the intermediate portion of the tumbler shaft. A cam actuated drive lever is drivingly connected to the actuator shaft and is arranged to rotate the actuator shaft which in turn imparts a rotary motion to the tumbler shaft at a location intermediate the end portions to thereby maintain the gripper devices connected to the tumbler shaft aligned longitudinally and in the same plane as the gripper devices are tumbled inwardly toward the axis of the transfer cylinder.

Accordingly, the principal object of this invention is to reduce the torsional deflection or longitudinal twisting of the tumbler shafts in a transfer cylinder of a printing press.

Another object of this invention is to provide apparatus for engaging the tumbler shaft in a transfer cylinder at a location intermediate the end portions of the cylinderand subjecting the tumbler shaft at this intermediate location to a torsional force and thereby reduce the torsional deflection of the tumbler shaft.

A still further object of this invention is to provide an actuator shaft drivingly engaged to the tumbler shaft intermediate the end portions of the tumbler shaft so that the torsional force on the tumbler shaft is exerted on an intermediate portion of the tumbler shaft.

These and other objects and advantages of this invention will be more completely disclosed and described in the following specification, the accompanying drawings and the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIGURE 1 is a perspective view of a third transfer cylinder taken from the drive side of the printing press.

FIGURE 2 is a fragmentary view in section and in elevation taken substantially along the lines **2—2** in FIGURE 1 illustrating the actuating mechanism for the perfector tumbler shaft.

FIGURE 3 is a view in end elevation of the third transfer cylinder taken along the line **3—3** in FIGURE 2 illustrating the cam actuated lever means for rotating the tumbler shafts.

FIGURE 4 is a view in section taken along the lines **4—4** in FIGURE 2 and illustrating the perfector and two-color gripper devices in detail and the link mechanism connecting the actuator shaft to the drive shaft rotated by the cam actuated lever.

FIGURE 5 is a view taken along the line **5—5** in FIGURE 2 and illustrating one of the plurality of resilient means that urge the respective tumbler shafts toward an outward or untumbled position.

FIGURE 6 is a view in section taken along the center line of the press and the transverse center of the third transfer cylinder illustrating the driving connections between the actuator shafts and the tumbler shafts.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The method and apparatus for perfector printing as illustrated and described in Gegenheimer et al. 2,757,610 is incorporated herein by reference. The Gegenheimer et al. Patent 2,757,610 discloses a method and apparatus for perfector printing wherein the press prints one or more colors on two sides of a sheet of paper. The printing press includes two or more printing units or couples that are connected to each other and have three transfer cylinders, a first transfer cylinder delivers the sheet from the first printing unit to a second transfer cylinder with the printed obverse side facing upwardly on the second transfer cylinder. The trailing edge of the sheet is engaged by a plurality of aligned perfector grippers on the third transfer cylinder and is transferred while on the third transfer cylinder to a plurality of aligned two-color grippers. By this transfer the trailing edge of the sheet becomes the leading edge of the sheet as it is delivered by the third transfer cylinder to an impression cylinder in the second printing unit with the reverse side of the sheet facing upwardly on the impression cylinder in the second printing unit. The reverse side of the sheet is then printed in the second printing unit.

The third transfer cylinder, during perfector printing, functions to engage the trailing edge of the sheet and to transfer the sheet by the trailing edge to the next impression cylinder. The apparatus on the third transfer cylinder that permits the sheet to be transferred in this manner includes a pair of parallel spaced gripper devices extending longitudinally along the periphery of the cylinder. One of the gripper devices is referred to as a perfector gripper device and the other gripper device is referred to as a two-color gripper device. The gripper devices comprises a plurality of grippers having a gripper pad and a gripper finger. The gripper finger in a closed position is arranged to engage the edge of the sheet to the gripper pad. The perfector grippers and the two-color grippers are interleaved and spaced from each other so that they may tumble toward each other without interference between the respective gripper devices.

The perfector tumbler shaft has a plurality of gripper shaft brackets that rotatably support a gripper shaft in parallel spaced relation with the tumbler shaft. A plurality of gripper fingers are spaced along the gripper shaft and are secured thereto for rotation therewith. Secured to the tumbler shaft in underlying relation with the spaced gripper fingers are a plurality of gripper pad brackets. The gripper pad brackets are nonrotatably secured to the tumbler shaft and have a pad surface against which an end portion of the gripper finger abuts to engage the edge of a paper sheet therebetween. A cam actuated means is provided to rotate the gripper shaft and move the gripper fingers away from the gripper pads to release the edge of a paper sheet engaged therebetween. Spring means urge the gripper fingers toward a closed position against the gripper pads.

The two-color tumbler shaft and gripper devices are substantially similar to the perfector tumbler shaft and gripper devices. The two-color gripper devices are so designated because they are also arranged to engage the leading edge of the sheet when the press is adjusted for two color printing on one side of a sheet. In the two-color process the perfector gripper devices are inactive in the sheet handling process.

In perfector printing the sheet is reversed by the third transfer cylinder, that is, the trailing edge of the sheet

as it is delivered from the first printing unit, becomes the leading edge of the sheet as it is fed into the second printing unit. The trailing edge of the sheet is engaged by the plurality of perfector grippers at the tangent point with the second transfer cylinder and then becomes the leading edge of the sheet. As the third transfer cylinder continues to rotate, the leading edge of the sheet i.e. the former trailing edge, is transferred from the perfector grippers to the two-color grippers. The two-color grippers then deliver the sheet to the second impression cylinder.

The perfector gripper finger actuating mechanism causes the perfector grippers to open before they reach the tangent point between the second transfer cylinder and the third transfer cylinder and close upon the trailing edge of the sheet delivered by the second transfer cylinder. After the sheet is engaged, a cam actuated mechanism rotates the two-color tumbler shaft and the perfector tumbler shaft so that the two-color grippers and the perfector grippers are tumbled toward each other and inwardly toward the axis of the transfer cylinder with the two-color grippers slightly in advance of the perfector grippers. The two-color grippers are then opened to receive the edge of the sheet. When the two-color grippers and the perfector grippers are at the innermost tumbled position, the perfector gripper fingers release the sheet and the two-color fingers grasp or engage the sheet. After the sheet is engaged by the two-color gripper fingers the resilient means connected to the tumbler shafts rotate the two-color and perfector tumbler shafts in an opposite direction to return the grippers to their outward untumbled position. The two-color gripper fingers now engaging the edge of the sheet deliver the former trailing edge of the sheet as the leading edge to the second printing unit.

Where the press is operated as a two-color press, that is, the first printing unit prints one color on the sheet and the second unit prints a second color on the sheet, the tumbler shafts are inactive and the respective perfector grippers and two-color grippers remain in their outermost untumbled position.

This invention is directed to an improvement in the apparatus illustrated and described in Gegenheimer et al. 2,757,610 to rotate the respective tumbler shafts and move the respective gripper devices inwardly toward the axis of the transfer cylinder so that the trailing edge of the sheet may be transferred from the perfector grippers to the two-color grippers.

Referring to FIGURE 1 there is illustrated a third transfer cylinder generally designated by the numeral **10** that is rotatably supported in side walls **12** and **14** of the printing press frame. Suitable gears **16** are arranged to rotate the third transfer cylinder **10** in timed relation with the other cylinders of the printing press. The third transfer cylinder **10** is of generally tubular construction with an external surface **18** and an opening **20** for the perfector gripper assembly **22** and the two-color gripper assembly **24**. Generally designated by the numeral **26** is the cam actuated mechanism for opening and closing the respective gripper fingers in the perfector gripper assembly **22** and the two-color gripper assembly **24**. The cam actuated mechanism **26** is similar to the mechanism illustrated and described in Gegenheimer et al. Patent 2,757,610.

The third transfer cylinder **10** is arranged to rotate in a clockwise direction as viewed from the operator's side indicated by the press frame **12** and in a counterclockwise direction as viewed from the drive side indicated by the press frame **14**. The third cylinder **10** is arranged upon rotation to have the trailing edge of the sheet engaged by the perfector gripper assembly **22** and transferred to the two-color gripper assembly **24** as the cylinder **10** rotates about its axis. The apparatus for tumbling the perfector gripper assembly **22** is illustrated in detail in FIGURES 2–6 inclusive. FIGURES 3–6 clearly illustrate the similarity between the perfector gripper assembly **22** and the two-color gripper assembly **24** and the apparatus for tumbling the respective gripper assemblies. Throughout the specification the same numerals are used to designate the same parts in the apparatus for tumbling the respective gripper assemblies and for the respective gripper assemblies.

FIGURE 2 is a section of one-half of the transfer cylinder **10** and illustrates the tubular external surface **18** with inner ribs **28**, **30** and **32** and an annular end portion **34** with a shaft portion **36** extending axially therefrom. The axial center or center line of the cylinder is indicated by the dash-dot line designated by the numeral **38**. The shaft portion **36** has an end portion **40** of reduced diameter rotatably supported in bearings **42** mounted in a receiver **44** secured in an aperture **46** in frame **12**.

A cam member **48** is secured to the receiver **44** and nonrotatably secured to the frame by rods **54** and **56** extending through apertures **50** in the frame **12**. A bridge member **52** is suitably secured to the rods **54** and **56** for movement of cam member **48** toward and away from the surface of the frame **12**. By adjusting nuts **58** the cam member **48** may be moved toward the inner surface of frame **12** and away from the cam roller **60** arranged to ride on cam surface **62** of cam member **48**. In this position, the press is adjusted for two-color operation and the gripper mechanisms remain stationary and are not tumbled. Where, however, the press is adjusted for perfector operation, the cam member **48** is moved away from the frame **12** to the position illustrated in FIGURE 2. In this position the cam roller **60** engages the cam surface **62** of cam **48** and tumbles the gripper assemblies **22** and **24**.

A pair of drive shafts **64** are journaled in tapered roller bearings **66** in the cylinder end portion **34**. One end of each drive shaft **64** is connected to a cam lever **68** that has the cam roller **60** rotatably secured thereto. The lever **68** (FIGURE 3) has an arm portion **70** with a stop surface **72** that is arranged to abut an adjustable stop member **74** secured to the external surface **76** of the cylinder end portion **34**. When the arm **70** abuts the stop member **74**, the gripper assembly is in an outwardly tumbled position as perfector gripper assembly **22** is illustrated in FIGURE 3. A plurality of springs, later described, urge the gripper assemblies **22** and **24** toward an outwardly tumbled position and against the stop member **74**.

The cylinder end portion **34** has a pair of longitudinal bores **78** therethrough and the web or rib portions **28**, **30** and **32** have similar pairs of aligned bores **80**, **82** and **84**. Positioned in the bores **78**, **80**, **82** and **84** within the transfer cylinder **10** are perfector and two-color actuator shafts **86** that are suitably journaled in needle bearings **88** in the bores **78** and **84**.

A separate link mechanism generally designated by the numeral **90** (FIGURES 2 and 4) connects each of the actuator shafts **86** with the drive shaft **64** and includes connecting rod **92** with yoke or bifurcated end portions **94** and **96**. The drive shaft **64** has a lever **98** nonrotatably secured thereto with an end portion **100** positioned between the bifurcated portions **94** of connecting rod **92**. A pin **102** connects the lever **98** to the rod **92**. Similarly, the actuator shaft **86** has a lever **104** nonrotatably connected thereto with an end portion **106** extending between the bifurcated portion **96** of rod **92**. A pin **108** rotatably connects the rod **92** to the lever **104**. With this arrangement, rotation of drive shaft **64** is transmitted through the link **90** to the actuated shaft **86** to rotate the same.

A perfector tumbler shaft **110** is suitably journaled in brackets **112**, **114**, **116** and **118** mounted on the transfer cylinder **10**. A similar two-color tumbler shaft **110** is also journaled in brackets mounted on the transfer cylinder. The bracket **112** is suitably secured to the transfer cylinder **10** by means of bolts **120** or the like. A stop member **122** is secured to the end of the tumbler shaft **110** adjacent the end thereof (FIGURE 3) and has a first arm portion **124** and a diametrically opposed second arm portion **126**. A stop member **128** is secured to the transfer cylinder end portion **34** and has a surface **130** against which the arm

124 of stop member 122 is arranged to abut when the gripper assembly 22 is in its outermost or untumbled position, as is illustrated in FIGURE 3. The stop member 128 has an inclined surface 132 against which the surface of arm 126 is arranged to abut when the perfector gripper assembly 22 is in its innermost tumbled position.

The two-color gripper assembly 24 has a similar stop member 122 and is designated by the same numeral. The two-color gripper assembly 24 in FIGURE 3 is illustrated with the arm 126 abutting the inclined surface 132. The gripper shaft brackets 134 are nonrotatably secured to the gripper tumbler shaft 110 in spaced relation along the tumbler shaft 110, as is illustrated in FIGURE 2. The gripper shaft brackets 134 have a gripper shaft 136 journaled therein for rotation relative to the tumbler shaft 110. The gripper actuating mechanism generally designated by the numeral 26 in FIGURE 1 is arranged to rotate the gripper shafts 136 relative to the tumbler shafts 110 in both the perfector gripper assembly 22 and the two-color gripper assembly 24.

The gripper shaft 136 has a plurality of gripper fingers 138 secured thereto in spaced relation to each other and spaced longitudinally along the gripper shaft 136. FIGURE 4 is a detailed view of gripper shafts 136 with gripper fingers 138 secured thereto for rotation therewith. The gripper fingers 138 have a rearwardly extending arm 140 and a gripper end portion 142. Gripper pads 144 are secured to the tumbler shaft 110 for rotation therewith and are positioned in underlying relation with the respective gripper fingers 138. The gripper pads 144 have an arcuate surface 146 that is engaged by the gripper finger 142 to grip the edge of the paper sheet therebetween. The gripper pad 144 has a rearwardly extending arm 148 that supports a spring 150. The spring 150 urges the gripper finger 142 into engagement with the surface 146 of gripper pad 144. FIGURE 4 illustrates the spring 150 in an expanded position for the perfector gripper assembly 22 and in a compressed position wherein the gripper finger 142 is spaced from the gripper pad 144 in the two-color gripper assembly 24. Rotation of perfector gripper shaft rod 136 in a counterclockwise direction as viewed in FIGURE 4, compresses the spring 150 and moves the gripper finger 142 away from the gripper pad 144.

In FIGURE 2 the gripper fingers and gripper pads for both the prefector gripper assemblies and the two-color gripper assemblies are illustrated diagrammatically by elongated rectangular blocks and are designated by the letters P and T-C respectively. The relative position of the perfector gripper assembly P and the two-color gripper assembly T-C on the transfer cylinder, although diagrammatic, is accurate to the extent that the gripper assemblies are illustrated in spaced relation to each other so that the gripper assemblies P and T-C may tumble inwardly toward the axis of the transfer cylinder 10 without interference.

Within the transfer cylinder 10 there are a plurality of transverse bores 154, 155 and 156 diagrammatically illustrated in FIGURE 2. FIGURE 5 illustrates in detail the bore 152 for the perfector spring 158 and bore 152 for the two-color spring 158. It should be understood, however, that the bore 152 for the perfector spring 158 and the bore 152 for the two-color spring 158 may be offset laterally from each other or aligned in the same transverse plane. The pair of bores 152 for the perfector spring and two-color spring are laterally offset whereas the pair of bores 154 are aligned with each other. The pair of bores 156 are likewise laterally offset from each other.

Referring to FIGURE 5, the bore 152 has a rod 160 extending axially therethrough with an enlarged head portion 162. A stop member 164 is secured in the bore 152 adjacent the upper edge by means of a snap ring 166 and spring 158 is positioned therebetween. The rod 160 is connected to a bracket 168 by means of a link-type chain 170. The bracket 168 is in turn nonrotatably secured to the tumbler shaft 110 for rotation therewith. The spring 158 thus urges the gripper assemblies 22 and 24 toward the outward untumbled position wherein the first arm portion 124 or stop member 122 abuts the stop member 128 (FIGURE 3). Sufficient torque is exerted by the plurality of springs 158 on the tumbler shaft 110 to maintain the tumbler shaft 110 in the position of the perfector tumbler shaft 110 illustrated in FIGURES 3 and 5. The perfector tumbler shaft 110, in order to rotate in a counterclockwise direction as illustrated in FIGURE 5, must compress the spring 158. The two-color tumbler shaft 110 is illustrated in the tumbled position in FIGURE 5 with the spring 158 compressed between the stops 162 and 164.

The tumbler shafts 110 are rotated by actuator shafts 86 through the drive connections generally designated by the numeral 172 and illustrated in FIGURES 2 and 6. The tumbler shaft 110 has a pinion gear 174 nonrotatably secured thereto with gear teeth 176 which mesh with a gear segment 178 at the outer end of a segment gear arm 180 that is nonrotatably secured at the other end 182 to the actuator shaft 86. Thus rotation of actuator shaft 86 rotates the tumbler shaft 110 by means of the gear segment 178 meshing with gear teeth 176 on the pinion gear 174. In FIGURE 6 the relative position of the gear segment 178 and the pinion gear 176 is illustrated for the perfector gripper assembly 22 in an untumbled outward position and in a tumbled inward position for the two-color gripper assembly 24.

OPERATION

The actuator mechanism illustrated in the drawings tumbles the respective perfector and two-color gripper assemblies 22 and 24 in the following manner. The tumbling of the perfector gripper assembly 22 will be described. It should be understood, however, that the two-color gripper assembly is tumbled in the same manner and in the timed relation with the perfector gripper assembly 22 as discussed in Gegenheimer et al. Patent 2,757,610.

The gripper assembly 22 is maintained in an outer untumbled position by the resilient springs 158. In this outer position the gripper shaft 136 is rotated to move the gripper finger end portions 142 away from the gripper pads 144. The trailing edge of the sheet is delivered to the third transfer cylinder and is engaged by the perfector gripper fingers 142 in the outermost untumbled position. Further rotation of the third transfer cylinder engages the cam roller 60 to the cam surface 62 (FIGURES 2 and 3) and moves lever 68 to rotate drive shaft 64. The link mechanism 90 transmits the rotation of drive shaft 64 to actuator shaft 86. The rotation of actuator shaft 86 is in turn transmitted to the tumbler shaft 110 through the meshing gears 178 and 180 to rotate the tumbler shaft 110 in a counterclockwise direction. The gripper pads 144 and the gripper shafts 136, being secured to the tumbler shaft 110 by brackets 134 rotate with the tumbler shaft 110 to tumble the gripper assembly 22 inwardly toward the axis of the transfer cylinder 10. When the tumbler shaft 110 is rotated to the extent that stop member 126 (FIGURE 3) abuts the surface 132 the gripper shaft 136 is rotated by the actuating means 26 to open the gripper fingers 138 and release the trailing edge of the sheet and transfer the trailing edge of the sheet to the grippers of the two-color gripper assembly 24 which have rotated to the innermost tumbled position. Further rotation of the transfer cylinder 10 results in the cam roller 60 leaving the cam surface 62 so that the springs 158 return the gripper assemblies 22 and 24 in sequence to their outermost untumbled position. The trailing edge of the sheet now engaged by the two-color gripper assembly 24 is delivered to the impression cylinder of the second printing unit.

The tumbler shaft 110 is actuated or rotated intermediate its end portions and preferably at its midpoint or longitudinal center by the driving connections 172 between the actuator shaft 86 and the tumbler shaft 110. Because

of the relative location of the actuator shaft **86**, the actuator shaft has a diameter substantially larger than the diameter of the tumbler shaft **110**. There is little, if any, torsional deflection imparted to the actuator shaft **86** during the rotation of the tumbler shaft **110** against the biasing force of the spring **158**. Because the tumbler shaft **110** is engaged at its midpoint and torque applied at this location to rotate the tumbler shaft and tumble the respective gripper assembly, torsional deflection of the tumbler shaft is maintained at a minimum and the gripper assemblies remain in aligned relation and in the same plane as they are tumbled inwardly to transfer the trailing edge of the sheet in perfector printing. The alignment of the gripper assemblies makes it possible to accurately transfer the sheet from one printing unit to the other so that the printing on the two sides of the sheet are matched.

According to the provisions of the patent statutes, I have explained the principles, preferred construction, and mode of operation of my invention and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. In a transfer cylinder for handling and transferring a sheet having a gripper assembly secured to the periphery thereof, said gripper assembly being operable to tumble toward and away from the axis of said cylinder, a tumbler shaft associated with said gripper assembly and rotatably mounted in said cylnder, and means urging said tumbler shaft to rotate in a first direction, the improvement comprising,

an actuator shaft rotatably mounted in said transfer cylinder,

drive means operable to rotate said actuator shaft in timed relation to the rotation of said transfer cylinder, and

means drivingly connecting said actuator shaft to said tumbler shaft at a location intermediate the ends of said tumbler shaft so that said actuator shaft, upon rotation by said drive means, rotates said tumbler shaft in a second direction by imparting torque to said intermediate portion of said tumbler shaft.

2. A transfer cylinder as set forth in claim 1 in which, said drive means includes a drive shaft journaled in said cylinder in spaced parallel relation to said actuator shaft, and

means drivingly connecting said drive shaft to said actuator shaft to transmit rotation of said drive shaft to said actuator shaft.

3. A transfer cylinder as set forth in claim 2 in which, said means drivingly connecting said drive shaft to said actuator shaft includes a link member secured to said drive shaft and said actuator shaft at a location adjacent an end portion of said transfer cylinder.

4. A transfer cylinder as set forth in claim 1 in which, said drive means includes a drive shaft journaled in said cylinder in spaced parallel relation to said actuator shaft,

said drive shaft having an end portion extending outwardly beyond an end portion of said cylinder,

a lever connected to said drive shaft end portion and operable to rotate said drive shaft, and

a link member connecting said drive shaft to said actuator shaft at a location adjacent the end portion of said transfer cylinder, said link member being operable to transmit rotation of said drive shaft to said actuator shaft.

5. A transfer cylinder as set forth in claim 4 in which, said link member includes a first lever secured to said drive shaft,

a second lever secured to said actuator shaft,

a rod member having bifurcated end portions with said respective levers positioned between said respective bifurcated end portions, and

pin members connecting said levers to said rod member.

6. A transfer cylinder as set forth in claim 1 in which, said actuator shaft is rotatably mounted in said cylinder in parallel spaced relation to said tumbler shaft and the diameter of said actuator shaft being greater than the diameter of said tumbler shaft.

7. A transfer cylinder as set forth in claim 1 in which, said means drivingly connecting said actuator shaft to said tumbler shaft includes a pinion gear secured to the intermediate portion of said tumbler shaft,

a lever secured at one end to said actuator shaft and having a gear segment at the other end,

said gear segment meshing with said pinion gear so that rotation of said actuator shaft pivots said lever and said gear segment thereon rotates said pinion gear and rotates said tumbler shaft secured thereto.

8. A transfer cylinder as set forth in claim 1 in which, said drive means for rotating said actuator shaft in timed relation to the rotation of said transfer cylinder includes a drive shaft journaled in said cylinder in spaced parallel relation to said actuator shaft,

a link member secured to said drive shaft and said actuator shaft at a location adjacent an end portion of said transfer cylinder, said link member being operable to transmit rotation of said drive shaft to said actuator shaft,

said means for drivingly connecting said actuator shaft to said tumbler shaft including a pinion gear secured to the intermediate portion of said tumbler shaft,

a lever secured at one end to said actuator shaft and having a gear segment secured at the other end,

said gear segment meshing with said pinion gear so that rotation of said actuator shaft pivots said lever and said gear segment rotates with said pinion gear and said tumbler shaft secured thereto.

9. In a transfer cylinder as set forth in claim 1 in which,

said drive means includes a drive shaft journaled in said cylinder in spaced parallel relation to said actuator shaft,

said drive shaft having an end portion extending outwardly beyond an end portion of said cylinder,

a lever connected to said drive shaft end portion and operable to rotate said drive shaft,

a first lever secured to said drive shaft,

a second lever secured to said actuator shaft,

a rod member having bifurcated end portions with said respective levers positioned between said respective bifurcated end portions,

pin members connecting said levers to said rod,

said levers and said rod connecting said drive shaft to said actuator shaft at a location adjacent the end portion of said transfer cylinder, said levers and said rod member being operable to transmit rotation of said drive shaft to said actuator shaft,

a pinion gear secured to the intermediate portion of said tumbler shaft,

a lever secured at one end to said actuator shaft and having a gear segment at the other end,

said gear segment meshing with said pinion gear so that rotation of said actuator shaft pivots said lever and said gear segment rotates said pinion gear and said tumbler shaft secured thereto.

References Cited

UNITED STATES PATENTS

2,757,610	8/1956	Gegenheimer	101—183
2,984,178	5/1961	Koch	101—409

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