United States Patent

[11] 3,631,801

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[54] **CLAMP ASSEMBLY FOR SKEWING AND SECURING A PRINTING PLATE**
16 Claims, 7 Drawing Figs.

[52] **U.S. Cl.** **101/378**
[51] **Int. Cl.** **B41f 27/10**
[50] **Field of Search** 101/378, 415.1, 383, 384, 385

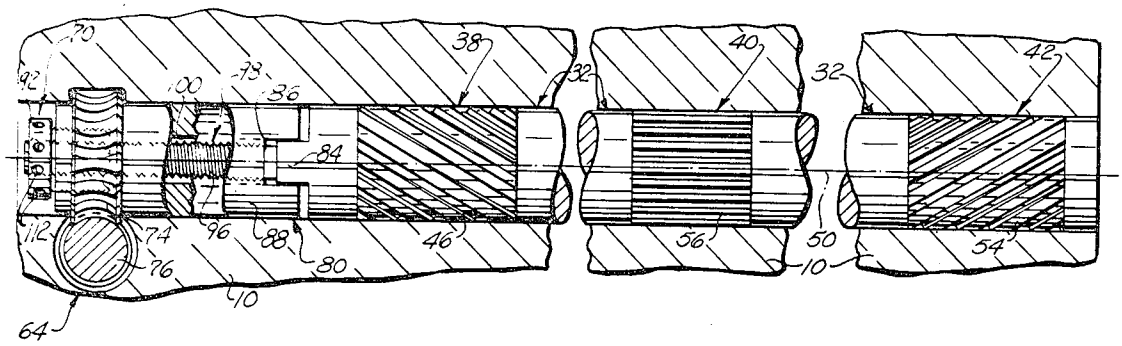
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ABSTRACT: An improved clamp assembly for securing a printing plate to a cylinder of a printing press includes a rotatable shaft having teeth which meshingly engage corresponding teeth on plate clamp members. The teeth on the shaft are angled in opposite directions relative to a longitudinal axis of the shaft. Therefore, when the shaft is moved axially, a camming action occurs between the teeth on the shaft and the teeth on the clamp members. This camming action moves the clamp members in opposite directions to skew the printing plate relative to the cylinder. When the shaft is rotated, the clamp members are moved in the same direction to advance or retard the plate relative to the cylinder.



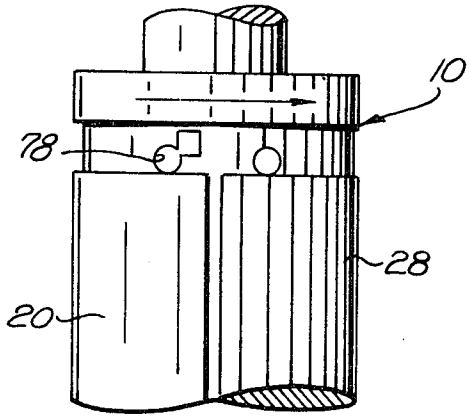


FIG. 1

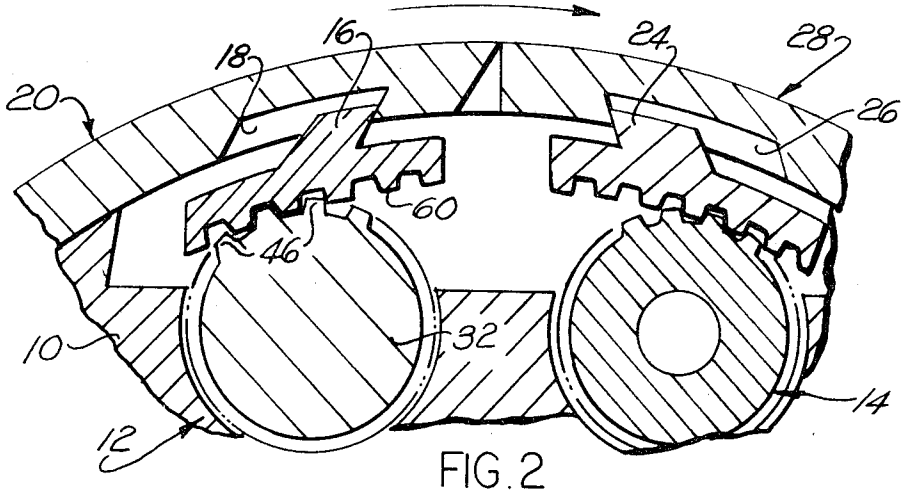


FIG. 2

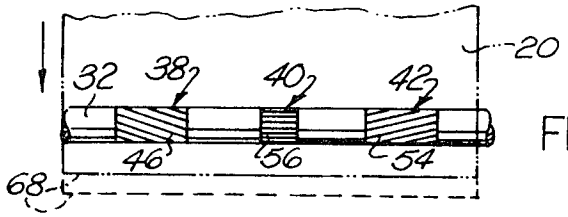


FIG. 4

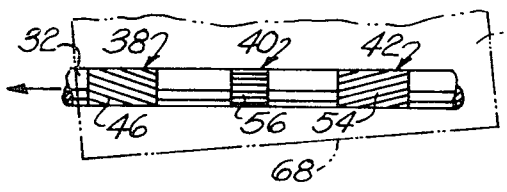


FIG. 5

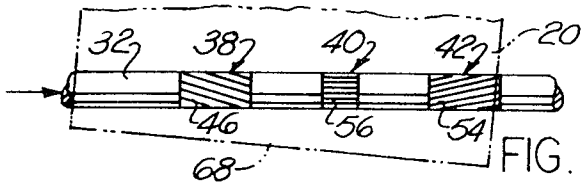


FIG. 6

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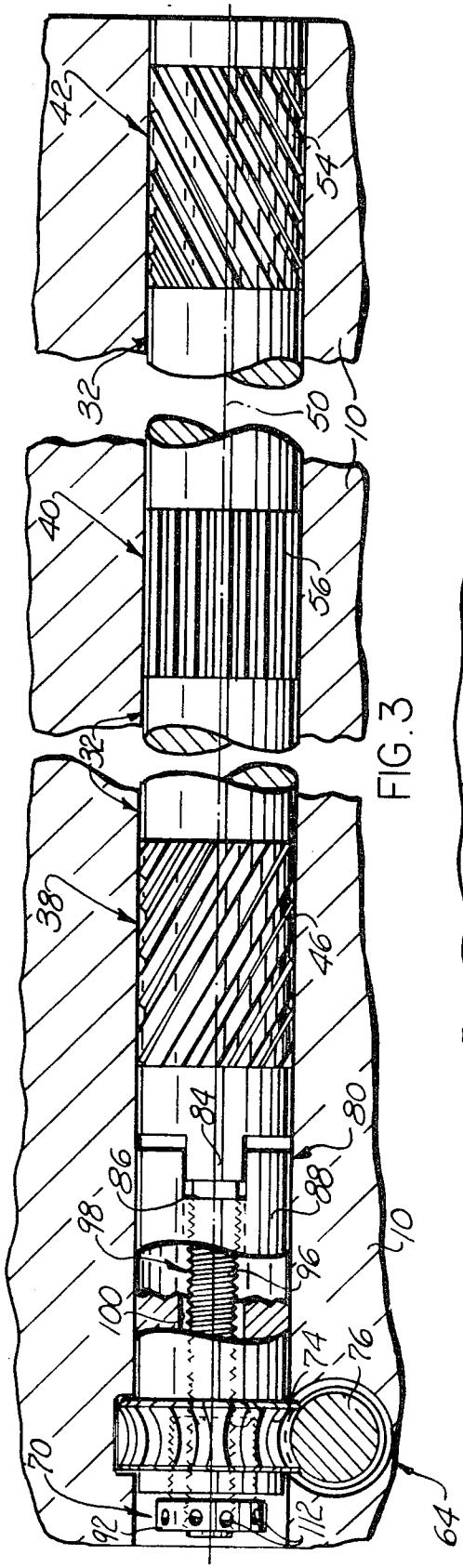


FIG. 3

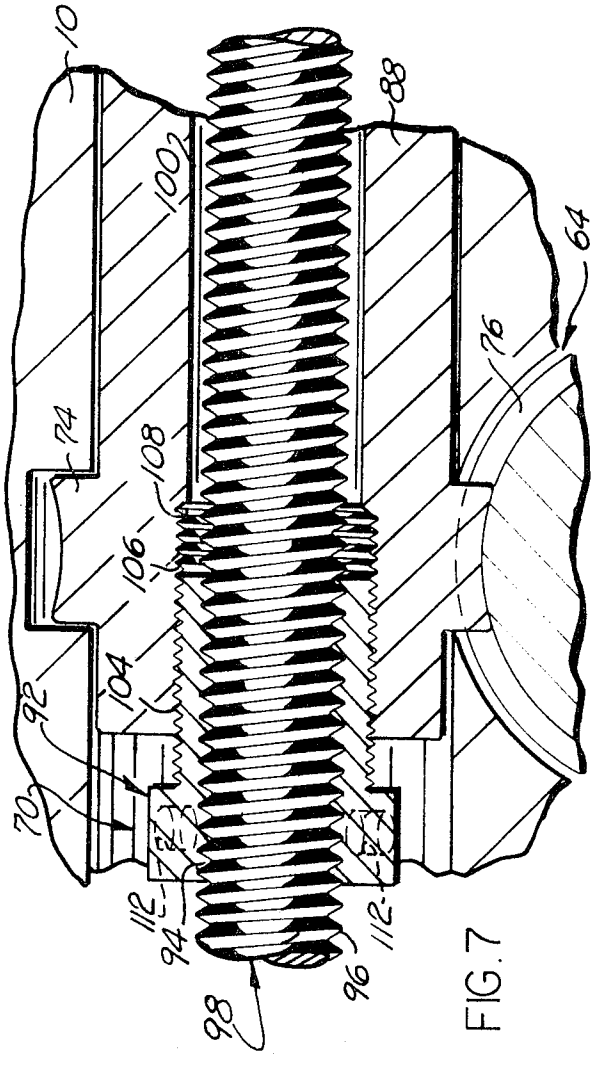


FIG. 7

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CLAMP ASSEMBLY FOR SKEWING AND SECURING A PRINTING PLATE

This invention relates generally to a clamp assembly and more particularly to a clamp assembly for securing a printing plate to a cylinder and adjusting the position of the printing plate relative to the cylinder.

Due to inaccuracies in the formation of mounting notches or recesses in printing plates, the printing plates must be adjusted relative to a plate cylinder to obtain precise color register. This adjusting may include skewing or twisting of the printing plate relative to the cylinder and advancing or retarding of the printing plate relative to the cylinder. A known printing plate clamp assembly for adjusting a printing plate relative to a cylinder is shown in U.S. Pat. No. 2,709,405 and includes a plurality of cam blocks which are moved by a complicated arrangement of telescoping shafts and springs. This arrangement of cam blocks and telescoping shafts includes a relatively large number of parts which must be assembled in a plate cylinder and maintained in proper working relationship to enable the printing plate to be adjusted to provide precise color registration.

Accordingly, it is an object of this invention to provide a new and improved clamp assembly for securing a printing plate to a cylinder wherein the clamp assembly is reliable in operation and includes relatively few elements which are easily manufactured and installed in a printing cylinder.

Another object of this invention is to provide a new and improved clamp assembly for securing a printing plate to a cylinder wherein the clamp assembly includes a shaft which is connected to sets of teeth having longitudinal axes which are oppositely inclined relative to the longitudinal axis of the shaft whereby axial movement of the shaft moves clamp members which cooperate with the teeth in opposite directions to skew the printing plate.

Another object of this invention is to provide a new and improved clamp assembly in accordance with the next preceding object wherein rotation of the shaft and the sets of teeth causes the clamp members to be moved through the same distance relative to the cylinder to advance or retard the printing plate relative to the cylinder without skewing the printing plate.

Another object of this invention is to provide a new and improved clamp assembly for securing a printing plate to a rotary cylinder of a printing press wherein the clamp assembly includes a plurality of cam elements which are movable along a path extending generally parallel to the longitudinal axis of the cylinder to effect a skewing of the printing plate relative to the cylinder and a means for rotating the cam elements in a given position along the path to thereby effect movement of the printing plate relative to the cylinder without skewing the printing plate.

These and other objects and features of the invention will become more apparent upon a consideration of the following description taken in connection with accompanying drawing wherein:

FIG. 1 is a fragmentary illustration of a portion of a printing cylinder of a rotary printing press;

FIG. 2 is a fragmentary schematic sectional view, on an enlarged scale, illustrating the relationship between leading and trailing end clamp or gang lockup assemblies and printing plates on the printing cylinder of FIG. 1;

FIG. 3 is a partially broken away plan view of a leading end plate clamp or gang lockup assembly constructed in accordance with the present invention;

FIG. 4 is a schematic illustration depicting the advancing and retarding of a printing plate relative to a printing cylinder by operation of the plate clamp assembly of FIG. 3;

FIG. 5 is a schematic illustration, similar to FIG. 4, illustrating the skewing of a printing plate in one direction relative to a printing cylinder;

FIG. 6 is a schematic illustration, generally similar to FIG. 5, illustrating the skewing of a printing plate in another direction relative to a printing cylinder; and

FIG. 7 is an enlarged fragmentary sectional view illustrating the relationship between a drive assembly for rotating the shaft and gear teeth of the plate clamp assembly of FIG. 3 to advance or retard the printing plate relative to the cylinder and a drive assembly for moving the shaft and gear teeth axially to skew the printing plate.

A clamp assembly constructed in accordance with the present invention is utilized to secure a printing plate to a cylinder and to adjust the position of a printing plate relative to the cylinder. The clamp assembly is selectively operable to either skew the printing plate relative to the cylinder or to advance or retard the printing plate relative to the cylinder. A printing cylinder **10** (FIG. 1) constructed in accordance with the present invention is utilized in a rotary printing press and includes a leading end clamp or gang lockup **12** (FIG. 2) and a trailing end clamp or gang lockup assembly **14** for securing a printing plate to the cylinder.

The leading end clamp assembly **12** includes a plurality of clamp members **16**, only one of which is shown, which extend into leading end mounting notches or recesses **18** formed in the printing plate **20** to retain the leading end of the printing plate **20** against movement relative to the cylinder. Similarly, the trailing end clamp assembly **14** includes clamp members **24** which extend into trailing end mounting notches or recesses **26** in a printing plate **28**. When the cylinder **10** is rotated in the direction of the arrow in FIG. 2, a trailing end clamp assembly, similar to the clamp assembly **14**, tensions the printing plate **20** to pull the printing plate against the associated leading end clamp assembly **12**. In this manner, the trailing end clamp assembly maintains tension in the printing plate **20** during operation of the printing press even though the printing plate **20** may tend to elongate. Although it is contemplated that many different types of trailing end clamp assemblies could be utilized in association with the leading end clamp assembly **12**, one particularly suitable trailing end clamp assembly is disclosed in my copending application Ser. No. 695,316, filed Dec. 28, 1967 and entitled Plate Clamp Mechanism.

The leading end clamp or lockup assembly **12** secures the leading end of the printing plate **20** against movement relative to the cylinder **10** and is selectively operable to adjust the printing plate relative to the cylinder to provide for precise color registration. Thus, the leading end clamp assembly **12** includes a gear or adjusting shaft **32** (FIG. 3) on which a plurality of gears **38**, **40** and **42** are integrally formed. The gear **38** includes a plurality of teeth **46** which are angled or inclined relative to a longitudinal axis **50** of the shaft **32**. Teeth **54** of the gear **42** are inclined in the opposite direction relative to the longitudinal axis **50** of the shaft **32** while teeth **56** of the gear **40** extend generally parallel to the longitudinal axis of the shaft. These gear teeth **46**, **54** and **56** cooperate with similarly angled gear teeth **60** formed on the associated clamp members **16** (FIG. 2).

A drive assembly **64** (FIG. 3) is selectively operable to rotate the shaft **32** to advance or retard the printing plate **20** relative to the cylinder **10**. When the drive assembly **64** is operated to rotate the shaft **32** in a clockwise direction as viewed in FIG. 2, clamp members **16** associated with each of the gears **38**, **40** and **42** are moved forwardly through the same distance to advance the printing plate **20** relative to the cylinder **10**. Advancing the printing plate **20** results in a leading end portion **68** of the printing plate being moved forwardly from the position shown in phantom lines in FIG. 4 toward the position shown in dashed lines in FIG. 4. During this advancing movement, the leading end portion **64** of the printing plate **20** is maintained parallel to the longitudinal axis **50** of the shaft **32** and the longitudinal axis of the cylinder **10**. The printing plate **20** can be retarded or moved backwardly relative to the cylinder **10** from the position shown in dashed lines in FIG. 4 to he position shown in phantom lines by merely rotating the shaft **32** in the opposite or counterclockwise direction as viewed in FIG. 2.

Due to inaccurate formation of the leading and trailing end notches or recesses **18** and **26** in a printing plate, it is occasionally necessary to skew or twist a printing plate relative to the cylinder **10** to obtain precise color registration. A counterclockwise skewing or twisting of the printing plate **20** from the position shown in FIG. **4** to the position shown in FIG. **5** is obtained by moving or shifting the shaft **32** axially toward the left (as viewed in FIG. **3**) with a drive assembly **70**. Leftward movement of the gear shaft **32** causes the longitudinally inclined or angled gear teeth **46** to interact with the gear teeth **60** on an associated clamp member **16** to cam or force the clamp member forwardly. During this leftward movement of the shaft **32**, the opposite longitudinal inclination or angling of the gear teeth **54** causes them to interact interact with the gear teeth **60** on an associated clamp member **16** to cam or force the clamp member rearwardly.

In view of the foregoing description it is apparent that leftward axial movement of the gear shaft **32** (as viewed in FIGS. **3** and **4**) results in the left-hand side portion of the printing plate **20** being advanced or moved forwardly by the clamp member **16** associated with the gear **38**. Simultaneously therewith, the right-hand side of the printing plate **20** is moved rearwardly by a clamp member **16** associated with the gear **42**. This opposite movement of the clamp members **16** under the influence of the gears **38** and **42** causes the printing plate **20** to tend to rotate or skew in the manner illustrated in FIG. **5**. It should be noted that the teeth **56** of the gear **40** extend generally parallel to the longitudinal axis of the shaft **32** and will, therefore, have little or no effect on the position of the printing plate relative to the cylinder during this axial movement of the gear shaft **32**. In fact, it is contemplated that in certain clamp assemblies, the gear **40** and associated clamp member **16** could be omitted.

The printing plate **20** can be skewed in the opposite direction, that is in a generally clockwise direction as viewed in FIGS. **4** and **6** by operating the drive assembly **70** to move the gear shaft **32** axially in the opposite or rightward direction as viewed in FIG. **3**. This rightward movement of the gear shaft **32** causes the longitudinally inclined or angled gear teeth **46** to move the associated clamp member **16** and the left side portion of the printing plate **20** rearwardly from the position shown in FIG. **4** toward the position shown in FIG. **6**. Simultaneously therewith, the gear teeth **54** on the gear **42** interact with the gear teeth **60** on the associated clamp member **16** to advance the right side portion of the printing plate **20** from the position shown in FIG. **4** toward the position shown in FIG. **6**. Thus, the printing plate **20** can be skewed in a counterclockwise direction from the position shown in FIG. **4** to the position shown in FIG. **5** by operating the drive assembly **70** to move the gear shaft **32** axially toward the left. The printing plate **20** can be skewed in a clockwise direction from the position shown in FIG. **4** to the position shown in FIG. **6** by operating the drive assembly **70** to move the gear shaft **32** toward the right.

The drive assembly **64** for rotating the gear shaft **32** relative to the cylinder **10** to either advance or retard the printing plate **20** includes a worm wheel **74** which meshes with a worm gear **76** (FIGS. **3** and **7**). A passage **78** (FIG. **1**) provides access to the worm gear **64** to enable the worm gear to be rotated with a known hand tool or by other means to thereby rotate the worm wheel **74**. Rotation of the worm wheel **74** is transferred to the gear shaft **32** by means of coupling assembly **80** (FIG. **3**). The coupling assembly **80** includes a lug **84** which is integrally formed with the gear shaft **32** and a recess **86** formed in a coupling member **88**. The coupling member **88** is fixedly secured to the worm wheel **74** so that rotation of the worm wheel rotates the coupling member and the shaft **32** by the interaction between the lug **84** on the shaft and the surfaces defining the recess **86** in the coupling member. It should be noted that there is substantial clearance between the lug **84** and the bottom of the recess **86** and that the lug **84** extends into the recess for a substantial distance to thereby enable the shaft **32** to be moved axially to skew the printing plate **20**. A suitable detent assembly (not shown) is associated with the worm gear **64** to lock the worm gear against rotation once the gear shaft **32** has been adjusted to a desired position.

The drive assembly **70** is operable to move the gear shaft **32** in an axial direction relative to the cylinder **10** while maintaining the longitudinal axis **50** of the gear shaft parallel to the longitudinal axis of the cylinder. The drive assembly **70** includes a nut **92** having internal threads **94** (FIG. **7**) which engage external threads **96** on a rod end or shaft **98** which extends outwardly from one end of the gear shaft **32** and is fixedly connected to the gear shaft. The shaft **98** extends through a cylindrical passage **100** in the coupling member **88** into the bore of the nut **92**. The nut **92** has external threads **104** which engage internal threads **106** formed on a recess **108** in the worm wheel **74**. A plurality of holes **112** are provided on the outer end of the nut **92** to receive a pin wrench to enable the nut to be rotated relative to the shaft **98** and the worm wheel **74**.

Upon rotation of the nut **92** relative to the shaft **98**, the interaction between the internal threads **94** on the nut **92** and the external threads **96** on the shaft **98** moves the shaft inwardly or outwardly a given distance relative to the nut **92**, depending upon the direction of rotation of the nut. Simultaneously therewith, the interaction between the external threads **104** on the nut **92** and the internal threads **106** on the worm wheel **74** moves the nut in the opposite direction a lesser distance relative to the worm wheel. Therefore, since the latter threads are of lesser pitch than the former threads there is a differential thread action which results in the nut being moved relative to the worm wheel **74** while the shaft **98** is moved relative to the nut to thereby move the gear shaft **32** minutely relative to the cylinder **10**.

During rotation of the nut **92** relative to the worm wheel **74**, the worm wheel is retained against rotation by the worm gear **76** which is held by an associated detent assembly (not shown). The worm wheel **74** is also retained against axial movement by its mounting in the cylinder **10**. Thus upon rotation of the nut **92**, the worm wheel **74** is retained against rotation so that the coupling assembly **80** holds the gear shaft **32** against rotation. However, rotation of the nut **92** moves the gear shaft **32** axially relative to the cylinder **10** and varies the amount of clearance between the end of the lug **84** and the bottom of the recess **86** of the coupling assembly **80**.

During rotational movement of the gear shaft **32** under the influence of the drive assembly **64**, the nut **92** rotates with the shaft **98** and the gear shaft **32** under the influence of drive forces transmitted from the worm wheel **74** to the gear shaft **32** by the coupling assembly **80**. Since the nut **92** rotates with the shaft **98** and the worm wheel **74**, the axial position of the nut relative to the cylinder **10** is maintained constant and the gear shaft **32** is rotated to either advance or retard the printing plate **20** relative to the cylinder **10**. Therefore during advancing or retarding movement of the printing plate **20**, the nut **92** is rotated with the worm gear **76** so that the printing plate is not skewed. Similarly when the printing plate **20** is skewed relative to the cylinder **10** by axial movement of the gear shaft **32**, the gear shaft is held against rotation so that the printing plate is not advanced or retarded. From the foregoing description, it can be seen that the leading end clamp or lockup assembly **12** includes a single gear shaft **32** with which the gear teeth **46**, **54**, and **56** are connected. The drive assembly **64** is operable to rotate the gear shaft **32** so that the gear teeth **46**, **54**, and **56** move the associated clamp members **16** through substantially the same distance to either advance or retard the position of the printing plate **20** relative to the cylinder **10**. Operation of the drive assembly **70** moves the shaft **32** axially so that the interaction between the longitudinally inclined gear teeth **46** and **54** and the associated clamp members **16** causes the clamp members to be moved in opposite directions to skew the printing plate **20**. The gear teeth **46**, **54** and **56** are advantageously integrally formed with the shaft **32** to tend to minimize the number of elements in the clamp assembly **12** and to facilitate installation of the clamp assembly in a printing cylinder.

Having described a specific preferred embodiment of the invention, the following is claimed:

1. A clamp assembly for securing a printing plate to a rotary cylinder of a printing press and for adjusting the position of the printing plate relative to the cylinder, said clamp assembly comprising clamp means for positioning and retaining the printing plate on the cylinder, said clamp means including a plurality of clamp members movably mounted on the cylinder and adapted to engage the printing plate and first and second sets of clamp teeth each of which is operatively connected with one of said clamp members, a shaft mounted in the cylinder, first and second sets of actuator teeth each of which is connected with said shaft and meshingly engages one of said sets of clamp teeth, said first and second sets of actuator teeth each including a plurality of teeth having longitudinal axes extending transversely to a longitudinal axis of said shaft with the longitudinal axes of the teeth of said first set of actuator teeth extending transversely to the longitudinal axes of the teeth of said second set of actuator teeth, means for rotating said shaft and said first and second sets of actuator teeth to drive said first and second sets of clamp teeth and move said clamp members through substantially equal distances in the same direction relative to the cylinder to thereby adjust the printing plate circumferentially of the cylinder while maintaining substantially constant the angular relationship between an edge portion of the printing plate and a longitudinal axis of the cylinder, and means for moving said shaft and said first and second sets of actuator teeth in a first direction to drive said first and second sets of clamp teeth in opposite directions and move one of said clamp members in one direction relative to the cylinder and another of said clamp members in another direction relative to the cylinder to thereby skew the printing plate relative to the cylinder and for moving said shaft and said first and second sets of actuator teeth in a second direction to drive said first and second sets of clamp teeth in opposite directions and move one of said clamp members in said other direction relative to the cylinder and said other clamp member in said one direction relative to the cylinder to thereby skew the printing plate in an opposite direction to the direction in which the printing plate is skewed upon movement of said shaft in said first direction.

2. A clamp assembly as set forth in claim 1 wherein said means for rotating said shaft and said first and second sets of actuator teeth retains said shaft and said first and second sets of actuator teeth against rotation during movement of said shaft in said first and second directions.

3. A clamp assembly as set forth in claim 1 wherein said means for moving said shaft and said first and second sets of actuator teeth includes a rotatable member and thread means interconnecting said shaft and said rotatable member whereby rotation of said rotatable member in one direction moves said shaft in said first direction and rotation of said rotatable member in a direction opposite to said one direction moves said shaft in said second direction.

4. A clamp assembly as set forth in claim 5 wherein said means for rotating said shaft and said first and second sets of actuator teeth includes a rotatable member retained against movement in said first and second directions and coupling means for connecting said rotatable member with said shaft and for enabling said shaft to move in said first and second directions relative to said rotatable member.

5. A clamp assembly as set forth in claim 4 wherein said means for moving said shaft and said first and second sets of actuator teeth includes external threads on said shaft and an internally threaded member which is mounted in threaded engagement with said external threads on said shaft, said internally threaded member being rotatable relative to said rotatable member to effect movement of said shaft in said first and second directions.

6. A clamp assembly as set forth in claim 5 further including external threads on said internally threaded member and internal threads on said rotatable member engaging said external threads on said internally threaded member to effect movement of said shaft and said internally threaded member in said first and second directions upon rotation of said internally threaded member.

7. A clamp assembly as set forth in claim 15 further including a third set of actuator teeth connected with said shaft and operatively connected with one of said clamp members, said third set of teeth being located intermediate said first and second sets of actuator teeth and including a plurality of teeth having longitudinal axes extending generally parallel to the longitudinal axes of said shaft and transversely to the longitudinal axes of the teeth of said first and second sets of actuator teeth.

8. A clamp assembly as set forth in claim 1 wherein said first and second sets of actuator teeth are operable to apply a camming action to said clamp teeth upon movement of said shaft in said first and second directions to thereby move said clamp members to skew the printing plate.

9. A clamp assembly for securing a printing plate to a rotary cylinder of a printing press, said clamp assembly comprising first and second cam elements mounted in a fixed relationship with each other in the cylinder, adjustable clamp means for positioning and retaining the printing plate on the cylinder, first means for moving said first and second cam elements along a path extending generally parallel to the longitudinal axis of the cylinder, connector means interconnecting said cam elements and said clamp means for adjusting said clamp means to skew the printing plate relative to the cylinder upon movement of said first and second cam elements along the path extending parallel to the longitudinal axis of the cylinder, and second means for moving said first and second cam elements relative to the cylinder while maintaining said cam elements in a given position along said path, said clamp means being operated by said connector means upon movement of said cam elements by said second means to move the printing plate relative to the cylinder with a constant angular relationship between a leading end portion of the printing plate and the longitudinal axis of the cylinder.

10. A clamp assembly as set forth in claim 16 wherein said second means includes means for rotating said first and second cam elements about an axis extending generally parallel to said path.

11. A clamp assembly as set forth in claim 10 further including mounting means for retaining said means for rotating said first and second cam elements against movement relative to the cylinder in a direction extending generally parallel to said path, said first means cooperating with said means for rotating said first and second cam elements to effect movement of said first and second cam elements along said path.

12. A clamp assembly as set forth in claim 9 further including a shaft, each of said first and second cam elements including a plurality of teeth integrally formed with said shaft and having longitudinal axes extending transversely to a longitudinal axis of said shaft.

13. A clamp assembly as set forth in claim 12 wherein the longitudinal axes of the teeth of said first cam element extend transversely to the longitudinal axes of the teeth of said second cam element.

14. A clamp assembly as set forth in claim 9 wherein said second means includes means for rotating said first and second cam elements about an axis extending generally parallel to said path and for retaining said cam element against rotation during movement of said first and second cam elements along said path under the influence of said first means.

15. A clamp assembly for securing a printing plate to a rotary cylinder of a printing press and for adjusting the position of the printing plate relative to the cylinder, said clamp assembly comprising a plurality of clamp members movably mounted on the cylinder and adapted to engage the printing plate, first and second cam means connected with said clamp members for effecting movement of said clamp members relative to the cylinder, a shaft mounted in the cylinder, third and fourth cam means connected with said shaft and disposed in engagement with said first and second cam means, said third

and fourth cam means each including an elongated cam surface having a longitudinal axis extending transversely to a longitudinal axis of said shaft with the longitudinal axis of the cam surface of said third cam means extending transversely to the longitudinal axis of the cam surface of said fourth cam means, means for rotating said shaft to force said cam surfaces of said third and fourth cam means against said first and second cam means to effect movement of said clamp members through substantially equal distances in the same direction relative to the cylinder to adjust the printing plate circumferentially of the cylinder while maintaining substantially constant the angular relationship between an edge portion of the printing plate and a longitudinal axis of the cylinder, and means for moving said shaft axially in a first direction to force at least one of said cam surfaces of said third and fourth cam means against at least one of said first and second cam means to effect movement of at least one of said clamp members to skew the printing plate relative to the cylinder and for moving said shaft axially in a second direction to force at least one of said cam surfaces of said third and fourth cam means against at least one of said first and second cam means to effect movement of at least one of said clamp members relative to the cylinder to skew the printing plate in an opposite direction to the direction in which the printing plate is skewed upon movement of said shaft in said first direction.

16. A clamp assembly as set forth in claim **15** wherein said means for rotating said shaft includes means for rotating said cam surfaces with said shaft and means for retaining said shaft and said cam surfaces against rotation during movement of said shaft in said first and second directions.

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