United States Patent

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[54] **FLEXIBLE PLATE CLAMPING ASSEMBLY INCLUDING INWARDLY BOWED SPRING AND MOVABLE JAW**
13 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** **101/415.1**
[51] **Int. Cl.** **B41f 27/12**
[50] **Field of Search** 101/415.1, 378, 383, 375

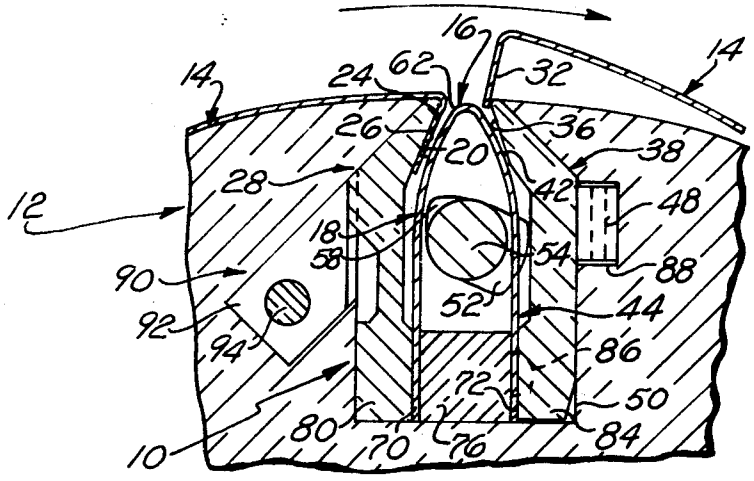
[56] **References Cited**

UNITED STATES PATENTS

3,095,811	7/1963	Peabody et al.	101/415.1
3,191,532	6/1965	Hermach et al.	101/415.1
3,359,899	12/1967	Luehrs	101/415.1
3,408,933	11/1968	Hermach et al.	101/415.1
3,425,348	2/1969	Hermach et al.	101/415.1

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ABSTRACT: An improved clamp assembly for securing a printing plate or other printing element on a cylinder includes an inwardly bowed or bent spring element. A movable jaw presses the spring element toward a clamping surface to grip or clamp a leading end portion of the printing plate between the surface and one side of the spring element. A trailing end portion of the printing plate is gripped or clamped between the movable jaw and the opposite side of the spring element. To maintain a substantially constant tension in the printing plate and to compensate for elongation of the printing plate, a longitudinally extending wave spring presses the movable jaw toward the inwardly bowed spring element with a substantially constant predetermined force. A cam assembly is selectively operable to release the printing plate.



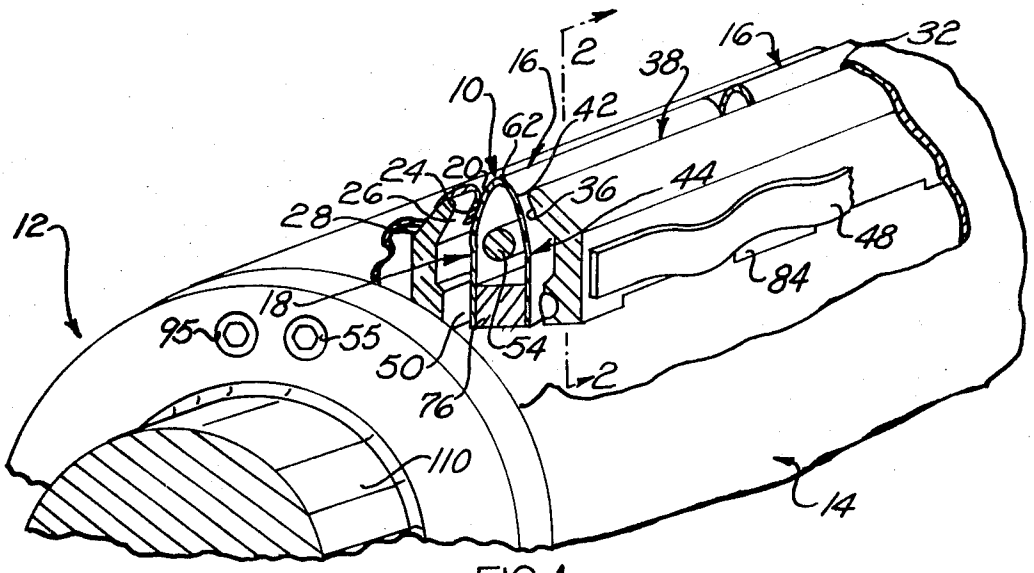


FIG. 1

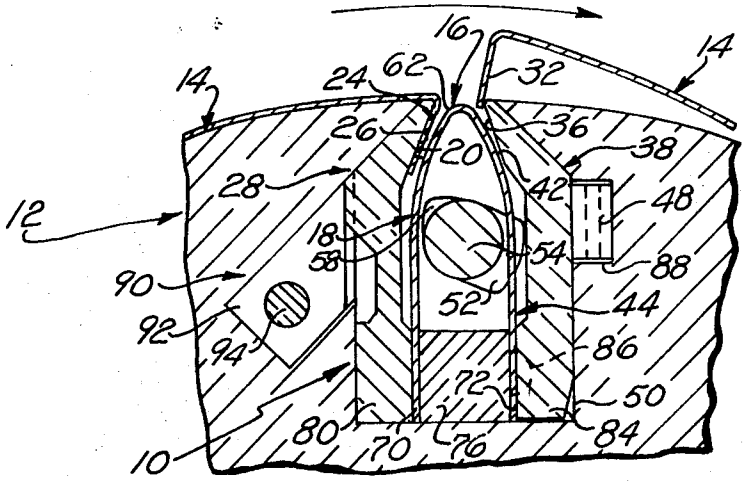


FIG. 2

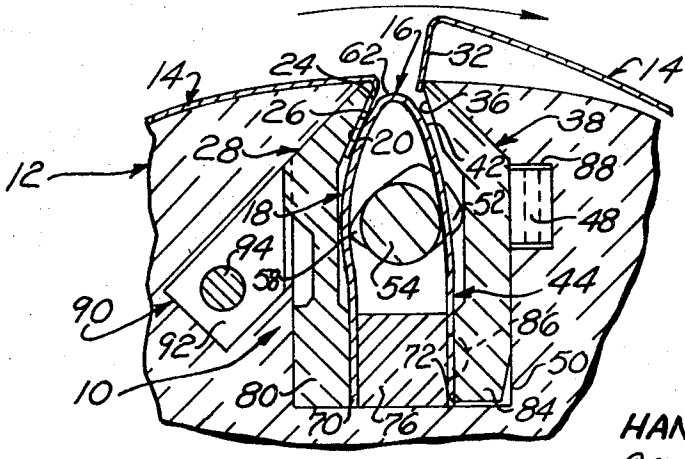


FIG. 3

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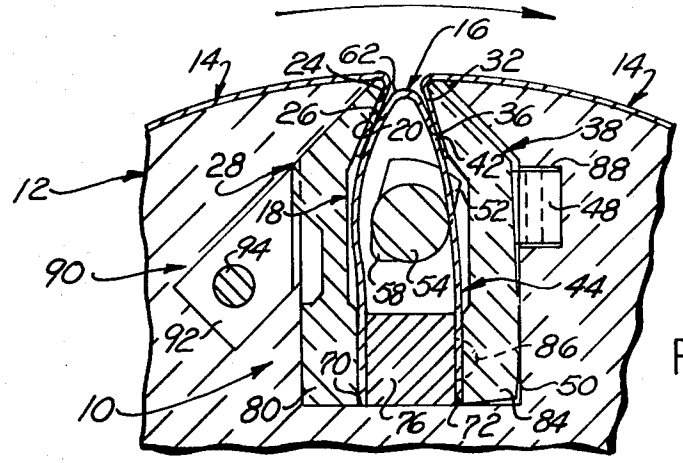


FIG. 4

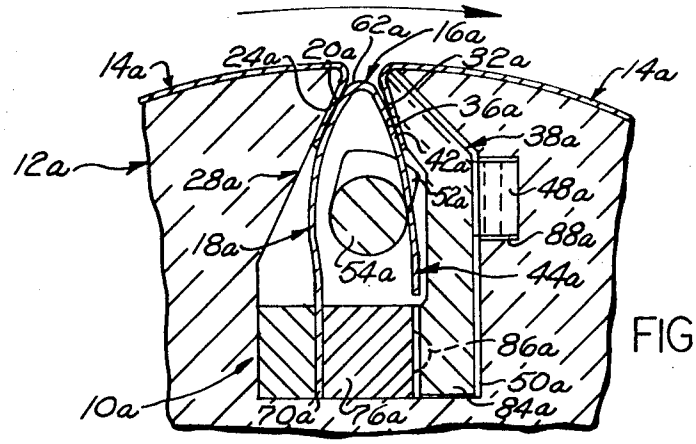


FIG. 5

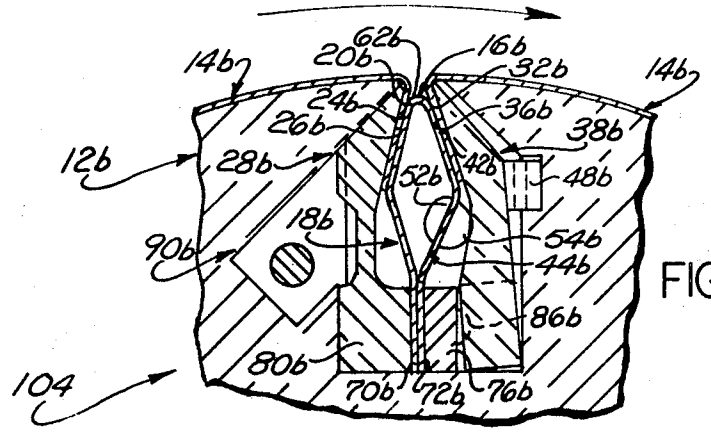


FIG. 6

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FLEXIBLE PLATE CLAMPING ASSEMBLY INCLUDING INWARDLY BOWED SPRING AND MOVABLE JAW

The present invention provides a new and improved clamp assembly for securing a printing plate or other printing elements to a cylinder.

During the first 2 hours of operation of a lithographic printing press, the printing plate tends to permanently elongate. However, during subsequent operation very little elongation of the printing plate will occur. Therefore, the printing plate clamp assembly should be capable of compensating for this elongation during initial operation of the printing press by maintaining a predetermined tension on the printing plate. Also, the clamp assembly should cause a minimum of deformation in the printing plate so that it can be preserved for reruns, an essential requirement for book printing. In addition, the clamp assembly should provide a fast lockup to minimize the press down time on short or repeat runs.

The foregoing operating characteristics should ideally be obtained by a relatively inexpensive clamp assembly which is reliable in operation and capable of being readily installed in a printing press. Many efforts have been made to design such a clamp assembly, as evidenced by many issued patents including my U.S. Pat. No. 3,359,899. While the clamp assemblies disclosed in these patents are more or less satisfactory, they all have shortcomings, economic or otherwise, which become apparent either during manufacture or operation of the associated printing press.

Accordingly, it is an object of this invention to provide a new and improved printing plate clamp assembly which is quick and reliable in operation and is capable of maintaining a predetermined tension in a printing plate while enabling the printing plate to be subsequently used for reruns.

Another object of this invention is to provide a new and improved clamp assembly for securing a printing element to a printing cylinder wherein the clamp assembly is relatively inexpensive to fabricate and is readily installed in the printing cylinder.

Another object of this invention is to provide a new and improved clamp assembly for securing a printing element to a printing cylinder wherein the clamp assembly is relatively compact and enables the cylinder journals to be constructed without cavities, thereby increasing the rigidity of the printing cylinder.

Another object of this invention is to provide a new and improved clamp assembly for securing a printing element to a printing cylinder wherein one end portion of the printing element is gripped between one side of an inwardly bowed spring element and an opposite end portion of the printing element is pressed with a predetermined force against an opposite side of the inwardly bowed spring element to maintain a predetermined tension in the printing element and to compensate for elongation of the printing element.

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

FIG. 1 is a schematic illustration of a specific preferred embodiment of the clamp assembly in association with a plate cylinder of a lithographic or wraparound press;

FIG. 2 is a fragmentary sectional view, taken on an enlarged scale along the line 2—2 of FIG. 1, illustrating the clamp assembly in a release or open condition;

FIG. 3 is a fragmentary sectional view, similar to FIG. 2, illustrating the clamp assembly in a partially engaged or locked condition;

FIG. 4 is a fragmentary sectional view, similar to FIGS. 2 and 3, illustrating the clamp assembly in a fully engaged or locked condition;

FIG. 5 is a sectional view, similar to FIG. 4, of another embodiment of the invention wherein only one end portion of a clamp spring is fixedly secured to the associated printing cylinder; and

FIG. 6 is a sectional view, similar to FIGS. 4 and 5, of another embodiment of the invention wherein inner ends of the clamp springs are secured to the associated printing cylinder in abutting engagement with each other.

Although a clamp assembly **10** forming a specific preferred embodiment of the present invention can be used to secure many different types of printing elements to different types of printing cylinders, the clamp assembly is illustrated in FIG. **1** in association with a plate cylinder **12** and is operable to secure a lithographic printing plate **14** to the plate cylinder. The clamp assembly **10** includes an inwardly bowed or bent clamp spring **16** having an archlike or U-shaped cross-sectional configuration. A leading side portion or arm **18** of the clamp spring **16** has a clamping surface **20** formed thereon for pressing a leading end portion **24** of the printing plate **14** against a serrated clamping surface **26** formed on a fixed jaw **28**. A trailing end portion **32** of the printing plate **14** is gripped between a clamping surface **36** on a movable jaw or clamp arm **38** and a clamping surface **42** on an upstanding trailing side portion or arm **44** or the clamp spring **16**. It should be noted that each of the end portions **24** and **32** of the printing plate **14** are bent only once and have a relatively small circumferential extent or length to tend to minimize deformation of the printing plate and to enable it to be used for reruns.

A substantially constant, predetermined tension is maintained in the printing plate **14** by a longitudinally extending wave spring **48**. The wave spring **48** is stronger than the clamp spring **16** and presses against the movable jaw **38** to provide a predetermined clamping pressure against the leading and trailing end portions **24** and **32** of the printing plate **14**. In addition, the movable jaw **38** continuously presses or urges the trailing end portion **32** of the printing plate **14** inwardly toward the center of a longitudinally extending gap **50** in the cylinder **12**. The continuous pressure applied by the movable jaw **38** results in a constant tension being maintained in the printing plate **14**. If the printing plate **14** should elongate, the relatively strong wave spring **48** will merely press the arms **18** and **44** of the relatively weak clamp spring **16** toward each other to thereby compensate for the elongation of the printing plate and maintain the tension in the printing plate substantially constant.

The clamp assembly **10** is operable to an open or release condition (FIG. **2**) in which the leading and trailing end portions **24** and **32** of the printing plate **14** can be either inserted between the clamping surfaces on the clamp spring **16** and jaws **28** and **38** or removed from between these clamping surfaces. The clamp assembly **10** is operated to the open or release condition by a main cam element **52** which is mounted on a camshaft **54** disposed midway between the spring arms **18** and **44**. The main cam element **52** presses the movable jaw **38** sidewardly or outwardly against the influence of the wave spring **48** to provide space between the clamp spring **16** and the jaws **28** and **38** so that the clamp spring **16** is free to assume a normal position shown in FIG. **2**.

Assuming that the printing plate **14** is to be mounted on the cylinder **12**, the leading end portion **24** of the printing plate is inserted into the space between the clamp surface **26** on the fixed jaw **28** and the clamp surface **20** on the spring arm **18**. The camshaft **54** is then rotated from the position shown in FIG. **2** to the position shown in FIG. **3** to operate the clamp assembly **10** to a partially engaged or locked condition. When the clamp assembly **10** is in the partially engaged condition, the leading end portion **24** of the printing plate is gripped or clamped between the clamp surface **20** on the spring arm **18** and the clamp surface **26** on the fixed jaw **28**. The spring arm **18** is pressed toward the fixed jaw **28** by a secondary cam element **58** on the camshaft **54** to provide this clamping action. It should be noted that the clamp surface **42** on the spring arm **44** is spaced from the clamp surface **36** on the movable jaw **38** since the movable jaw is still pressed sidewardly or outwardly against the influence of the wave spring **48** by the main cam element **52**.

After the leading end portion of the printing plate **14** has been securely gripped between the clamp surfaces **20** and **26**. The cylinder **12** may be rotated one revolution to wrap the

printing plate **14** around it and the trailing end portion **32** of the printing plate is then inserted into the space between the clamp surfaces **42** and **36** (see FIG. **3**). The camshaft **54** is then rotated, by a lug **55** (FIG. **1**), to the position illustrated in FIG. **4** to operate the clamp assembly **10** to a fully engaged or locked condition in which the main cam element **52** is spaced from the movable jaw **38** to enable the movable jaw to be forced or pressed inwardly by the wave spring **48**. The trailing end portion **32** of the printing plate **14** is then securely gripped between the clamp surface **42** on the spring arm **44** and the clamp surface **36** on the movable jaw **38**.

A portion of the force or pressure applied by the movable jaw **38** under the influence of the wave spring **48** is resisted by the printing plate **14** to maintain a predetermined tension in the printing plate. The remainder of the force or pressure applied by the movable jaw **38** is transmitted by an arcuate outermost portion **62** of the clamp spring **16** to the spring arm **18**. While an almost negligible amount of this force is absorbed in overcoming the natural resilience of the spring arms **44** and **18**, the majority of this force is utilized to securely grip the leading end portion **24** of the printing plate **14** between the clamp surface **29** on the spring arm **18** and the clamp surface **26** on the fixed jaw **28**. If the printing plate **14** stretches or elongates, the movable jaw **38** will move the pring arm **44** toward the opposite spring arm **18** against the influence of the relatively weak clamp spring **16**. This movement of the spring arm **44** absorbs or compensates for the elongation of the printing plate **14** so that the movable jaw **38** and wave spring **48** maintain the tension in the printing plate substantially constant even though the printing plate elongates.

While it is contemplated that the clamp assembly **10** can be constructed in many different ways utilizing springs of different sizes and stiffnesses, in a specific preferred embodiment of the invention six steel clamp springs **16** were located at intervals in a spaced-apart relationship along the longitudinal axis of a gap or cavity **50** in the printing cylinder **12**. The wave spring **48** pressed the movable jaw **38** inwardly toward the clamp springs **16** with a force of approximately 150 pounds. Approximately 75 pounds of this spring force was utilized to tension the printing plate **14**. The remaining 75 pounds of the spring force is utilized to clamp the leading end portion **24** of the printing plate **14** between the clamp surfaces **20** and **26** on the spring arm **18** and fixed jaw **28** and to clamp the trailing end portion **32** between the clamp surfaces **42** and **36** on the spring arm **44** and movable jaw **38**. Of course, the clamp assembly **10** can be constructed with different numbers of clamp springs **16** and with a wave spring **48** which apply either a greater or lesser spring force to the movable jaw **38**. Therefore, the foregoing specific spring forces should be considered as merely being illustrative.

Innermost end portions **70** and **72** of the clamp spring **16** are fixedly connected to a mounting block **76** which is in turn connected to the plate cylinder **12** at an innermost end of the gap **50**. An inner end portion **80** of the fixed jaw **28** is disposed in a fixed relationship with the mounting block **76** and the printing cylinder **12**. An inner end portion **84** of the movable jaw **38** is pivotally mounted on an arcuate protruberance **86** to enable the movable jaw **38** to pivot between the release position of FIG. **2** and the engaged position of FIG. **4**. The wave spring **48** which urges the movable jaw **88** toward the engaged position of FIG. **4** is readily installed in a sidewardly protruding and longitudinally extending recess **88** formed in the cylinder **12**.

An adjustment assembly **90** is provided for advancing or skewing the plate **14** for the purpose of registering colors. The adjustment assembly **90** includes a wedge member **92** which is movable longitudinally in the printing cylinder **12** by means of an adjusting screw **94** which is rotated by means of a lug **95** (FIG. **1**). Moving the wedge member **92** changes the angular relationship between the fixed jaw **28** and the movable jaw **38** to thereby skew the printing plate **14** in a known manner. A second adjustment assembly (not shown), similar to the adjustment assembly **90**, is provided adjacent the opposite longitudinal end of the printing cylinder **12**. By operating both of the adjustment assemblies, the printing plate **14** can be advanced by moving the fixed jaw forwardly without skewing the printing plate. However, with accurately etched and crimped printing plates, the adjustment assembly **90** may be omitted.

Two other clamp assemblies **100** and **104** forming other specific preferred embodiments of the invention are illustrated in FIGS. **5** and **6**. Since the components of the clamp assemblies **100** and **104** are substantially the same as the components of the clamp assembly **10** and since they operate in much the same manner as does the clamp assembly **10**, the components of the clamp assemblies **100** and **104** which are similar to the components of the clamp assembly **10** have been designated with the same numerals. However, the suffix letter "*a*" has been added to the numerical designation for the components of the clamp assembly **100** and the suffix letter "*b*" has been added to the numerical designation for the components of the clamp assembly **104** to avoid confusion.

The clamp assembly **100** includes a clamp spring **16***a* having an upstanding spring arm **18***a* with a clamp surface **20***a* formed thereon for clamping a leading end portion **24***a* of the printing plate **14***a* against the clamp surface **26***a* formed on a fixed jaw **28***a*. It should be noted that the fixed jaw **28***a* is integrally formed with the printing cylinder **12***a* and is not adjustable to provide for registering of colors. A movable jaw **38***a* is forced or pressed against an upstanding spring arm **44***a* by a wave spring **48***a* by a wave spring **48***a* to thereby clamp a trailing end portion **32***a* of the printing plate **14***a* between a clamp surface **42***a* formed on the spring arm **44***a* between a clamp surface **36***a* formed on the movable jaw **38***a*.

The clamp springs **16***a* differs from the clamp spring **16** of the embodiment of FIGS. **1–4** in that the spring arm or side **44***a* is not secured to a mounting block **76***a* as is the innermost end portion **72** of the spring arm **44** of FIGS. **1** through **4**. It should be noted that the innermost end portion **70***a* of the spring arm **18***a* is fixedly secured to the mounting block **76***a*.

The clamp assembly **104** (FIG. **6**) includes a clamp spring **16***b* having clamp surfaces **20***b* and **42***b* which cooperate with clamp surfaces **26***b* and **36***b*, respectively, to clampingly engage leading and trailing end portions **24***b* and **32***b* of the printing plate **14***b*. The clamp surface **36***b* is formed on a movable jaw **38***b* which is urged toward the clamp spring **16***b* by a wave spring **48***b* in a manner previously explained in connection with the embodiment of FIGS. **1–4**. The clamp surface **26***b* is formed on the jaw **28***b*. The clamp spring **16***b* includes upstanding spring arms or side portions **18***b* and **44***b* on which the clamp surfaces **20***b* and **42***b* are located. The innermost end portions **70***b* and **72***b* of the spring arms **18***b* and **44***b* are fixedly secured to a mounting block **76***b* with inner surfaces of the inner end portions **70***b* and **72***b* in abutting engagement.

A cam **54***b*, having only a main cam element **52***b*, is located between the spring arm **44***b* and the movable jaw **38***b*. The cam **54***b* is rotatable from the position illustrated in FIG. **6** to operate the clamp assembly **104** to a release or open condition in much the same manner as previously explained in connection with the embodiment of FIGS. **1–4**. Specifically, the main cam element **52***b* engages the movable jaw **38***b* and presses the movable jaw sidewardly or outwardly against the influence of the wave spring **48***b* to release the clamping pressure against the leading and trailing end portions **24***b* and **32***b* of the printing plate **14**. In the embodiment of the invention illustrated in FIG. **6**, the cam **54***b* is formed by a pair of studs rotatably mounted at opposite ends of the cylinder **12**. A through camshaft is not utilized since it would interfere with the spring **16***b*.

In view of the foregoing remarks, it can be seen that the clamp assemblies **10**, **100**, **104** are quickly operable between an engaged or locked condition and a released or unlocked condition by rotation of a camshaft. In the engaged or locked condition, the movable jaw **38** maintains a predetermined tension in the printing plate **14** to compensate for any elongation of the printing plate. The trailing end portion of the printing plate is pressed against the spring arm **44** by the movable jaw

38 under the influence of the relatively strong wave spring 48. This action presses a second resiliently deflectable spring arm 18 toward a clamping surface 26 on a fixed jaw 28 to thereby clamp the leading end portion 24 between the spring arm 18 and the fixed jaw 28.

The use of the single longitudinally extending wave spring 48 to press the movable jaw 38 toward the clamp spring 16 enables the clamp assemblies to be readily installed in the gap 50 of a printing cylinder. In addition, the use of the inwardly bowed clamp spring 16 which has an archlike shape or configuration enables the camshaft 54 to be located between the upwardly extending spring arms 18 and 44 to minimize the necessity of forming holes or cavities in the printing cylinder 12. It should be noted that journals at opposite ends of the printing cylinder, only the journal 110 at one end of the printing cylinder being shown at FIG. 1, have a continuous outer surface to thereby increase the rigidity of the printing cylinder.

I claim:

1. A clamp assembly for holding a printing element against an outer surface of a printing cylinder, said clamp assembly comprising means for defining first and second longitudinally extending clamp surfaces located along opposite sides of a longitudinally extending gap which extends transversely from the outer surface of the printing cylinder in an inward direction toward the center portion of the printing cylinder, inwardly bowed spring means located intermediate said first and second clamp surfaces for cooperating therewith to clampingly engage opposite end potions of the printing element, said inwardly bowed spring means including first and second clamp portions for cooperating with said first and second clamp surfaces to grip end portions of a printing element and an arcuate bight portion interconnecting said first and second clamp portions, said first and second clamp portions having outermost ends disposed adjacent to the outer surface of the printing cylinder and innermost ends spaced further from the outer surface of the printing cylinder than said outermost ends, said arcuate bight portion being located between said clamp surfaces and extending between said outermost ends of said first and second clamp portions to form a continuous spring which is bowed with said clamp portions extending in the inward direction from said arcuate bight portion, and means for operating said clamp assembly from a released condition to an engaged condition in which one end portion of the printing element is clamped between said first clamp surface and said first clamp portion of said inwardly bowed spring means and in which another end portion of the printing element is clamped between said second clamp surface and said second clamp portion of said inwardly bowed spring means to thereby securely connect the printing element to the printing cylinder.

2. A clamp assembly as set forth in claim 1 further including a movable jaw element extending longitudinally along one side of said gap adjacent to said first clamp portion of said inwardly bowed spring means, said first clamp surface being formed on said movable jaw element, said means for operating said clamp assembly from a released condition to an engaged condition including longitudinally extending spring means for urging said jaw element toward said first clamp portion of said inwardly bowed spring means to grip said one end portion of said printing element therebetween and for urging said second clamp portion toward said second clamp surface under the influence of forces transmitted from said first clamp portion to said second clamp portion by said arcuate bight portion to grip said other end portion of said printing element between said second clamp portion and said second clamp surface.

3. A clamp assembly as set forth in claim 1 wherein said innermost end of at least one of said clamp portions is fixedly connected with said printing cylinder.

4. A clamp assembly as set forth in claim 1 wherein said means for defining said first and second longitudinally extending clamp surfaces includes a movable jaw element with one of said clamp surfaces disposed thereon, said clamp assembly further including cam means located inwardly of said arcuate bight portion for engaging said movable jaw element and moving said movable jaw element in a direction away from said first and second clamp portions to operate said clamp assembly from said engaged condition to said released condition.

5. A clamp assembly as set forth in claim 4 wherein said cam means includes a longitudinally extending shaft disposed intermediate opposite side portions of said inwardly bowed spring means.

6. A clamp assembly as set forth in claim 4 wherein said cam means is disposed intermediate said movable jaw element and said inwardly bowed spring means.

7. A clamp assembly as set forth in claim 1 wherein said clamp assembly further includes means for skewing the printing element relative to the printing cylinder by varying a longitudinal angular relationship between said first and second clamp surfaces.

8. A clamp assembly for securing a printing element to a printing cylinder, said clamp assembly comprising means for defining a plurality of longitudinally extending clamp surfaces disposed along opposite sides of a longitudinally extending gap in the printing cylinder, said means including a movable jaw element defining one of said clamp surfaces, first and second resiliently deflectable spring arms operatively connected with the printing cylinder and located intermediate said clamp surfaces, means interconnecting said spring arms for transmitting force from said first spring arm to said second spring arm, spring means for urging said movable jaw element toward said first spring arm to clamp one end portion of the printing element between said one clamp surface on said movable jaw element and said first spring arm and for urging said second resiliently deflectable spring arm toward said other clamp surface with a predetermined force transmitted from said first spring arm to said second spring arm by said means of interconnecting said spring arms to clamp another end portion of the printing element between said second spring arm and said other clamp surface, and actuator means disposed in the gap in the cylinder for moving said jaw element away from said first spring arm to operate said clamp assembly to a release condition in which at least one of the end portions of the printing element is free to move relative to said clamp surfaces.

9. A clamp assembly as set forth in claim 8 wherein said actuator means includes a first cam element for engaging said jaw element to move said jaw element away from said first spring arm and a second cam element for engaging said second spring arm to move said second spring arm toward said other clamp surface to clamp the other end portion of the printing element between said other clamp surface and said other spring arm when said jaw element is moved away from said first spring arm by said first cam element to thereby enable the other end portion of the printing element to be clamped while the one end portion of the printing element is free to move.

10. A clamp assembly as set forth in claim 8 wherein said means for urging said movable jaw element toward said first spring arm includes a wave spring extending longitudinally of the printing cylinder.

11. A clamp assembly as set forth in claim 8 wherein said means interconnecting said first and second springs arms comprises an arcuate bight portion which extends between and forms a continuation of said first and second spring arms.

12. A clamp assembly as set forth in claim 11 wherein said arcuate bight portion is disposed intermediate said clamp surfaces adjacent to an outer surface of the printing cylinder.

13. A clamp assembly for holding a printing element against an outer surface of a printing cylinder, said clamp assembly comprising means for defining first and second longitudinally extending clamp surfaces disposed along opposite sides of a longitudinally extending gap which extends transversely from the outer surface of the printing cylinder in an inward direction toward the center portion of the printing cylinder, said means including a movable jaw element defining said first

clamp surface, inwardly bowed spring means located intermediate said first and second clamp surfaces for cooperating therewith to clampingly engage opposite end portions of the printing element, said inwardly bowed spring means including first and second resiliently deflectable spring arms located intermediate said first and second clamp surfaces and and arcuate bight portion extending between and forming a continuation of said spring arms, said arcuate bight portion being located between said first and second clamp surfaces and extending between outermost ends of said first and second spring arms adjacent to the outer surface of the cylinder to form a continuous spring which is bowed with said spring arms extending in the inward direction from said arcuate bight portion, at least one of said spring arms having an innermost end portion fixedly connected to the printing cylinder, spring means for urging said movable jaw element toward said first

spring arm to clamp one end portion of the printing element between said first clamp surface on said movable jaw element and said first spring arm and for urging said second resiliently deflectable spring arm toward said second clamp surface with a predetermined biasing force transmitted from said first spring arm to said second spring arm by said arcuate bight portion to clamp another end portion of the printing element between said second spring arm and said second clamp surface, and cam means disposed in the gap in the cylinder inwardly of said arcuate bight portion and operable to move said jaw element away from said first spring arm to thereby operate said clamp assembly to a release condition in which at least one of the end portions of the printing element is free to move relative to said clamp surfaces.