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Murata

[11] **3,858,513**

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[54] **DEVICE FOR CLAMPING THE TRAILING END PORTION OF A SHEET TO A DRUM**

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[73] Assignee: **Ricoh Co., Ltd.,** Tokyo, Japan

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[52] **U.S. Cl.** **101/415.1**

[51] **Int. Cl.** **B41f 27/06**

[58] **Field of Search** 101/415.1, 132, 132.5, 101/142–144, 409–411

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[57] **ABSTRACT**

A device comprising clamp means including hooks for piercing the trailing end portion of a sheet after the leading end portion of the sheet is automatically gripped by grip claw means on a rotating drum and the sheet is wound on the drum. By being pierced by the hooks, the trailing end portion of the sheet is automatically clamped to the periphery of the drum.

6 Claims, 6 Drawing Figures

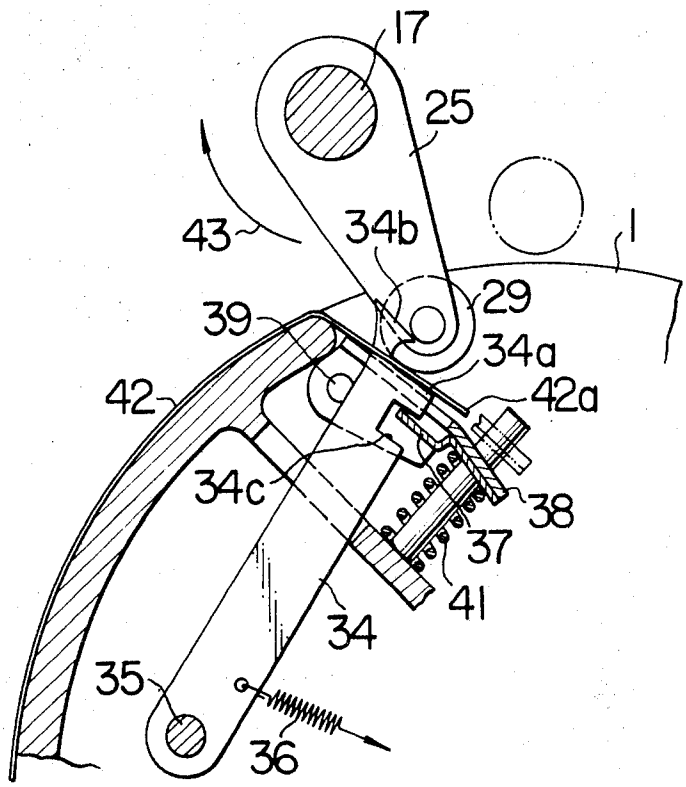

FIG. 1

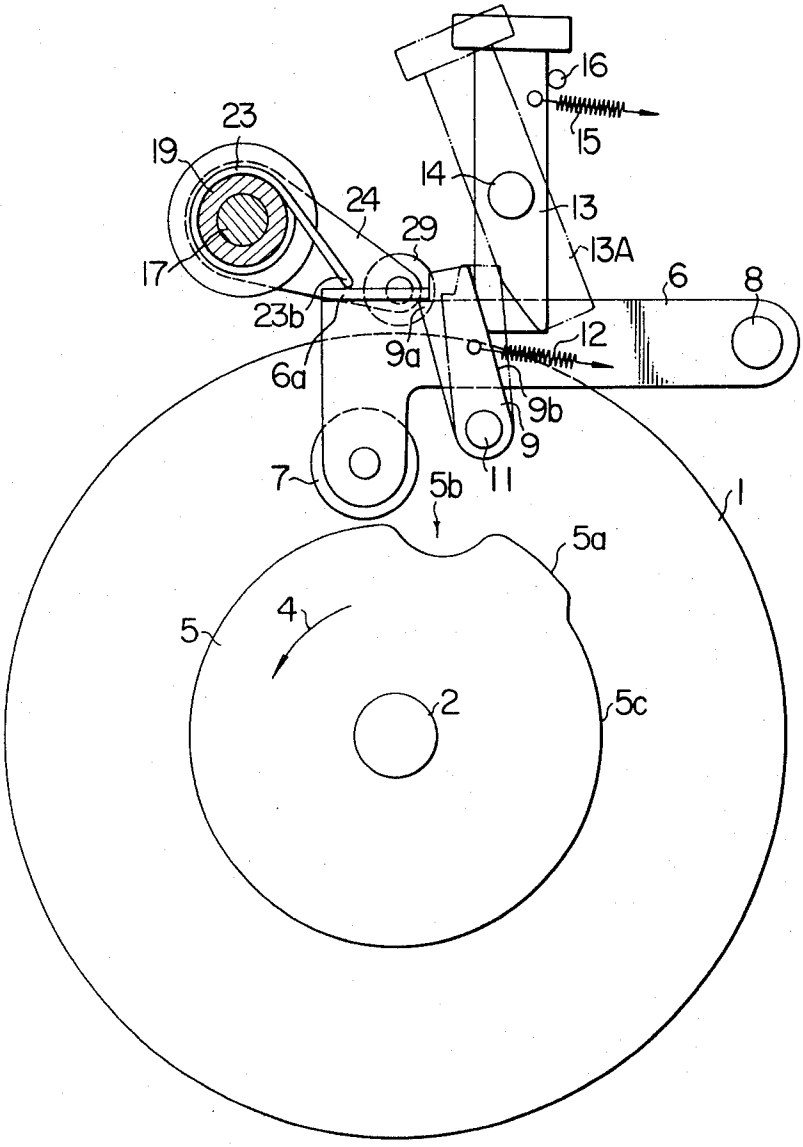

FIG. 2

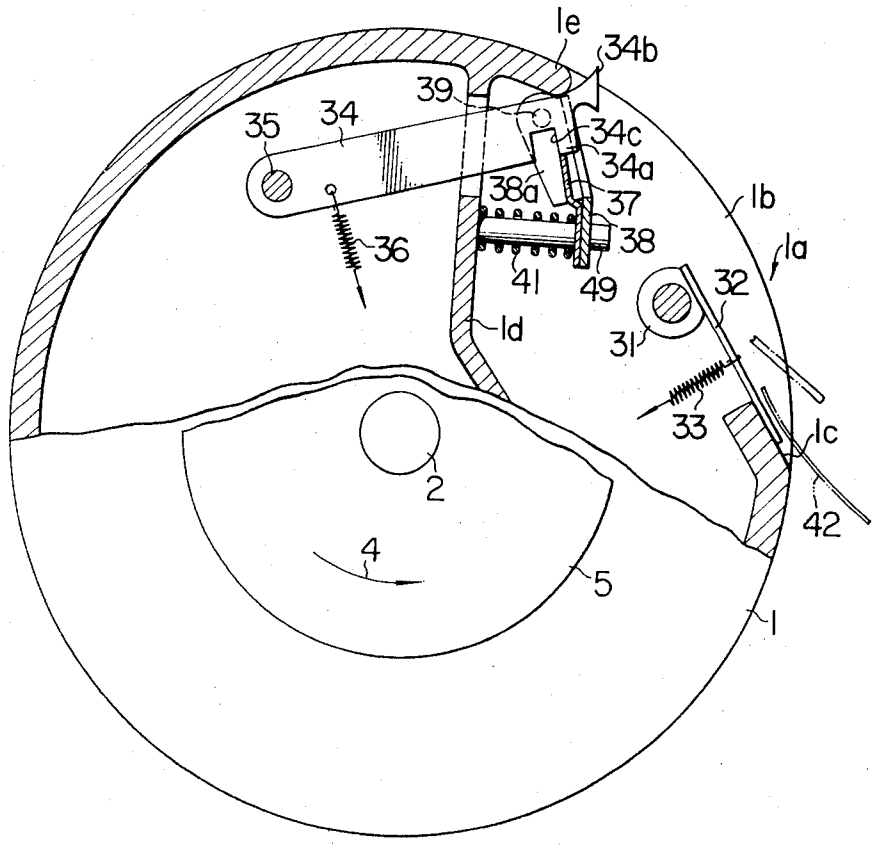
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FIG. 3

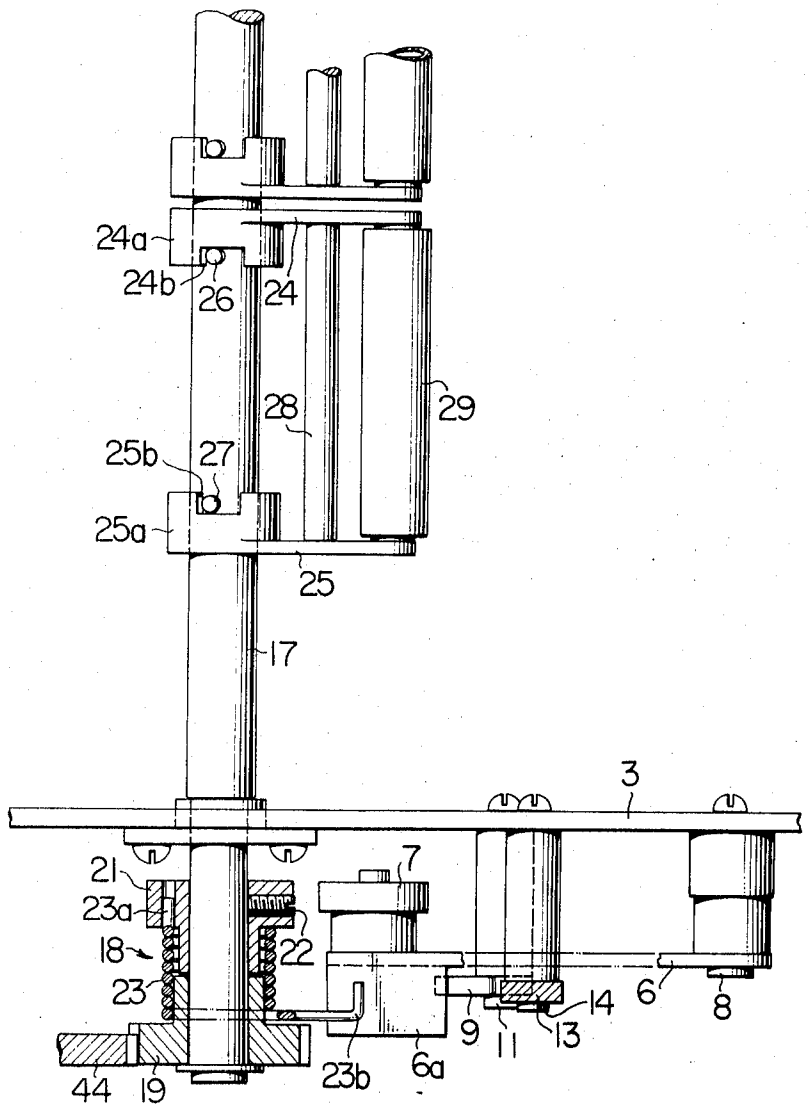
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FIG. 4

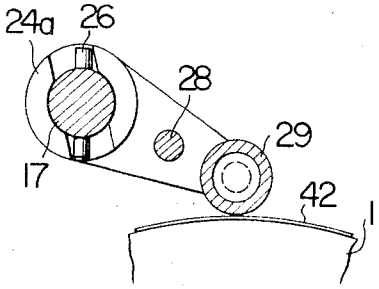


FIG. 5

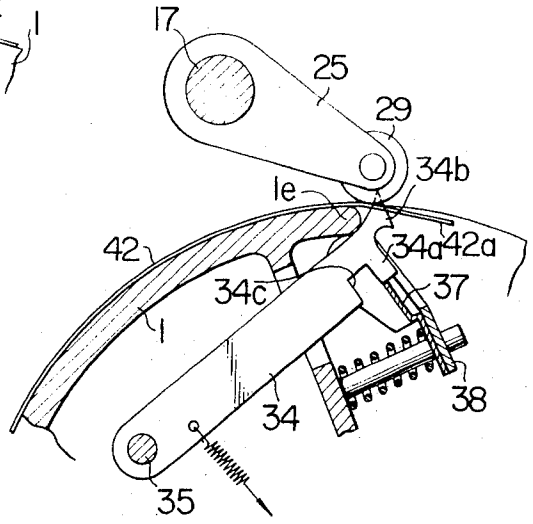
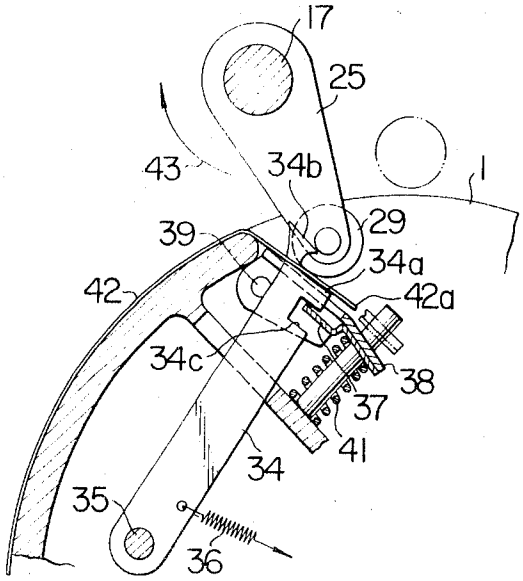


FIG. 6



DEVICE FOR CLAMPING THE TRAILING END PORTION OF A SHEET TO A DRUM

BACKGROUND OF THE INVENTION

This invention relates to a device for automatically clamping the trailing end portion of a sheet to a rotating drum by piercing it with hooks after the leading end portion of the sheet is automatically gripped by grip claw means on the drum.

In apparatus comprising a drum adapted to be rotated to perform an operation with a sheet mounted on the surface thereof and having its leading end portion automatically gripped by one portion of the drum, it is necessary to positively clamp not only the leading end portion of the sheet but also the trailing end portion thereof to the periphery of the drum.

In offset duplicating apparatus, for example, a sheet, such as a master or printing plate, is supplied to a rotating drum (or master cylinder) and its leading end portion is clamped to the periphery of the master cylinder by being gripped by grip claw means provided on the master cylinder. In some types of offset duplicating apparatus, the trailing end portion of the master plate is not clamped to the master cylnder and thus free to move. The master plate having a free trailing end portion has the disadvantage of frequently being inadvertently brought into contact with the ink roller and soiled with ink.

In some types of duplicating apparatus, means is provided for preparing a master plate on the periphery of a drum by mounting on the drum a photosensitive sheet used for electrophotography. If the trailing end portion of the photosensitive sheet on the drum is not clamped to the drum, it will not be possible to satisfactorily carry out exposure of the sheet to an optical image of an original. It is thus desirable to positively clamp not only the leading end portion but also the trailing end portion of the sheet to the drum.

Proposals have been made to obviate these disadvantages of the prior art by providing means to clamp the trailing end portion of a sheet to a drum. The operation of mounting a sheet on a drum can be performed either by manually clamping the leading and trailing end portions or the drum when the sheet is mounted on the drum after the rotation of the drum is interrupted, or by feeding a sheet in good timing to the rotating drum and clamping both the leading and trailing end portions thereof to the drum without interrupting its rotation.

In one method known in the art to clamp not only the leading end portion but also the trailing end portion of a sheet to a drum while the latter is rotating, the sheet automatically fed to the rotating drum has its leading end portion gripped by grip claws and clamped to the drum, and the trailing end portion thereof is clamped to the drum by clamp means disposed in a recess in the periphery of the drum which clamp means is pulled out of the recess and moved above the sheet when the sheet is fed to the drum and returned to its original position in the recess when the trailing end portion of the sheet is brought to a position in which it is engaged by the clamp means and clamped to the drum.

The method of manually clamping the sheet to the drum has the disadvantages of not only requiring troublesome manual attention but also having to interrupt the rotation of the drum. The conventional method of using clamp means to clamp the trailing end portion of the sheet to the drum is not without disadvantages. This method requires a complex mechanism for performing various operations, and difficulty is experienced in performing these operations in timed relation.

SUMMARY OF THE INVENTION

This invention has as its object the provision of a device for automatically clamping the trailing end portion of a sheet to a rotating drum which obviates the disadvantages of similar devices of the prior art.

This invention permits the trailing end portion of a sheet to be automatically clamped to the periphery of a rotating drum, with the sheet being maintained in intimate contact with the periphery of the drum after the trailing end portion thereof is clamped. Any sheet can have its trailing end portion clamped to the periphery of the drum irrespective of the length of the sheet or the presence of openings in the sheet. The clamped trailing end portion of the sheet is readily released from the periphery of the drum when the sheet is to be removed from the drum.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side view of the device for clamping the trailing end portion of a sheet to a drum comprising one embodiment of the invention;

FIG. **2** is a side view of a drum with certain portions thereof being cut away to show the mechanism disposed in the interior of the drum;

FIG. **3** is a plan view of FIG. **1** with the drum being eliminated in the interest of brevity;

FIG. **4** is a view showing the operation of the sheet hold-down roller; and

FIG. **5** and FIG. **6** are views showing the operation of the mechanism shown in FIG. **2.**

DESCRIPTION OF A PREFERRED EMBODIMENT

In FIG. **1,** a drum **1** is mounted on a shaft **2** rotatably supported at its opposite ends by a pair of side plates (one of which is shown at **3** in FIG. **3**) and rotated in the direction of an arrow **4** by conventional drive means (not shown). An actuation cam **5** is secured to the shaft **2** and tracked at its periphery by a roller **7** supported through a shaft on the lower portion of a free end of a follower **6** which is pivotally supported at its base by a shaft **8** connected to side plate **3** (See FIG. **3**). The follower **6** is formed at the upper portion of its free end with a bent portion **6***a* which is adapted to be engaged and locked by an offset portion **9***a* of locking member **9.** When the roller **7** of the follower **6** is in engagement with a major diameter portion **5***a* of the actuation cam **5,** there is a gap between the offset portion **9***a* of the locking member **9** and the bent portion **6***a* of the follower. However, when the roller **7** drops out of engagement with portion **5***a*, it is held out of engagement with a valley **5***b* and a minor diameter portion **5***c*, the bent portion **6***a* is brought into pressing engagement with the offset portion **9***a* and locked thereby.

The locking member **9** is pivotally supported at its base by a shaft **11** connected to a side plate **3** and urged to move clockwise about the shaft **11** by the biasing force of a spring **12** connected at one end to an immovable member such as a pin on plate **3** (not shown) and at the other end to the member **9.** The member **9** is thus brought into pressing engagement at its back edge **9***b* with the lower portion of one side edge of an operation lever **13.** The operaation lever **13** is pivotally supported

by a shaft **14** connected to the side plate **3** and urged to move clockwise about the shaft **14** by the biasing force of a spring **15** connected at one end to another immovable member, such as a pin on plate **3** (not shown) and at the other end to the lever **13**, so that the operation lever **13** is normally disposed in a position in which it is maintained at the other side edge thereof in pressing engagement with a stopper **16**.

As also seen in FIG. **3**, a gear **19** of a spring clutch generally designated **18** is loosely mounted at one end portion of a shaft **17** rotatably supported by the pair of side plates **3** (only one side plate is shown), and a fixed member **21** disposed adjacent the gear **19** is secured to the shaft **17** by a screw **22**. A helical spring **23** is mounted on bosses of the gear **19** and fixed member **21**, and connected at one end portion **23***a* to the fixed member **21** and is in pressing engagement at the other end portion **23***b* thereof with the bent portion **6***a* of the follower **6**. The boss of the fixed member **21** has a diameter which is slightly smaller than that of the boss of gear **19**, so that the helical spring **23** is maintained in intimate contact with the boss of the gear **19** but spaced apart from the boss of the fixed member **21** when fitted over them.

The gear **19** is driven by a gear **44** to rotate clockwise in FIG. **1**. However, since the one end portion **23***b* of the helical spring **23** is in pressing engagement with the bent portion **6***a* of the follower **6** and the spring **23** is loose, rotation of the gear **19** is not transmitted to the fixed member **21** and the gear **19** consequently rotates idly.

A pair of support arms **24** and **25** are loosely mounted at bosses **24***a* and **25***a* thereof on the shaft **17**. Cutouts **24***b* and **25***b* are formed in the support arms **24** and **25** for receiving therein pins **26** and **27** respectively which are fixed on the shaft **17** to limit the range of movement of the support arms **24** and **25**. The support arms **24** and **25** are interconnected by a stay **28** and support at their free ends a sheet hold-down roller **29** for rotation. The shaft **17** supports a plurality of sets of support arms **24** and **25**, so that a plurality of sheet hold-down rollers **29** are provided.

In FIG. **2**, the drum **1** is shown as being formed therein with a relatively large recess **1***a* defined by two side walls **1***b* loosely supporting opposite ends of a shaft **31** having sheet grip claws **32** secured thereto at their base. The sheet grip claws **32** each have a free end which is urged to move into pressing engagement with a front end portion **1***c* of the periphery of the drum **1** by the biasing force of a spring **33** mounted between the side wall **1***b* and the claws **32**.

Clamp means **34** comprising a plurality of plate members is disposed in a rear end portion of recess **1***a* in the periphery of the drum **1** and secured at its base to a shaft **35** loosely supported at opposite ends by the two side walls **1***b*. The clamp means **34** is urged to move clockwise about the shaft **35** by the biasing force of a spring **36** connected at one end to the side wall **1***b* and at the other end to the clamp means **34**, so that a projection **34***a* formed at a free end of each plate member of the clamp means **34** is maintained in pressing engagement with the front end of one of a plurality of stoppers **37** corresponding in number to the plate members of the clamp means **34**. The stoppers **37** are secured at their bases to a hold plate **38** disposed parallel to the axis of the drum **1** and having at its opposite end bent portions **38***a* (only one of such bent portions is shown) each pivotally supported by shafts **39** connected to the side walls **1***b* of the drum **1**.

The hold plate **38** is formed at its base with a plurality of slots (not shown) each loosely receiving therein a free end portion of one of a plurality of guide rods **49** secured at their base to a reinforcing plate **1***d*. A compression spring **41** is mounted between the free end of the hold plate **38** and the reinforcing plate **1***d* to urge the hold plate **38** to move counter clockwise about shaft **39**, so that the hold plate **38** is maintained at its base in pressing engagement with a rear end portion **1***e* of the periphery of the drum **1**.

A hook **34***b* is formed at the free end of each plate member of the clamp means **34** for piercing the trailing end portion of a sheet **42** as subsequently to be described and clamping the end of the sheet to the drum. A recess **34***c* is formed at the free end of each plate member of the clamp means **34** for relieving the stoppers **37**. When the clamp means **34** is in the position shown in FIG. **2**, the actuation cam **5** is in the position shown in FIG. **1**.

In operation as shown in FIG. **2**, the sheet **42** is automatically fed to the drum **1** by a known sheet feed device (not shown). When the leading end portion of the sheet **42** reaches the recess **1***a* in the drum **1**, the grip claws **32** are opened and closed with appropriate timing as shown in dash-and-dot lines to grip the leading end portion of the sheet **42**. Clamping of the trailing end portion of the sheet **42** to the periphery of the drum **1** while the leading end portion thereof is gripped by the grip claws **32** on the rotating drum **1** can be accomplished by manually moving the operation lever **13** (See FIG. **1**) to an operative position shown at **13**A in dash-and-dot lines in FIG. **1**.

Moving the operation lever **13** to its operative position the bent portion **6***a* permits the locking member **9** to move clockwise and if released from the bent portion **6***a* of the follower **6**. Thus, the locking member **9** is free to move as aforementioned, and the roller **7** comes into engagement with the major diameter portion **5***a* of the cam **5**, the engagement of the offset portion **9***a* with the bent portion **6***a* is loosened and released. As the drum **1** and the actuation cam **5** continue to rotate in the direction of the arrow **4**, with the locking member **9** released from locking engagement with the follower **6**, the roller **7** will ride on minor diameter portion **5***c* and is brought into engagement with the recess **5***b*. Thereupon, the follower **6** moves counter clockwise and the end portion **23***b* of the spring **23** is released from pressing engagement with the bent portion **6***a* of the follower **6**. Although the shaft **17** is urged to move clockwise in FIG. **1** by the weight of the shaft hold-down roller **29** and the suport arms **24** and **25**, its clockwise movement is precluded by the end portion **23***b* of the spring **23** being maintained in pressing engagement with the bent portion **6***a* of the follower **6** in FIG. **1**. As a result, there is a relatively large gap between the spring **23** and the boss of the fixed member **21**.

The operation lever **13** is held in the operative position for only a short interval so that the locking member **9** can be released from engagement with the follower **6**. The locking mechanism will be restored to its position shown in FIG. **1** when the roller **7** is again brought into engagement with the major diameter portion **5***a* of the actuation cam **5**.

Whe the follower **6** pivots about the shaft **8** and its forward end moves downwardly in FIG. **1**, the end portion **23***b* of the spring **23** is released from engagement with the bent portion **6***a* of the follower **6**. As a result, the spring **23** is tightened by its resilience and clamped over the boss of the gear **19**, so that the spring **23** and the boss of the gear **19** act as a unit and rotation of the gear **19** is transmitted to the spring **23**.

By the time end portion **23***b* of the spring **23**, after from engagement with the bent portion **6***a* of the follower **6** substantially makes one complete revolution together with the gear **19**, the follower **6** has pivoted back to its original position. Thus, the end portion **23***b* is brought into pressing engagement with the bent portion **6***a* again and further rotation of the former is precluded. As a result, the spring **23** is again loosened by the rotation of the gear **19**, so that the gear **19** can rotate alone.

It will be appreciated that the spring clutch **18** performs the function of tightening the spring **23**, and that it is not intended to transmit the rotation of the gear **19** directly to the fixed member **21** and the shaft **17**. More specifically, when the clutch **18** is engaged, the spring **23** is tightened by its resilience and clamped over the boss of the gear **19** to act as a unit with the gear **19** and rotate therewith. However, since the end portion **23***b* is brought into pressing engagement with the bent portion **6***a* before the spring **23** is tightened by its resilience and clamped over the boss of the fixed member **21**, the spring **23** is not clamped to the boss of the fixed member **21**.

On the other hand, the spring **23** is tightened by the gear **19** and charged as aforementioned and produces a torsion torque which brings the sheet hold-down roller **29** connected to the fixed member **21** into pressing engagement with the periphery of the drum **1** with a light force as shown in FIG. **4**, thereby forcing the sheet **42** tightly over the periphery of the drum **1**.

Further rotation of the drum **1** moves the sheet hold-down roller **29** from the rear end portion **1***e* of the periphery of the drum **1** into engagement with the recess **1***a* as shown in FIG. **5**, simultaneously as the roller **7** is brought into engagement with the valley **5***b* of the actuation cam **5**. Thus the trailing end portion **42***a* of the sheet **42** is pushed by the sheet hold-down roller **29** into the recess **1***a*, so that the hooks **34***b* of the clamp means **34** penetrate the trailing end portion **42***a* of the sheet **42**. The sheet hold-down roller **29** rotates in the direction of an arrow **43** in FIG. **6** about the shaft **17** by virtue of the action of the spring clutch **18** and forces the trailing end portion **42***a* of the sheet **42** tightly against the hold plate **38**, thereby permitting the trailing end portion **42***a* to be fully penetrated by the hooks **34***b*.

The hold plate **38** moves clockwise as it is pressed by the hold-down roller **29**, so that the projections **34***a* of the clamp means **34** are released from engagement with the stopper **37**. As a result, the clamp means **34** is moved clockwise by the biasing force of the spring **36** and forces the trailing end portion **42***a* of the sheet **42** tightly over the periphery of the drum **1**. the sheet hold-down roller **29** is released from engagement with the hold plate **38** as the drum **1** rotates in the direction of the arrow **43** about the shaft **17** in FIG. **6** to be restored and held in the original position shown in FIG. **1**.

When it is desired to remove the sheet **42** from the drum **1**, the trailing end portion **42***a* of the sheet **42** can be released from the hooks **34***b* of the clamp means **34** by merely moving the leading end portion thereof away from the periphery of the drum **1**. No specific means is required for releasing the trailing end portion of the sheet from its clamped engagement with the drum. Releasing of the trailing end portion **42***a* of the sheet **42** from the hooks **34***b* moves the clamp means **34** counter clockwise about the shaft **35** and the projections **34***a* of the clamp means **34** are released from engagement with the stopper **37**, so that the hold plate **38** is restored from its position shown in FIG. **6** to its original position shown in FIG. **2**.

The invention has been described as effecting clamping of the sheet trailing end portion **42***a* by manually operating the operation lever **13**. It is to be understood that the invention is not limited to this mode of operation and that the operation lever **13** may be automatically rendered operative conjointly with the actuation of the sheet feed mechanism adapted to feed the sheet **42** to the drum **1**.

What is claimed is:

1. A device for clamping the trailing end portion of a sheet mounted on the peripheral surface of a rotating drum comprising:

a. clamping means disposed within an opening in the drum surface and mounted for pivoting between an inner position and an outer position, said clampling means comprising:
   i. a plurality of plate members each having a free end with an adjacent recess;
   ii. hook means on each of said plate members for hooking the trailing end of the sheet when brought into contact therewith; and
   iii. spring means for urging said plate members toward said inner position;

b. hold-plate means disposed within said opening adjacent to said clamping means and mounted for pivoting between an inner position and an outer position, said hold-plate means comprising:
   i. a pivoted hold-plate disposed adjacent said plate members in a position in which said hook means extend thereby outwardy of said opening;
   ii. stop means on said hold-plate engaging the free ends of said plate members for preventing said clamping means from pivoting to its inner position; and
   iii. spring means for urging said hold plate toward its outer position;

c. a shaft mounted for rotation ajacent said drum;

d. rotating means for rotating said shaft;

e. spring clutch means for operatively connecting, when engaged, said rotating means and said shaft to urge said shaft to rotate;

f. lock means for maintaining said spring clutch means disengaged;

g. sheet hold-down means mounted on said shaft for rotation therewith and including roller means thereon for pressing said sheet against the periphery of said drum and bringing the trailing end of said sheet into contact with said hook means for hooking thereby; and

h. means responsive to the rotation of said drum for engaging said spring clutch means when said lock means is released, to urge said shaft to rotate whereby said roller means, urged to rotate with said shaft, upon bringing the trailing end of the sheet into contact with said hook means in said opening, pivots said hold-plate means to its inner

position causing the stop means thereon to enter the recesses adjacent the free ends of said plate members permitting said clamping means to pivot to its inner position drawing the trailing end portion of said sheet into said opening and maintaining said sheet in contact with the surface of the drum.

2. A device as in claim **1** wherein said means responsive to the rotation of said drum comprises an actuation cam secured to one side of the drum for rotation therewith and pivotable follower means for tracking the periphery of said actuation cam.

3. A device as in claim **2** wherein said lock means comprises abutment means on said follower means engaged by an end of said spring clutch means and means for holding said follower means against pivoting to release said end of said spring clutch means.

4. A device as in claim **3** wherein said holding means comprises:

i. a pivotable member engaging said abutment means;

ii. means for urging said pivotable member to pivot out of engagement with said abutment means; and

iii. an operation lever holding said pivotable member from pivoting by said urging means.

5. A device as in claim **2** wherein the periphery of said actuation cam comprises:

i. a major diameter portion;

ii. a minor diameter portion; and

iii. a valley in said minor diameter portion.

6. A device as in claim **1** wherein said rotating means comprises a rotating gear loosely mounted on said shaft and having a boss thereon.

* * * * *