Feb. 14, 1967 K. J. TONKIN ETAL 3,303,778

OFFSET DUPLICATING MACHINE HAVING UNIFIED CONTROL

Filed Aug. 10, 1964 5 Sheets-Sheet 1

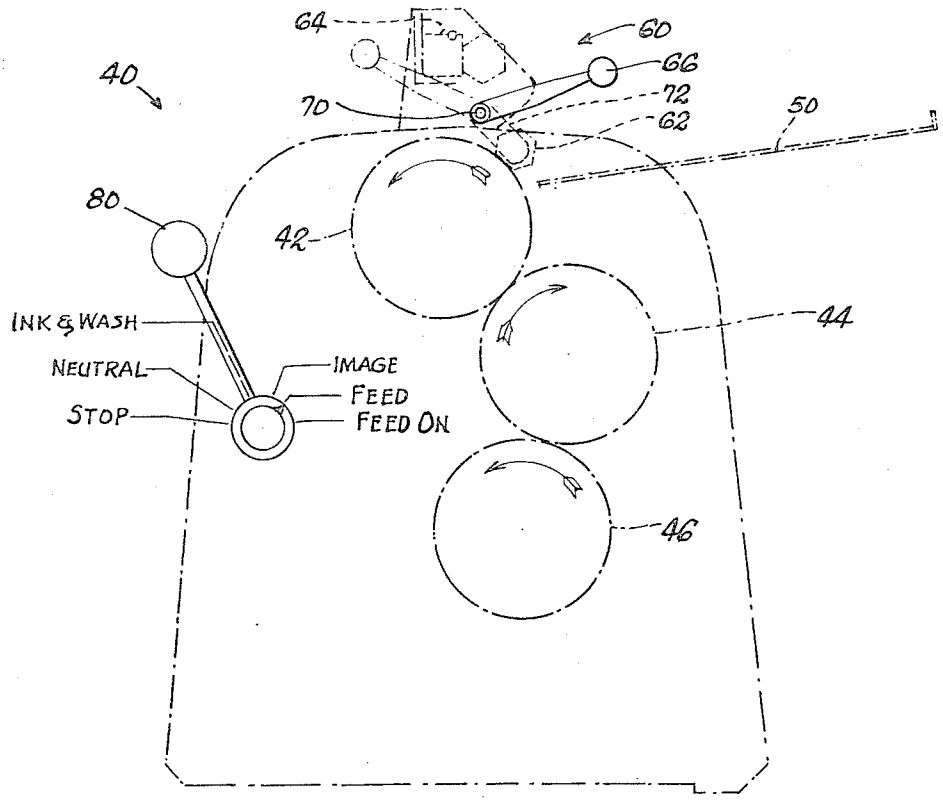


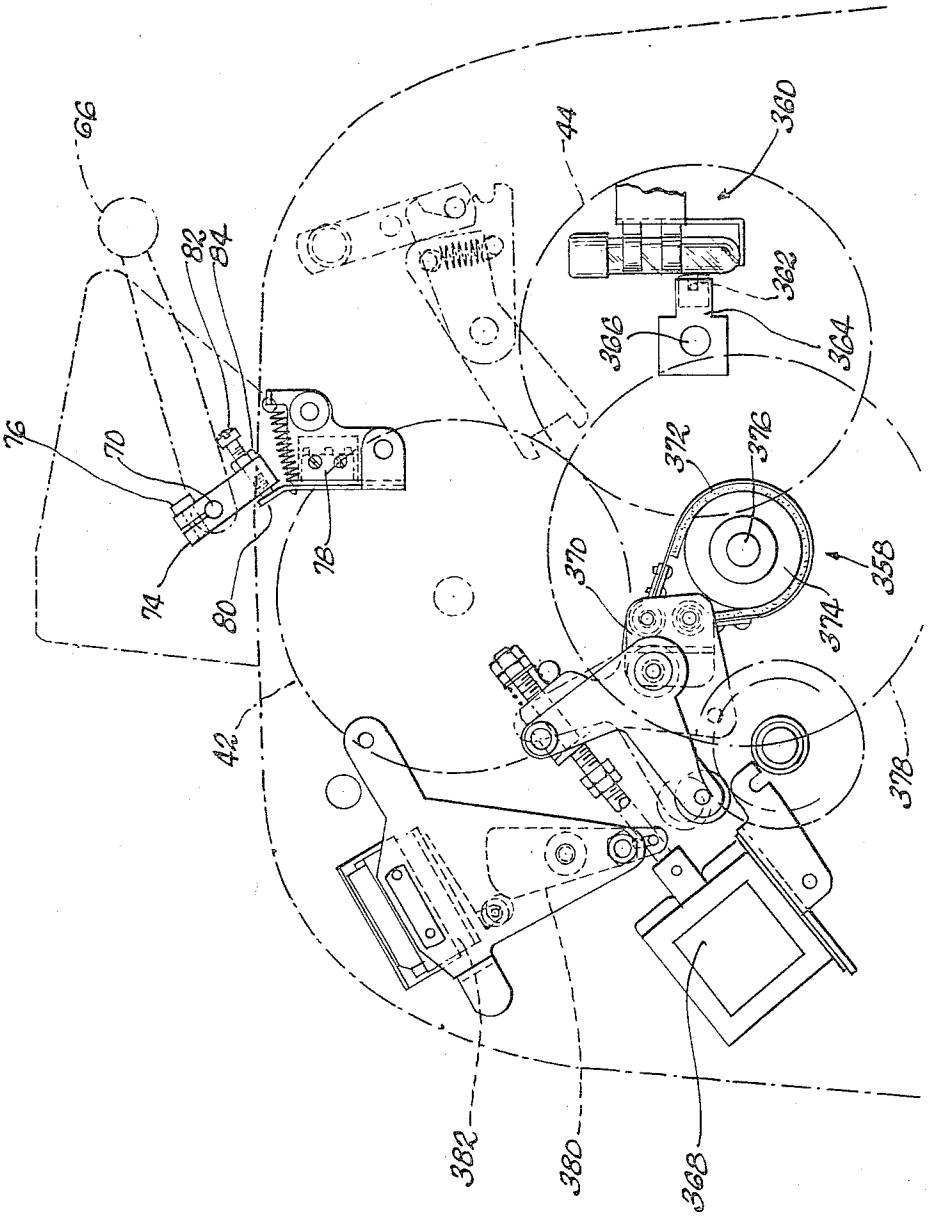
FIG. 1

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OFFSET DUPLICATING MACHINE HAVING UNIFIED CONTROL

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FIG. 2

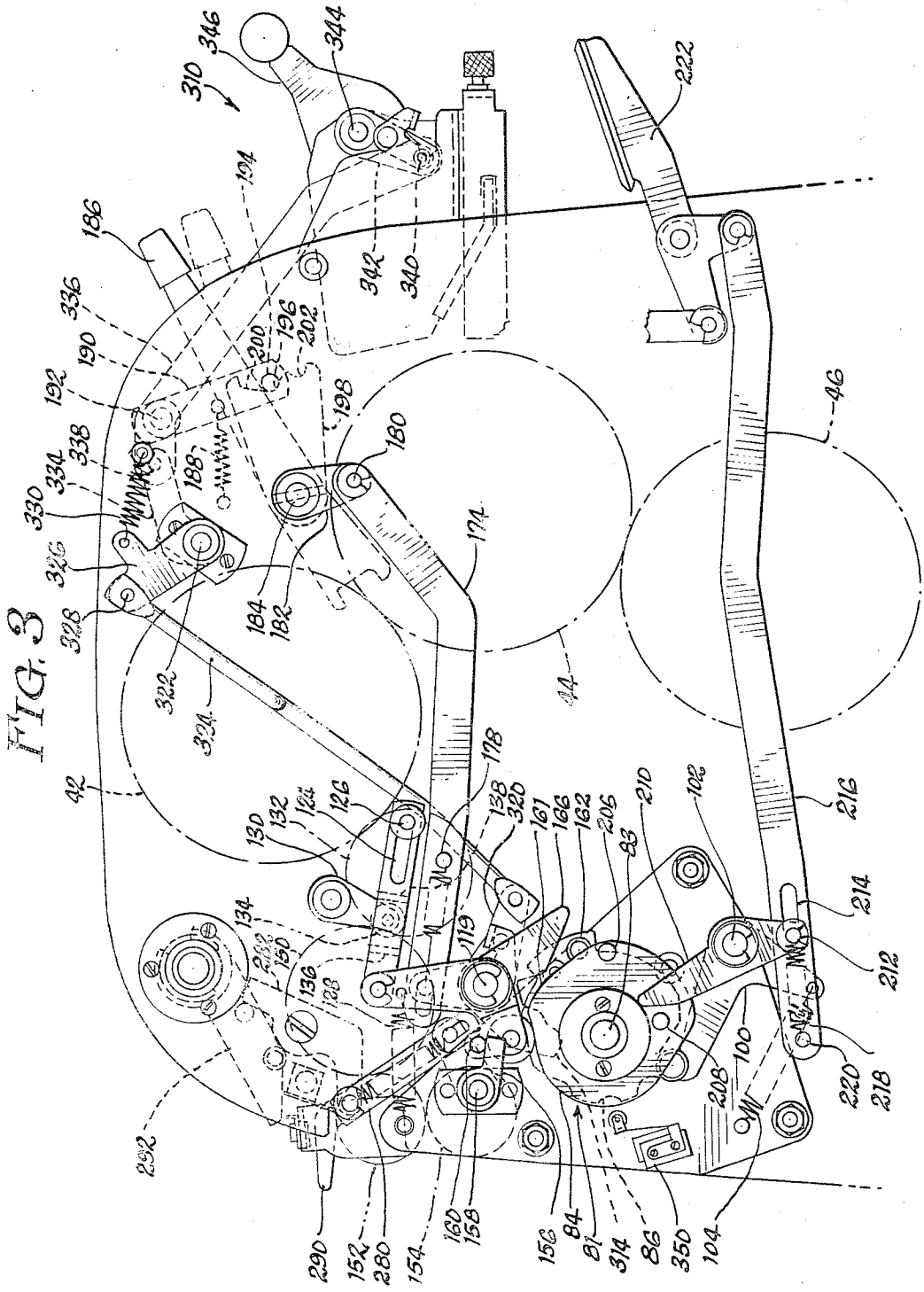


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OFFSET DUPLICATING MACHINE HAVING UNIFIED CONTROL

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FIG. 3



OFFSET DUPLICATING MACHINE HAVING UNIFIED CONTROL

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FIG. 4

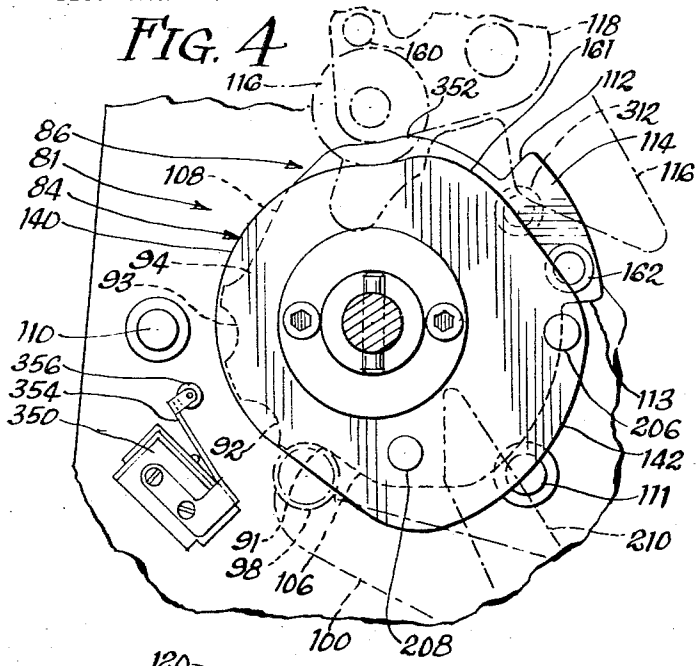


FIG. 5

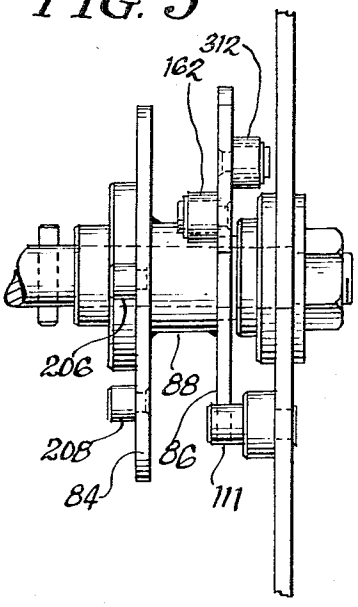


FIG. 7

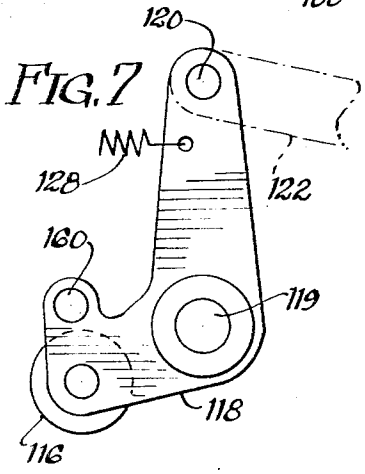


FIG. 8

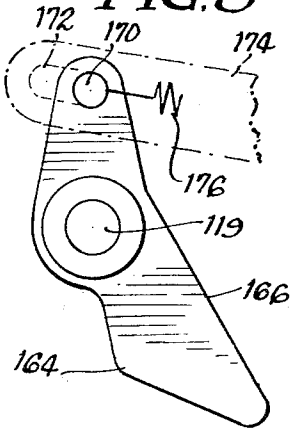


FIG. 9

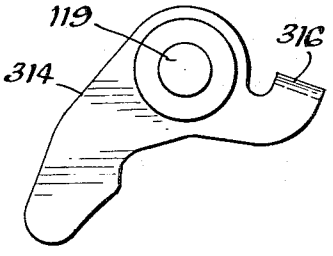


FIG. 6

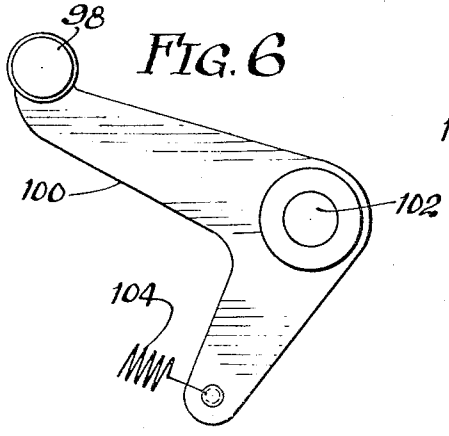
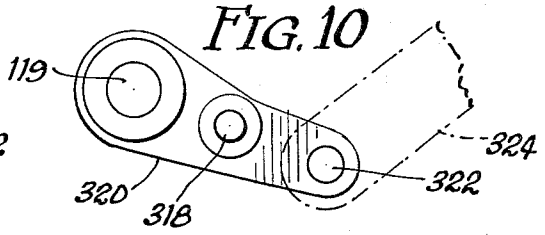


FIG. 10



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OFFSET DUPLICATING MACHINE HAVING UNIFIED CONTROL

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FIG. 12

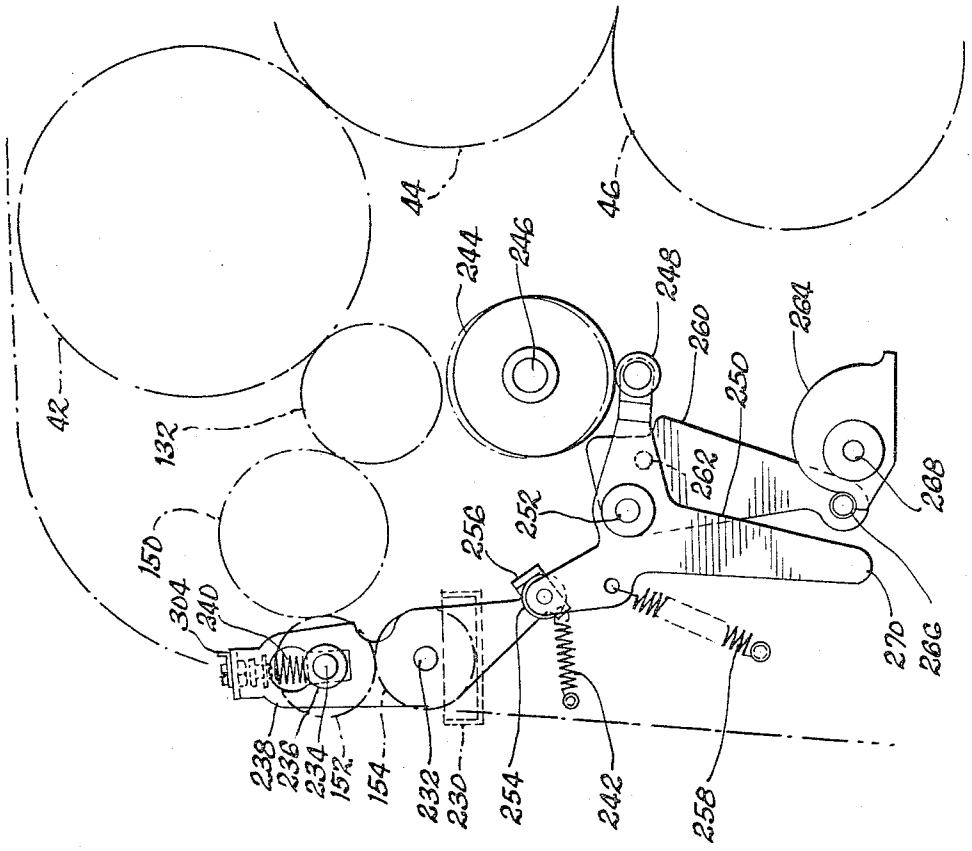
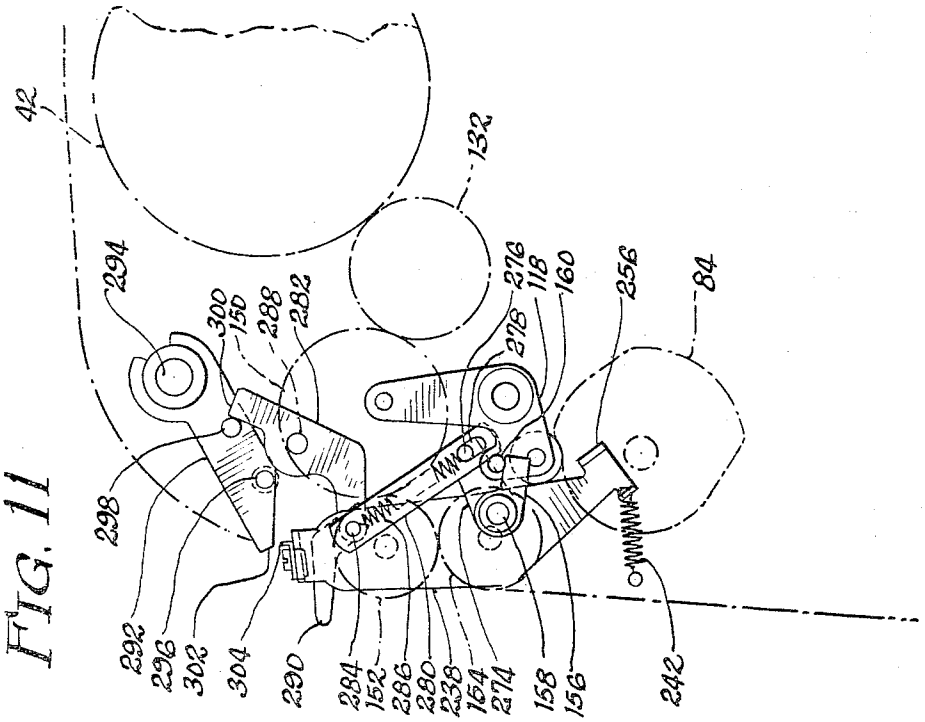


FIG. 11



United States Patent Office 3,303,778 Patented Feb. 14, 1967

3,303,778

OFFSET DUPLICATING MACHINE HAVING UNIFIED CONTROL

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Filed Aug. 10, 1964, Ser. No. 388,475
16 Claims. (Cl. 101—144)

This invention relates to duplicating machines and printing presses in general, and particularly to offset duplicating machines. Such offset machines normally use the lithographic process and involve a transfer or offsetting of the printed impression from the lithographic printing plate or master sheet to a rubber blanket, which in turn transfers the printed impression to a copy sheet.

One principal object of the present invention is to provide an offset duplicating machine in which the various mechanisms of the machine are automatically controlled and coordinated in a new and improved manner, so that the machine may be operated with much greater speed and facility, while the possibility of human error is greatly reduced.

A further object is to provide a new and improved offset duplicator in which a single master control lever or member is provided to unify the control of the machine, so that most of the control functions may be carried out simply by operating the single control lever.

It is a further object to provide such a new and improved offset duplicator in which the single control lever or member actuates the inking mechanism, the dampening mechanism, the imaging mechanism for bringing the master cylinder into engagement with the blanket, the feed mechanism for supplying copy sheets to the machine, and the blanket washing mechanism for washing the old image off the banket, in preparation for the use of a new master sheet.

Another object is to provide such a new and improved offset duplicator in which the single control lever is also effective to shut off the machine at the conclusion of a printing run.

It is a further object to provide such a new and improved offset duplicator in which the printing operation is started by swinging the control lever in one direction, and is terminated by swinging the lever in the opposite direction.

A further object is to provide such a new and improved offset duplicator in which the single control lever is operative to carry out one function at a certain position during the movement of the lever in one direction, and a different function at the same position during the movement of the lever in the opposite direction.

It is a further object to provide such a new and improved offset duplicator in which the blanket washing mechanism is actuated at a certain position during the return movement of the single control lever, while the machine is being shut down, but is not actuated during the advancing movement of the control lever, while the machine is being started up. The blanket washer may be actuated in the same position of the control lever, during its return movement, as the inking mechanism is actuated during the advancing movement of the lever.

A further object is to provide such as offset machine in which the single control lever is effective to control the repellent mechanism in a new and improved manner.

Another object is to provide such a new and improved offset duplicator in which the unified control system greatly facilitates and speeds up the operation of the machine, and also reduces the possibility of human error, while adding only a relatively small amount to the cost of the machine.

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 general diagrammatic side elevational view of a lithographic offset duplicator to be described as an illustrative embodiment of the present invention.

FIG. 2 is a diagrammatic elevational view showing the switch mechanism for starting the machine when the etch applicator mechanism is operated, and also the brake for stopping the machine.

FIG. 3 is a diagrammatic elevational view showing the unified automatic control mechanism which is operated by the single control lever, to co-ordinate the operations involved in starting up and shutting down the machine.

FIG. 4 is an enlarged diagrammatic view of the cam cluster which is operated by the single control lever.

FIG. 5 is an edge view of the cam cluster.

FIGS. 6–10 are elevational views of various control levers operated by the cam cluster. Specifically, FIG. 6 illustrates the detent lever; FIG. 7, the control lever for the inking and dampening mechanism; FIG. 8, the control lever to cause the image to be developed on the blanket; FIG. 9, the blanket washer pawl; and FIG. 10, the blanket washer lever, operable by the pawl.

FIG. 11 is a diagrammatic elevational view of a portion of the mechanism for operating and controlling the dampening mechanism.

FIG. 12 is a diagrammatic elevational view showing the remaining portion of the operating and control mechanism for the dampening system.

The present invention will be described as embodied in a lithographic offset duplicator or printing press **40**, illustrated diagrammatically in FIG. 1. This machine is of the three-cylinder type, having a master cylinder **42**, a blanket or offset cylinder **44**, and an impression cylinder **46**. The master cylinder **42** is adapted to carry the master or printing sheet, which is usually made of paper or thin sheet metal, such as aluminum. Normally, the machine uses the lithographic process, so that certain image areas of the master are adapted to accept lithographic ink. The non-image areas of the master are adapted to accept water or a water-base moistening solution, which repels the ink.

The ink applied to the master on the master cylinder **42** is transferred or offset to the rubber blanket on the blanket cylinder **44**. Copy sheets, usually made of paper, are fed between the blanket cylinder **44** and the impression cylinder **46**, so that the inked image on the blanket will be transferred to the copy sheets. Offset duplicators of this general construction are well known to those skilled in the art.

To facilitate the loading of the master sheet on to the master cylinder **42**, the machine may be provided with a master feed table **50**, shown diagrammatically in FIG. 1. At the beginning of a new printing run, a master may be placed on the feed table **50** and may be fed manually to the master cylinder **42**. At this time, the master cylinder **42** is stationary and is correctly positioned to receive the master from the feed table **50**. To hold the master, the master cylinder **42** may be provided with a suitable clamp. Those skilled in the art will be familiar with such master clamps.

The lithographic duplicator **40** is equipped with an etch applicator or mechanism **60** for applying an etching solution to the new master on the master cylinder **42**, to prepare the master for the application of water and ink. In this case, the etch applicator **60** comprises a pad or wiper **62** which is movable between a sponge **64** and the surface of the master on the master cylinder **42**. The sponge **64** serves as a reservoir to hold a supply of the etching solution. The illustrated pad **62** is hexagonal in shape so as to provide six working surfaces which may be used successively to prolong the life of the pad. The etch ap-

plicator **60** is provided with an actuating lever **66** which may be swung clockwise to move the pad **62** between the sponge **64** and the master cylinder **42**.

The etch applicator **60** is preferably constructed and arranged so that the actuation of the etch applicator automatically energizes the drive motor which rotates the cylinders **42**, **44** and **46**. This automatic control arrangement is shown to advantage in FIG. 2. It will be seen that the etch applicator **60** comprises a shaft **70** to which the control lever **66** is secured. The shaft **70** also carries a pair of arms **72** which support the applicator pad or roller **62**. To start the machine, a switch actuating arm **74** is secured to the shaft **70** by means of a clamp **76**, so that the position of the arm **74** on the shaft **70** may readily be adjusted. A control switch **78** is provided to energize the drive motor for the machine. The switch **78** has a swingable operating lever **77** which is adapted to be engaged and actuated by the end of an adjusting screw **79** mounted on the arm **74**. A lock nut **79***a* is provided to retain the screw **79** in its adjusted position.

When the etch applicator **60** is actuated, the arm **74** is swung clockwise. The screw **79** engages the lever **77** and swings it counterclockwise. In this way, the switch **78** is operated so as to start the machine.

This tie-in between the etch applicator and the starting of the machine insures that the etch applicator will be actuated to apply the etching solution to each new master sheet at the beginning of each printing run. The applicator pad **62** is already in engagement with the master sheet on the master cylinder **42** when the machine is started by the actuation of the switch **78**. The control lever **66** is held in its actuated position for at least one revolution of the master cylinder, so that the etching solution will be applied to the entire master sheet.

The duplicator **40** has a single master control lever or member **80** which operates a unified control mechanism **82** (FIG. 3), to be described in detail presently. The lever **80** is employed by the operator to carry out all of the functions which are necessary to initiate and terminate the printing of copy sheets from any particular master. It will be seen that the control lever **80** has six positions. The normal starting position is designated NEUTRAL. The control lever **80** should be in the NEUTRAL position when the machine is started by the actuation of the etch control lever **66**. After the etching solution has been applied to the new master and the etch control lever **66** has been returned to its initial position, the control lever **80** is advanced one step in a clockwise direction to the position designated INK. In this position, the inking mechanism is actuated so that ink will be applied to the master.

The control lever **80** is then advanced another step to the position designated IMAGE. This movement of the control lever causes the master cylinder **42** to move into engagement with the blanket cylinder **44** so that ink is transferred to the rubber blanket to develop an inked image on the blanket.

Next, the master control lever **80** is swung clockwise to the FEED position, and then is swung an additional amount to the FEED ON position. The movement of the control lever to the FEED position actuates the dampening mechanism so that water will be applied to the master sheet on the master cylinder **42**. The movement of the control lever **80** to the FEED ON position initiates the operation of the mechanism which feeds paper sheets between the blanket and impression cylinders **44** and **46**. Such paper feed mechanisms are well known to those skilled in the art.

When the lever **80** is released, it does not stay in the FEED ON position, but is resiliently returned to the FEED position, while the feed mechanism continues to operate. In FIG. 1 the control lever **80** is shown in the FEED position. The lever **80** is left in the FEED position until the desired number of copy sheets have been printed. The control lever **80** is then returned manually in a counterclockwise direction, through the IMAGE and INK positions to the NEUTRAL position. The return movement to the IMAGE position terminates the operation of the paper feed mechanism if such operation has not already been terminated by an automatic counter or a separate manual control. The return of the control lever **80** to the IMAGE position also discontinues the supply of water to the master cylinder.

The INK position of the control lever **80** is also designated WASH. In this position, on the return movement of the control lever **80**, the blanket washing mechanism is actuated so as to wash the ink off the rubber blanket on the blanket cylinder **44**. Such blanket washing mechanisms are well known to those skilled in the art.

The return of the control lever **80** to the NEUTRAL position cuts off the supply of ink to the master on the master cylinder **42**.

Next, the master lever **80** is moved in a counterclockwise direction beyond the NEUTRAL position to the position designated STOP, whereupon the cylinders **42**, **44** and **46** are stopped in a convenient position for changing the master on the master cylinder **42**. When the lever **80** is released, it returns resiliently to the NEUTRAL position. The machine is then ready for the loading of a new master and the cycling of the machine through a new printing run.

The details of the unified control mechanism **82** are shown in FIGS. 3–10. The master control lever **80** is connected to a cam cluster or assembly **81** which is rotatable about a pivot or shaft **83**. It will be seen that the cam cluster **81** comprises a control cam **84** and a detent cam **86** which are secured together by means of a hub or spacer **88**. In FIGS. 3 and 4, the cam cluster **81** is shown in the position which it occupies when the control lever **80** is in the FEED position. The detent cam **86** is formed with a series of detent notches **91**, **92**, **93** and **94**, which correspond to the FEED, IMAGE, INK and NEUTRAL positions of the master control lever **80**.

The detent cam **86** is engaged by a roller **98** carried by a follower lever **100** which is swingable about a pivot **102**. A spring **104** is provided to bias the lever **100** in a clockwise-direction so that the roller **98** will be held against the detent cam **86**.

Two of the detent notches **92** and **93** are generally semicircular to provide a definite detenting action in both directions, but the detent notch **91** has one side portion **106** which slopes gradually in an outward direction to provide a spring return action for the FEED ON position. It will be recalled that the detent cam **86** is shown in the FEED position in FIGS. 3 and 4. When the cam is rotated clockwise to the FEED ON position, the roller **98** rides up the inclined portion **106**. When the control lever **80** is released the spring **104** is effective to return the detent cam **86** to the FEED position.

Similarly, the detent notch **94** has one side portion **108** which slopes gradually in an outward direction to provide a spring return action for the STOP position. Thus, the spring **104** is effective to return the detent cam **86** to the NEUTRAL position when the lever **80** is released after being swung to the STOP position.

The rotation of the cam cluster **81** is limited by two fixed stop pins **110** and **111** which are engageable by radial shoulders **112** and **113** on the detent cam **86**. The shoulders **112** and **113** are formed on an outwardly projecting portion **114** of the detent cam **86**. The shoulder **113** engages the fixed pin **111** when the control lever **80** is swung clockwise to the FEED ON position. When the control lever **80** is swung counterclockwise to the STOP position, the shoulder **112** engages the fixed pin **110**.

The control cam **84** is engaged by a roller **116** which is carried by one end of an L shaped lever **118**, shown in FIGS. 3, 4, 7 and 11. The lever **118** is swingable about a pivot pin **119**. The other end of the lever **118** is connected by means of a pin **120** to a link **122**. As shown in FIG. 3, the link **122** is formed with a slot **124** in which a

fixed guide pin 126 is slidably received. Thus, the swinging movement of the lever 118 causes the link 122 to slide upon the pin 126. A spring 128 is connected to the lever 118 to bias it counterclockwise so that the roller 116 will be held against the control cam 84.

The link 122 is adapted to operate a lever 130 which controls the application of ink to the master on the master cylinder 42. The ink is applied to the master cylinder 42 by an inking system which includes a form roller 132. Such inking systems are well know to those skilled in the art. When the lever 130 is swing clockwise, to the position shown in FIG. 3, the form roller 132 is moved into engagement with the master cylinder 42. When the lever 130 is swung counterclockwise, the form roller 132 is separated from the master cylinder 42. The lever 130 carries a roller 134 which is adapted to be engaged by a pair of spaced flanges 136 and 138 on the link 122.

As shown in FIGS. 3 and 4 roller 116 is on the low portion 140 of the control cam 84. The cam 84 also has a high portion 142 which engages the roller 116 when the cam 84 is rotated to the NEUTRAL position. Thus, the lever 118 is swung clockwise so as to move the link 122 to the right. Such movement of the link 122 causes the flange 136 to engage the roller 134 so as to shift the lever 130 in a counterclockwise direction. In this way, the form roller 132 is moved away from the master cylinder 42. The lever 118 is also employed to control the application of water or repellent solution to the master sheet on the master cylinder 42. The water is applied to the master by the form roller 132 which receives the water from an oscillating roller 150 which is one of the rollers of the inking system. The roller 150 oscillates longitudinally and is effective to spread the ink uniformly on the form roller 132.

The water is applied to the oscillating roller 150 by a water ductor roller 152 which in turn receives the water from a fountain roller 154. In this case, the ductor roller 152 continuously engages the fountain roller 154, but is moved into and out of engagement with the oscillating roller 150 in a cyclical manner. When it is desired to interrupt the supply of water to the form roller 132, the ductor roller 152 is held away from the oscillating roller 150.

Such interruption of the supply of water is brought about by the movement of an arm 156 which is mounted on a shaft 158 and is adapted to be swung clockwise by a pin 160 on the lever 118. When the control cam 84 is moved between the FEED and IMAGE positions, the lever 118 is swung clockwise by an intermediate portion 161 on the came 84. This swinging movement causes the arm 156 to swing counterclockwise, with the result that the supply of water to the form roller 132 is interrupted, in a manner to be described in detail presently. When the cam 84 is moved between the INK and NEUTRAL positions, the lever 118 is swung an additional amount, so that the form roller 132 is separated from the master cylinder 42 as previously described.

When the printing operation is started, the control lever 80 is moved from the NEUTRAL position to the INK position. The cam 84 causes the lever 118 to swing counterclockwise and thereby causes the form roller 132 to move against the master cylinder 42. The position of the form roller is maintained when the lever 80 is moved to the IMAGE, FEED and FEED ON positions. When the control lever 80 is moved between the IMAGE and FEED positions, the cam 84 causes the lever 118 to swing counterclockwise an additional amount, with the result that the arm 156 is swung clockwise, so as to start the application of water to the oscillating roller 150 by the ductor roller 152. Further details of the water system will be described presently, in connection with FIGS. 11 and 12.

In the IMAGE position, the master cylinder 42 is shifted so that the master engages the blanket cylinder 44. This causes an image of the master to develop on the blanket. The shifting of the master cylinder 42 is brought about by a roller 162 which is mounted on the detent cam 86 and projects forwardly therefrom, as shown in FIGS. 3–5. When the control lever 80 is moved to the IMAGE position, the roller 162 engages a cam lobe 164 on a lever 166 and causes the lever to swing counterclockwise about the pivot pin 119. It will be recalled that the pin 119 also supports the lever 118. The upper end of the lever 166 is provided with a pin 170 which is slidably received in a slot 172 formed in a link 174. A spring 176 is connected between the pin 170 and another pin 178 on the link 174. Normally, the spring 176 holds the right-hand end of the slot 172 against the pin 170. The spring 176 causes the link 174 to move to the left when the lever 166 is swung counterclockwise. The right-hand end of the link 174 is connected by means of a pin 180 to an arm 182 which is mounted on a shaft 184. The shaft 184 also supports a control lever 186 which may be swung downwardly to operate a mechanism which is effective to cause the master cylinder 42 to be shifted into engagement with the blanket cylinder 44.

To provide a spring return for the control lever 186 a spring 188 is connected to a detent arm 190 so as to bias the arm in a clockwise direction about its pivot 192. The arm 190 carries a detent pin 194 which initially engages a detent notch 196 in a plate 198 which is secured to the shaft 184. The notch 196 has one side portion 200 which slopes gradually in an outward direction so that the camming action between the pin 194 and the sloping portion 200 tends to return the lever 186 to its initial position when the lever is swung clockwise. The detent plate 198 also has another notch 202 adapted to retain the pin 194 when the lever 186 is swung manually in a counterclockwise direction. Such movement of the lever from its initial position is effective to hold the master cylinder 42 away from the blanket cylinder 44.

Movement of the control lever 80 to the IMAGE position causes the lever 166 to be swung counterclockwise so as ot actuate the mechanism which causes the master cylinder to move into engagement with the blanket cylinder. When the master control lever 80 is moved to the FEED and FEED ON positions, the roller 162 no longer engages the lever 166, so that the movement of the master cylinder 42 into and out of engagement with the blanket cylinder 44 is controlled automatically by the paper feed mechanism, in a manner that will be familiar to those skilled in the art. When the feeding of the paper sheets is terminated, the feed mechanism causes the master cylinder to be separated from the blanket cylinder.

The movement of the control lever 80 to the FEED ON position starts the operation of the feed mechanism for the paper sheets. The operation of the feed mechanism continues when the lever 80 is allowed to return to the FEED position. When the lever 80 is returned to the IMAGE position, the feed mechanism is turned off.

The functions of turning the feed mechanism on and off are controlled by pins 206 and 208 projecting forwardly from the control cam 84. The pins 206 and 208 are engageable with the opposite edges of a lever 210 which is swingable about the pivot pin 102. It will be recalled that the pin 102 also supports the detent lever 100. The lower end of the lever 210 is fitted with a pin 212 which is slidably received in a slot 214 formed in an elongated link 216. A spring 218 is connected between the pin 212 and another pin 220 on the link 216.

The right-hand end of the link 216 is connected to a hand lever 222 which controls the operation of the paper feed mechanism. Such control arrangements will be familiar to those skilled in the art. When the lever 222 is swung upwardly, the operation of the paper feed mechanism is started, so that the paper sheets are fed between the blanket and impression cylinders 44 and 46. Such movement of the lever 222 is caused by the pin 206

when it engages the lever **210** and swings it in a counterclockwise direction. The lever **222** is detained in its raised position by a detent mechanism embodied in the paper feed mechanism, not shown.

In FIG. 3, the lever **222** is shown in its raised position, in which the FEED is on. Likewise, the lever **210** is shown in its actuated position. When the control lever **80** is moved from the FEED position to the IMAGE position, the pin **208** engages the lever **210** and swings it in a clockwise direction to the position in which the FEED is off. The lever **210** is then out of the path of the pin **208** so that the pin **208** is able to pass the lever without interference. It will be noted that the pin **206** is at a greater radial distance from the axis of the cam cluster **81** than is the pin **208**. Thus, the lever **210** is still in the path of the pin **206** when the lever **210** is in its OFF position.

As already indicated, FIGS. 11 and 12 illustrate additional details of the control arrangement for the repellent system which supplies water to the master sheet on the master cylinder **42** during the printing operation. The fountain roller **154** is partly immersed in a pool of water or repellent solution contained in a fountain or trough **230**. The roller **154** has a shaft **232** which is geared to the blanket cylinder **44** and thus is continuously driven. The ductor roller **152** is frictionally driven by the fountain roller **154**.

The ductor roller **152** has a shaft **234** which is supported by bearings **236** mounted on a pair of levers **238**. Springs **240** are mounted on the levers **238** to bias the bearings **236** downwardly so that the ductor roller **152** will be pressed against the fountain roller **154**. The levers **238** are freely swingable about the shaft **232**.

The ductor roller **152** is biased toward the oscillating roller **150** by a pair of springs **242** which are connected to the lower ends of the levers **238**. A pair of eccentrics or cams **244** are provided to swing the levers **238** in a counterclockwise direction so as to move the ductor roller **152** away from the oscillating roller **150**. The eccentrics **244** are secured to a shaft **246** which is geared to the blanket cylinder **44** and thus is continuously driven.

The eccentrics **244** are adapted to be engaged by rollers **248** mounted on a pair of cam follower levers **250** which are swingable about pivots **252**. Each lever **250** carries a roller **254** which is engageable with a flange or ear **256** on the corresponding lever **238**. A spring **258** is connected to each lever **250** to bias it in a counterclockwise direction so that the rollers **248** will tend to follow the eccentrics **244**.

To provide for adjustment of swinging movement of the ductor roller **152**, the pivots **252** are mounted on swingable plates or levers **260** which in turn are supported by fixed pivots **262**. Manually operable cams **264** are provided to adjust the positions of the plates **260**. The lower end of each plate **260** is fitted with a pin or roller **266** to engage the corresponding cam **264**. The cams **264** are secured to a shaft **268** which may be rotated manually to adjust the positions of the cams **264**. The springs **258** are effective to hold the pins **266** against the cams **264**. The pins **266** also serve as stops for elongated arms **270** which project downwardly on the levers **250**.

As shown in FIG. 12, the cams **264** are turned so that their low points engage the pins **266**. In this position, the pivots **252** are moved to the maximum extent away from the eccentrics **244**, so that the cam follower levers **250** are not able to move the levers **238**, even when the levers **250** are swung to the maximum possible extent in the clockwise direction by the eccentrics **244**. As the cams **264** are rotated counterclockwise, the pivots **252** are moved closer to the eccentrics **244** so that the cam follower lever **250** is able to move the ductor roller **152** away from the oscillating roller **150** during part of the rotary cycle of the eccentrics **244**. When the high point on each of the cams **264** engages the corresponding pin **266**, the ductor roller **152** is held away from the oscillating roller **150** during the entire cycle of the eccentrics **244**. Thus, the cams **264** are effective to adjust the portion of the cycle during which the ductor roller **152** dwells against the oscillating roller **150**. It is during this interval of dwell that the water is actually supplied to the oscillating roller **150**.

It has already been indicated that the clockwise movement of the lever **118**, due to the rotation of the control cam **86** between its FEED and IMAGE positions, is effective to discontinue the supplying of water to the oscillating roller **150**. Such movement of the lever **118** causes counterclockwise movement of the arm **156**, as it follows the pin **160** on the lever **118**.

As shown in FIG. 11, the shaft **158**, to which the arm **156** is secured, also carries an arm **274** which is fitted with a pin **276**. The pin extends through a slot **278** in the lower end of a link **280**. The upper end of the link **280** is connected to a lever **282** by means of a pin **284**. A spring **286** is connected between the pins **276** and **284** and is normally effective to hold the pin **276** against the upper end of the slot **278**. The lever **282** is swingable about a pivot **288** and is provided with an extension **290** which is accessible for manual operation.

The lever **282** is adapted to operate a pair of blocking levers **292** which are swingable about pivots **294** and are connected together by a cross rod **296** to form a swing frame adapted to swing as a unit. The levers **292** are on opposite sides of the machine and are adapted to block the movement of the levers **238** on which the ductor roller **152** is mounted. One of the levers **292** carries a pin **298** which is engageable with an upwardly projecting arm **300** on the lever **282**. Each of the levers **292** has a reduced outer end portion or nose **302** which is movable into the path of a flange or ear **304** on the corresponding lever **238**.

The levers **292** and the cross rod **296** tend to move downwardly by their own weight. Such weight is transmitted to the lever **282** by the pin **298** and is effective to bias the lever **282** clockwise. Accordingly, the link **280** is biased upwardly, and the arm **156** is biased counterclockwise against the pin **160**.

When the lever **118** is swung clockwise by the control cam **84**, the weight of the levers **292** and the rod **296** causes the levers **292** to drop downwardly until the nose portions **302** are in the paths of the flanges **304**. The levers **292** thus block the clockwise movement of the levers **238** and prevent the ductor roller **152** from engaging the oscillating roller **150**. Accordingly, the supply of water to the oscillating roller **150** is cut off.

When the lever **118** swings counterclockwise to the position shown in FIG. 11, the levers **292** are raised away from the flanges **304** on the levers **238** so that the oscillating movement of the ductor roller **152** is resumed. Thus, the ductor roller **152** again engages the oscillating roller **150** during part of the cycle, so that water is applied to the oscillating roller **150**.

As already indicated, the INK position of the master control lever **80** also serves as the WASH position, in which the ink is washed off the blanket cylinder **44** when the control lever is being returned from the FEED position to the NEUTRAL position. The blanket on the blanket cylinder is cleaned by a blanket washer mechanism **310** which applies a solvent to the blanket and is effective to wash the ink off the blanket. Those skilled in the art will be familiar with such blanket washers. To actuate the blanket washer **310**, a roller **312** is mounted on the rear side of the detent cam **86**. When the control lever **80** is moved to the WASH position, the roller **312** engages a lever or pawl **314** and is effective to swing it in a clockwise direction about the pivot **119**, which is also the pivot for the lever **118**. The lever **314** is loosely mounted on the pivot **119** and is formed with a flange or ear **316** which is engageable with a pin **318** on a lever **320**, also swingable about the pivot **119**. Thus, the

clockwise swinging movement of the lever 314 is transmitted to the lever 320.

The outer end of the lever 320 is connected by means of a pin 322 to a link 324 which extends to a lever 326 and is connected thereto by another pin 328. A spring 330 biases the lever 326 in a clockwise direction. The lever 326 is secured to a shaft 332 which also carries an arm 334. A link 336 of irregular shape is connected to the arm 334 by means of a pin 338. The other end of the link 336 is connected by means of a pin 340 to an arm 342 which is mounted on a shaft 344. It will be seen that the actuating lever 346 for the blanket washer 310 is mounted on the shaft 344.

The actuation of the lever 314 by the roller 312 on the cam 84 causes the lever 346 to swing in a clockwise direction so as to actuate the blanket washer mechanism 310. The blanket washer is operated for a number of revolutions of the blanket cylinder, and then the master control lever 80 is returned to the NEUTRAL position. During such movement of the control lever 80, the roller 312 passes and moves away from the lever or pawl 314 so that the blanket washer 310 is no longer actuated.

The blanket washer 310 is actuated during the return movement of the control lever 80 from the FEED to the NEUTRAL position, but not during the advancing movement of the control lever from the NEUTRAL to the FEED position. During such advancing movement, the roller 312 engages the pawl 314 and swings it counterclockwise about the pivot 119. Such counterclockwise movement is not transmitted to the lever 320 due to the one way connection afforded by the flange 316 and the pin 318. Thus, the roller 312 merely passes the pawl 314 without actuating the blanket washer. After the roller 312 has passed, the pawl 314 returns to its initial position by gravity.

As already indicated, the movement of the control lever 80 from the NEUTRAL position to the STOP position causes the machine to stop, so that the old master sheet may be removed and replaced with a new master. The operation of stopping the machine is controlled by a stopping switch 350 which is adapted to be operated by a high point or lobe 352 on the detent cam 86. The switch 350 has an operating arm 354 which carries a roller 356 for engaging the cam lobe 352.

The actuation of the switch 350 is effective to energize an electric brake 358 through a positioning switch 360, so that the cylinders 42, 44 and 46 are stopped in a position which is convenient for removing the master from the master cylinder 42.

The positioning switch 360 is of the magnetically operable impulse type and is adapted to be operated by a permanent magnet 362 mounted on the outer end of an arm 364 which is clamped to the shaft 366 for the blanket cylinder 44. The arm 364 may be adjusted relative to the shaft 366 so as to change the position in which the machine stops.

The electric brake 358 has an actuating solenoid 368 which is energized by the positioning switch 360, in response to the actuation of the stopping switch 350. The solenoid 368 operates a lever 370 which tightens a brake band 372 extending around a drum 374 mounted on a shaft 376. The shaft 376 is suitably geared to the blanket cylinder 44 and is fitted with a drive pulley 378, whereby the machine is driven by a suitable electric motor. The shaft 376 may also carry a hand wheel for manually turning the cylinders 42, 44 and 46.

The solenoid 368 also operates a cam sector 380 which actuates a switch 382, adapted to stop the drive motor when the electric brake is applied.

It may be helpful to summarize the operation of the offset duplicating machine 40. Initially, the master, blanket and impression cylinders 42, 44 and 46 are stationary so that a new master may be mounted on the master cylinder 42. The master is placed on the feed table 50 and fed manually to the master cylinder 42.

The machine is then started by swinging the etch control lever 66 clockwise to the position shown in FIG. 1. The arm 74 on the etch applicator shaft 70 operates the starting switch 78 so as to start the drive motor for the machine.

The clockwise movement of the etch control lever 66 also swings the applicator pad or roller 62 against the master cylinder so that the etching solution is applied to the new master during the first few revolutions of the master cylinder. The inter-connection between the etch applicator and the starting switch insures that etching solution will be applied to each new master.

All of the other functions of the duplicator are controlled by the master control lever 80, which is initially in its NEUTRAL position. After the etch applicator 60 has been operated, the control lever 80 is advanced clockwise to the INK and WASH position. The roller 116 on the lever 118 rides down the control cam 84 between the high portion 142 and the intermediate portion 161, with the result that the lever 118 swings counterclockwise. The flange 138 on the link 122 is effective to move the lever 130 clockwise so as to bring about the movement of the form roller 132 of the inking system into engagement with the master cylinder 42. Thus, ink is applied to the master on the master cylinder.

Next, the control lever 80 is advanced another step in a clockwise direction to the IMAGE position. The roller 162 on the detent cam 86 swings the lever 164 in a counterclockwise direction. Accordingly, the link 174 causes the image control lever 186 to swing downwardly which brings apout the movement of the master cylinder 42 into engagement with the blanket cylinder 44, so that an image of the master is applied or offset upon the rubber blanket on the blanket cylinder.

The master control lever 80 is then moved to the FEED position, whereupon the roller 116 rides down the control cam 84 between the intermediate portion 161 and the low portion 140. The additional counterclockwise movement of the lever 118 has the effect of causing water to be supplied to the oscillating roller 150 by the ductor roller 152. Specifically, the pin 160 on the lever 118 swings the lever 156 clockwise. By means of the link 280, the lever 282 is swung counterclockwise so as to raise the arms 292. In this way, the arms 292 are moved clear of the flanges 304 on the levers 238 so that the levers may be swung back and forth by the eccentrics 244. The ductor roller 152 engages the oscillating roller 150 during part of the cycle of the eccentrics 244, so that water is applied to the oscillating roller 150.

The operation of starting the machine is completed by swinging the control lever 80 to the FEED ON position. The pin 206 on the control cam 84 pushes the lever 210 counterclockwise. The link 216 transmits this movement to the control lever 222 so as to start the operation of the feed mechanism. Paper sheets are thereby fed between the blanket and impression cylinders 44 and 46. The control lever 80 returns to the FEED position by spring action.

When the machine is to be shut down, the control lever 80 is returned from the FEED to the IMAGE position. Such movement causes the pin 208 to engage the lever 210 and shut off the feed mechanism. The intermediate portion 161 of the control cam 84 causes the lever 118 to swing clockwise, so as to discontinue the supply of water to the oscillating roller 150. The clockwise movement of the lever 118 allows the arms 292 to drop downwardly so as to block the movement of the flanges 304 and thereby prevent the levers 238 from oscillating.

The control lever 80 is moved between the IMAGE position and the INK and WASH position, whereupon the roller 312 on the detent cam 86 engages the pawl 314 and swings it clockwise. The flange 316 on the pawl engages the pin 318 and swings the lever 320 clockwise. The link 324, the lever 326 and the link 336 transmit this movement to the lever 346 so as to actuate the blanket washer

310. The blanket washer applies solvent to the blanket and removes the ink therefrom. The control lever 80 is normally held in the WASH position for several revolutions of the blanket cylinder.

Next, the control lever 80 is returned to the NEUTRAL position. The high portion 142 of the cam 84 swings the lever 118 an additional amount clockwise. Such movement is transmitted to the lever 130 by the link 122 and the flange 136, so as to bring about the movement of the form roller 132 away from the master cylinder 42.

Finally, the master control lever 80 is swung counterclockwise, past the NEUTRAL position to the STOP position. The high lobe 352 on the detent cam 86 actuates the stopping switch 350. When the blanket cylinder 44 reaches the desired position, the positioning switch 360 actuates the electric brake 358 so that the machine is stopped. The cam sector 380 operates the switch 382 so as to stop the drive motor.

When the control lever 80 is released, it returns to the NEUTRAL position by spring action. The machine is then ready for the loading of a new master onto the master cylinder 42.

The operation of the present machine is greatly facilitated and expedited by the provision of the single master control lever. It is an easy matter to carry out the many control functions which are required to complete each operating cycle. Moreover, the provision of a single master control lever minimizes the possibility of error on the part of the operator, so that uniform standards of high quality can readily be maintained. It will be apparent that the present offset duplicating machine is particularly well adapted for short run service, in which short printing runs are made from a large number of successive masters. The machine is capable of greatly increased production in short run service, when compared with prior manually controlled machines. Moreover, the automatic features of the present machine insure that the proper procedures will be followed, so that good work will be produced, with little or no waste of time or material. The present machine also makes it much easier to train operators. Moreover, operator fatigue is greatly reduced.

Various other 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 rotatable master cylinder for carrying a printing sheet, a blanket cylinder for receiving an offset image from the printing sheet, an impression cylinder for pressing copy sheets against said blanket cylinder, a movable control lever swingable in opposite directions from a neutral position, detent means for detaining said lever in said neutral position and also in first, second and third positions on one side of said neutral position, means operable by movement of said control lever from said neutral position to said first position for causing the application of ink to the printing sheet, means operable by movement of said control lever to said second position for causing the development of an offset image of the printing sheet on said blanket cylinder, means operable by movement of said control lever to said third position for causing the application of water to said printing sheet, means operable by movement of said control lever beyond said third position for causing the feeding of copy sheets between said blanket and impression cylinders, means operable by return movement of said control lever between said third and second positions for discontinuing the feeding of copy sheets, means operable by return movement of said lever to said first position for causing the removal of the image from said blanket cylinder, and means operable by movement of said control lever from said neutral position in the opposite direction for stopping the rotation of said cylinders.

2. In a printing machine, the combination comprising a rotatable master supporting member for carrying a printing sheet, a rotable blanket member for receiving an offset image from the printing sheet, a rotatable impression member for pressing copy sheets against said blanket member, a control member movable in opposite directions from a neutral position, detent means for detaining said control member in said neutral position and also in first, second and third positions on one side of said neutral position, said control member being movable beyond said third position to a fourth position, means for resiliently returning said control member from said fourth position to said third position, said control member being movable to a fifth position on the opposite side of said neutral position, means for resiliently returning said control member from said fifth position to said neutral position, means operable by movement of said control member from said neutral position to said first position for causing the application of ink to the printing sheet, means operable by movement of said control member to said second position for causing the development of an offset image of the printing sheet on said blanket member, means operable by movement of said control member to said third position for causing the application of water to said printing sheet, means operable by movement of said control member to said fourth position for initiating the feeding of copy sheets between said blanket and impression members, means operable by return movement of said control member between said third and second positions for terminating the feeding of copy sheets, means operable by return movement of said control member to said first position for causing the removal of the image from said blanket member, and means operable by movement of said control member between said neutral and said fifth positions for stopping the rotation of said master supporting member, said blanket member and said impression member.

3. In a printing machine, the combination comprising a rotatable master supporting member for carrying a printing sheet, a rotatable blanket member for receiving an offset image from the printing sheet, a rotatable impression member for pressing copy sheets against said blanket member, a cam assembly movable from a neutral position to a series of control positions for causing the application of ink to said printing sheet, causing the offsetting of an image from said printing sheet to said blanket member, causing the application of water to said printing sheet, and causing the feeding of copy sheets between said blanket and impression members, a pawl movable adjacent said cam assembly, a blanket washer control member adjacent said pawl for causing the removal of the image from said blanket member, said pawl having an operating element engageable with said blanket washer control member by movement of said pawl in one direction for operating said blanket washer control member, and a cam element on said cam assembly for engaging and moving said pawl in said one direction in response to return movement of said cam assembly to one of said control positions, said cam element being operative to pass idly by said pawl while moving said pawl in the opposite direction during advancing movement of said cam assembly from said neutral position whereby said blanket washer control member is not operated by advancing movement of said cam assembly.

4. In a printing machine, the combination comprising a rotatable master supporting member for carrying a printing sheet, a rotatable blanket member for receiving an offset image from the printing sheet, a rotatable impression member for pressing copy sheets against said blanket member, a cam assembly movable from a neutral position to a series of control positions, a pawl movable adjacent said cam assembly, a control member adjacent said pawl for causing the removal of the image from said blanket member, said pawl having an operating element engageable with said control member by movement of said pawl in one direction for operating said con-

trol member, and a cam element on said cam assembly for engaging and moving said pawl in said one direction in response to return movement of said cam assembly to one of said control positions, said cam element being operative to pass idly by said pawl, while moving said pawl in the opposite direction during advancing movement of said cam assembly from said neutral position whereby said control member is operated by return movement but not by advancing movement of said cam assembly.

5. In a printing machine, the combination comprising a rotatable master supporting member for carrying a printing sheet, a rotatable blanket member for receiving an offset image from the printing sheet, a rotatable impression member for pressing copy sheets against said blanket member, a control member movable from a neutral position, detent means for detaining said control member in said neutral position and also in first, second and third positions on one side of said neutral position, said control member being movable beyond said third position to a fourth position, means for resiliently returning said control member from said fourth position to said third position, means operable by movement of said control member from said neutral position to said first position for causing the application of ink to the printing sheet, means operable by movement of said control member to said second position for causing the development of an offset image of the printing sheet on said blanket member, means operable by movement of said control member to said third position for causing the application of water to said printing sheet, means operable by movement of said control member to said fourth position for initiatting the feeding of copy sheets between said blanket and impression members, means operable by return movement of said control member between said third and second positions for terminating the feeding of copy sheets, and means operable by return movement of said control member to said first position for causing the removal of the image from said blanket member.

6. In a printing machine, the combination comprising a rotatable master supporting member for carrying a printing sheet, a rotatable blanket member for receiving an offset image from the printing sheet, a rotatable impression member for pressing copy sheets against said blanket member, a control member movable from a neutral position, detent means for detaining said control member in said neutral position and also in first, second and third positions on one side of said neutral position, said control member being movable beyond said third position to a fourth position, means for resiliently returning said control member from said fourth position to said third position, means operable by movement of said control member from said neutral position to said first position for causing the application of ink to the printing sheet, means operable by movement of said control member to said second position for causing the development of an offset image of the printing sheet on said blanket member, means operable by movement of said control member to said third position for causing the application of water to said printing sheet, means operable by movement of said control member to said fourth position for initiating the feeding of copy sheets between said blanket and impression members, and means operable by return movement of said control member between said third and second positions for terminating the feeding of copy sheets.

7. In a printing machine, the combination comprising a rotatable master supporting member for carrying a printing sheet, a control member movable to a plurality of control positions from a neutral position, a cam operable by said control member, a movable follower engaging said cam, said cam having a first step for moving said follower a first distance and a second step for moving said follower an additional distance, means operable in response to movement of said follower through said first distance for causing the application of ink to the printing sheet, and means operable by movement of said follower through said additional distance for causing the application of water to said printing sheet.

8. In a printing machine, the combination comprising a rotatable master supporting member for carrying a printing sheet, a roller system for applying ink and water to said printing sheet, and including a form roller for engaging said printing sheet, said roller system including a particular roller for receiving water, a control cam movable to a plurality of control positions, a movable follower engaging said cam, said cam having a first step for moving said follower through a first distance and a second step for moving said follower through an additional distance, means operable in response to movement of said follower through said first distance for causing said form roller to move into engagement with said printing sheet, a movable ductor roller, means for supplying water to said ductor roller, means for oscillating said ductor roller into and out of engagement with said particular roller, a water control member for blocking the movement of said ductor roller into engagement with said particular roller, and means operable in response to movement of said follower through said additional distance for moving said water control member out of blocking relation to said ductor roller so as to cause the application of water to said particular roller.

9. In a printing machine, the combination comprising a rotatable master supporting member for carrying a printing sheet, a rotatable blanket member for receiving an offset image from the printing sheet, a rotatable impression member for pressing copy sheets against said blanket member, a control member movable in one direction from a neutral position to first, second, third and fourth positions, said control member being movable in the opposite direction from said neutral position to a fifth position, means operable by movement of said control member from said neutral position to said first position for causing the application of ink to the printing sheet, means operable by movement of said control member to said second position for causing the development of an offset image of the printing sheet on said blanket member, means operable by movement of said control member to said third position for causing the application of water to said printing sheet, means operable by movement of said control member to said fourth position for initiating the feeding of copy sheets between said blanket and impression cylinders, means for resiliently returning said control member from said fourth position to said third position, means operable by return movement of said control member between said third and second positions for terminating the feeding of copy sheets, means operable by return movement of said control member to said first position for causing the removal of the image from said blanket member, and means operable by the movement of said control member between said neutral and said fifth positions for stopping the rotation of said master supporting member, said blanket member and said impression member.

10. In a printing machine, the combination comprising a rotatable master supporting member for carrying a printing sheet, a rotatable blanket member for receiving an offset image from the printing sheet, a rotatable impression member for pressing copy sheets against said blanket member, a control member movable in one direction from a neutral position to first, second, third and fourth positions, said control member being movable in the opposite direction from said neutral position to a fifth position, means operable by movement of said control member from said neutral position to said first position for causing the application of ink to the printing sheet, means operable by movement of said control member to said second position for causing the development of an offset image of the printing sheet on said blanket member, means operable by movement of said control member to said third position for causing the application of water to said printing sheet, means operable by movement of

said control member to said fourth position for initiating the feeding of copy sheets between said blanket and impression cylinders, means operable by return movement of said control member between said third and second positions for terminating the feeding of copy sheets, means operable by return movement of said control member to said first position for causing the removal of the image from said blanket member, means operable by the movement of said control member between said neutral and said fifth positions for stopping the rotation of said master supporting member, said blanket member and said impression member, and means for resiliently returning said control member from said fifth position to said neutral position.

11. In a printing machine, the combination comprising a rotatable master supporting member for carrying a printing sheet, a rotatable blanket member for receiving an offset image from the printing sheet, a rotatable impression member for pressing copy sheets against said blanket member, a control member movable from a neutral position, detent means for detaining said control member in said neutral position and also in a series of positions on one side of said neutral position, said control member being movable beyond the last of said series of positions to an additional position, means for resiliently returning said control member from said additional position to the last of said series of positions, means operable by movement of said control member from said neutral position to said series of positions for causing the application of ink to the printing sheet, causing the development of an offset image of the printing sheet on said blanket member, and causing the application of water to said printing sheet, means operable by movement of said control member to said additional position for initiating the feeding of copy sheets between said blanket and impression members, and means operable by return movement of said control member to said neutral position from the last of said series of positions for terminating the feeding of copy sheets and causing the removal of the image from said blanket member.

12. In a printing machine, the combination comprising a rotatable master supporting member for carrying a printing sheet, a rotatable blanket member for receiving an offset image from the printing sheet, a rotatable impression member for pressing copy sheets against said blanket member, a control member movable from a neutral position, detent means for detaining said control member in said neutral position and also in a plurality of successive positions on one side of said neutral position, said control member being movable beyond the last of said successive positions to an additional position, means for resiliently returning said control member from said additional position to the last of said successive positions, means operable by a movement of said control member from said neutral position to said successive positions for causing the application of ink to the printing sheet, causing the development of an offset image of the printing sheet on said blanket member, and causing the application of water to said printing sheet, means operable by movement of said control member to said additional position for initiating the feeding of copy sheets between said blanket and impression members, and means operable by return movement of said control member from the last of said successive positions to said neutral position for terminating the feeding of copy sheet.

13. In a printing machine, the combination comprising a rotatable master cylinder for carrying a printing sheet, a blanket cylinder for receiving an offset image from the printing sheet, an impression cylinder for pressing copy sheets against said blanket cylinder, a movable control lever swingable in opposite directions from a neutral position, detent means for detaining said lever in said neutral position and also in first, second and third positions on one side of said neutral position, means operable by movement of said control lever from said neutral position to said first position for causing the application of ink to the printing sheet, means operable by movement of said control lever to said second position for causing the development of an offset image of the printing sheet on said blanket cylinder, means operable by movement of said control lever to said third position for causing the application of water to said printing sheet, means operable by movement of said control member beyond said third position to an additional position for causing the feeding of copy sheets between said blanket and impression cylinders, means for resiliently returning said control lever from said additional position to said third position, means operable by return movement of said control lever between said third and second positions for discontinuing the feeding of copy sheets, means operable by return movement of said lever to said first position for causing the removal of the image from said blanket cylinder, and means operable by movement of said control lever from said neutral position in the opposite direction for stopping the rotation of said cylinders.

14. In a printing machine, the combination comprising a rotatable master cylinder for carrying a printing sheet, a blanket cylinder for receiving an offset image from the printing sheet, an impression cylinder for pressing copy sheets against said blanket cylinder, a movable control lever swingable in opposite directions from a neutral position, detent means for detaining said lever in said neutral position and also in first, second and third positions on one side of said neutral position, means operable by movement of said control lever from said neutral position to said first position for causing the application of ink to the printing sheet, means operable by movement of said control lever to said second position for causing the development of an offset image of the printing sheet on said blanket cylinder, means operable by movement of said control lever to said third position for causing the application of water to said printing sheet, means operable by movement of said control lever beyond said third position for causing the feeding of copy sheets between said blanket and impression cylinders, means operable by return movement of said control lever between said third and second positions for discontinuing the feeding of copy sheets, means operable by return movement of said lever to said first position for causing the removal of the image from said blanket cylinder, means operable by movement of said control lever from said neutral position in the opposite direction to an additional position for stopping the rotation of said cylinders, and means for resiliently returning said control lever from said additional position to said netural position.

15. In a printing machine, the combination comprising a rotatable master supporting member for carrying a printing sheet, a rotatable blanket member for receiving an offset image from the printing sheet, a rotatable impression member for pressing copy sheets against said blanket member, a control member movable in one direction from a neutral position to first, second, third and fourth positions, means operable by movement of said control member from said neutral position to said first position for causing the application of ink to the printing sheet, means operable by movement of said control member to said second position for causing the development of an offset image of the printing sheet on said blanket member, means operable by movement of said control member to said third position for causing the application of water to said printing sheet, means operable by movement of said control member to said fourth positions for initiating the feeding of copy sheets between said blanket and impression cylinders, means for resiliently returning said control member from said fourth position to said third position, means operable by return movement of said control member between said third and second positions for terminating the feeding of copy sheets and means operable by return movement of said control member from said second position to said neutral position for

causing the removal of the image from said blanket member.

16. In a printing machine, the combination comprising a rotatable master supporting member for carrying a printing sheet, a rotatable blanket member for receiving an offset image from the printing sheet, a rotatable impression member for pressing copy sheets against said blanket member, a control member movable in one direction from a neutral position to a plurality of successive positions, means operable by movement of said control member to said successive positions for causing the application of ink to the printing sheets, causing the development of an offset image of the printing sheet on said blanket member, and causing the application of water to said printing sheets, means operable by a movement of said control member beyond the last of said successive positions to an additional position for initiating the feeding of copy sheets between said blanket and impression cylinders, means for resiliently returning said control member between said additional position and the last of said successive positions, and means operable by return movement of said control member from the last of said successive positions to said neutral position for terminating the feeding of copy sheets and causing the removal of the image from said blanket member.

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