United States Patent [19]

Minami

[11] **3,866,568**

[45] **Feb. 18, 1975**

[54] **BOOKBINDING MACHINE**

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[22] Filed: **Dec. 15, 1972**

[21] Appl. No.: **315,594**

[30] **Foreign Application Priority Data**

Dec. 20, 1971 Japan 46-120373

[52] **U.S. Cl.** **118/238,** 118/241, 118/244

[51] **Int. Cl.** **B05c 1/02,** B42c 9/02

[58] **Field of Search** ..... 11/1 AD; 118/241, 238, 118/236, 261, 1, 244

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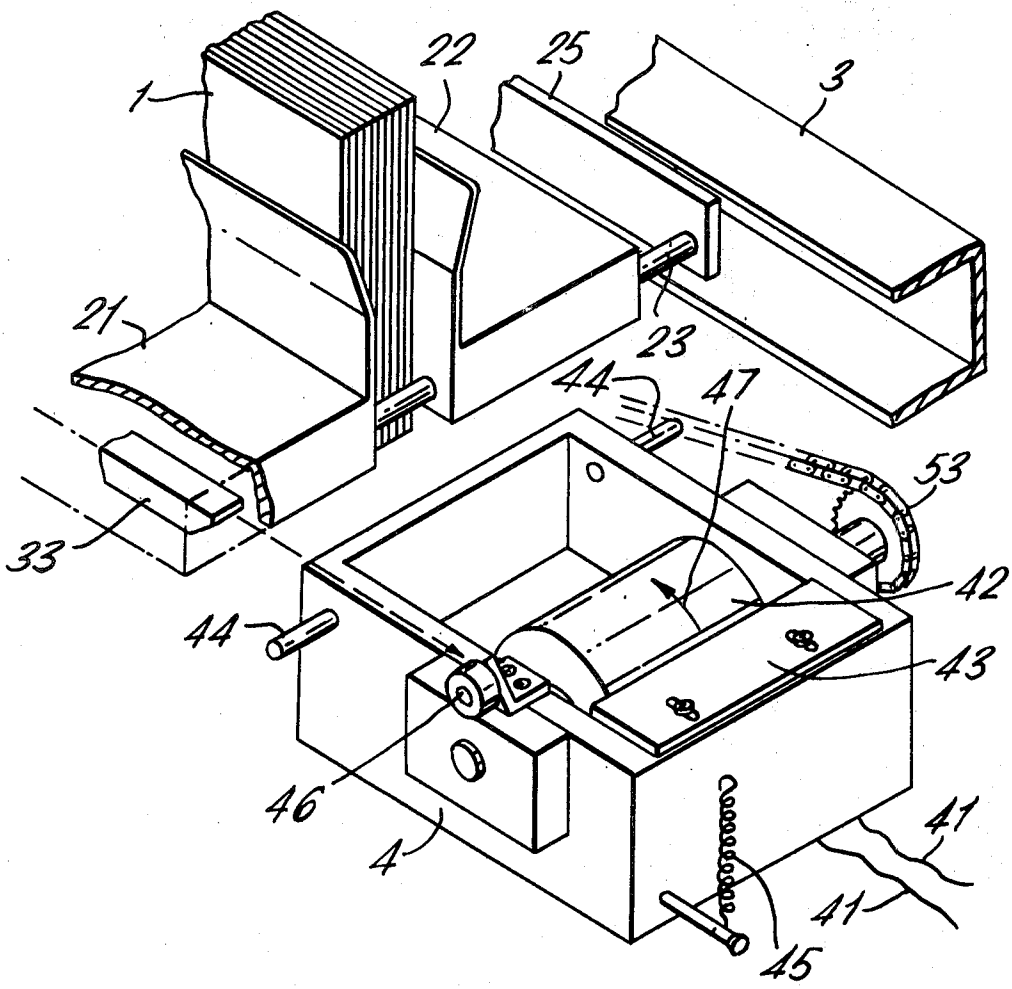
[57] **ABSTRACT**

A bookbinding machine wherein a book to be bound at one edge surface thereof is moved past a rotating drum on the circumferential surface of which an adhesive material is carried so that as the edge surface slides over the drum surface, the adhesive material is transferred from the drum surface onto the edge surface of the book

6 Claims, 3 Drawing Figures



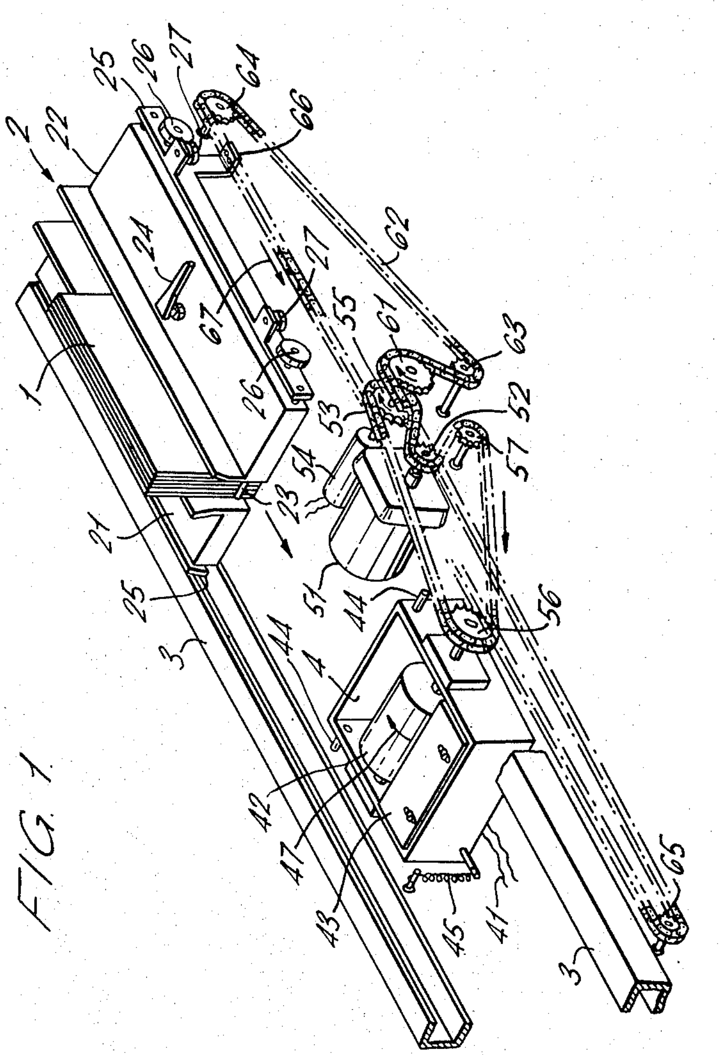

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FIG. 1

FIG. 2.

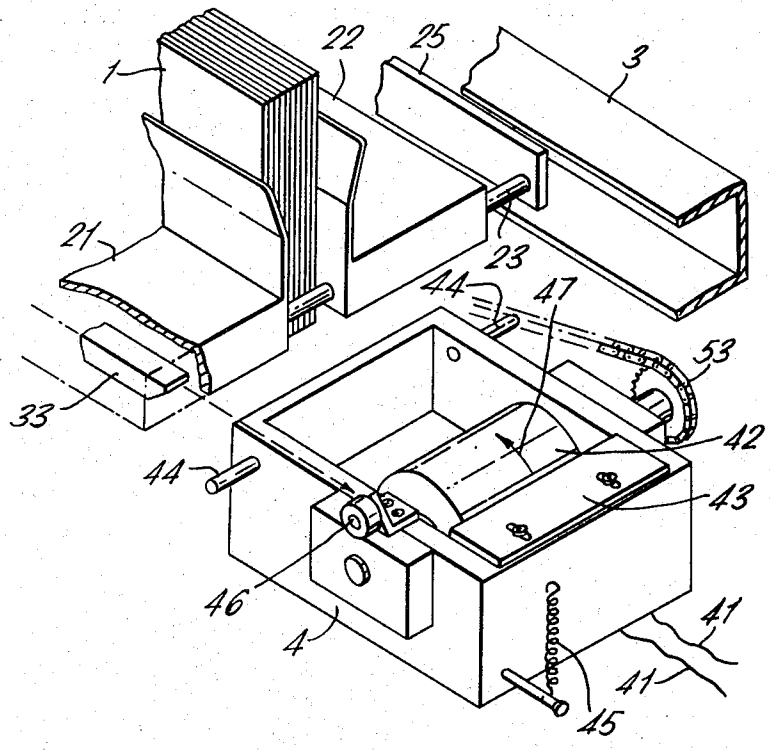
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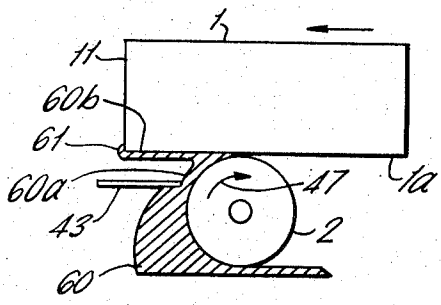
FIG. 3.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BOOKBINDING MACHINE

This invention relates to an apparatus for binding piled sheets of paper or the like material at one edge surface or back thereof to form a book or the like.

It is well known to arrange many sheets of paper, whether printed or not, into one set and bind them at one edge with a suitable adhesive material to form a book. Known adhesive materials, however, dry relatively slowly after their application onto an object, so that it has been necessary to leave an object untouched for a long time until the adhesive thereon becomes dry. This certainly reduces the production efficiency.

Recently, adhesives of hot-melt type have become commercially available, which normally are solid but become softened or liquidized upon application of heat thereto. When applied to an object, they becme dry after a few seconds, providing a stron bondage. In order to use this type of adhesive materials, a heating device is required, which makes the whole of the binding machine bulky and expensive. Such a machine may advantageously be used for binding many books of a particular type such as magazines or telephone books at one time, but it is not very handy.

Accordingly, the primary object of the invention is to provide a bookbinding machine of a simple construction which utilizes a hot-melt type of adhesive material.

Another object of the invention is to provide a bookbinding machine in which a set of piled sheets of paper or the like to be bound is merely passed over a drum having an adhesive material lying on the outer circumferential surface thereof so as to bind one edge or back of the set into a book.

Another object of the invention is to provide a bookbinding machine in which application of an excessive amount of adhesive material to the edge of a book to be bound can be prevented.

Still another object of the invention is to provide a bookbinding machine wherein application of adhesive material onto any edges of the book other than the one edge at which the book is to be bound. If adhesive material were applied to, say, a portion of an edge adjacent to the edge to be bound, it would be difficult to open the book with such excessively bound edges.

The bookbinding machine of this invention can be used for binding not only magazines and books but also various kinds of sheets of paper at business offices, such as slips, documents or the like. The machine is particularly useful in those sheets of paper, such as those used in electronic computers, which it is impossible to bind by means of a stapler, because with the machine of the invention it is possible to bind sheets of paper at the edge surface thereof alone.

The machine of this invention is provided with a clamping device for holding therein a book comprising many sheets of paper. The clamping device is moved along a path defined by a pair of guide rails. Along the path there is provided a box containing a hot-melt type of adhesive material, with a rotatable drum having one portion of its circumferential surface dipped in the adhesive material and another portion thereof exposed upwardly of the box. The drum is rotated in the opposite direction to that in which the clamping device with a book to be bound being held therein is moved. As the clamping device passes over the adhesive containing box, the book has its downwardly facing edge surface in sliding contact with the upwardly exposed drum surface. As the drum is rotated, some of the adhesive material is carried upwardly on the drum surface, so that it is transferred from the drum surface onto the downwardly facing edge surface of the book as it slides over the drum surface. After the clamping device has passed the drum, the book is released from the device. The applied adhesive becomes dry in a few seconds to securely bind the edge of the book. The clamping device is returned to the original position to be ready for the operation.

As the adhesive material is carried upward on the rotating drum surface, a blade having one edge spaced a variable distance from the drum surface scrapes an excessive amount of the material off from the drum surface, so that a constant amount of adhesive material is carried on the upwardly exposed portion of the drum surface so as to be brought into contact with the edge surface of the coming book to be bound. By changing the gap between the edge of the scraping blade and the drum surface, it is possible to control the amount of the adhesive material to be applied to the edge surface of the book.

Since the drum is rotated in the opposite direction to that of the movement of the clamping device, the edge surface of the coming book slides in frictional contact with the drum surface, so that substantially all of the adhesive material on the drum surface can be transferred onto the edge surface of the book. This, together with the function of the scraping blade, assures uniform and even application of adhesive material on the book edge to be bound along the whole length thereof.

Immediately before the book on the clamping device reaches the drum surface, the drum is temporarily lowered out of the way of the coming book, and when the lower forward corner of the book has passed the drum surface, the drum is raised to the original position so as to bring it into contact with the book edge to be bound. If the drum surface were not lowered, the lower forward corner of the book would touch the adhesive material on the drum surface so that some adhesive material would be applied to the lower portion of the forward edge surface of the book where no binding should occur. This can effectively be prevented by the arrangement of the invention that the drum surface is temporarily lowered in the above-mentioned manner. Such lowering of the drum surface can be effected by moving the drum relative to the adhesive containing box, or by moving the box together with the drum.

The invention will be described in further detail with reference to the accompanying drawings, wherein:

FIG. 1 is a perspective view of one embodiment of the invention, with parts thereof being cut away for clearness of illustration;

FIG. 2 is an enlarged view of a portion of FIG. 1; and

FIG. 3 is a schematic view showing the relation between the drum on which adhesive material is carried and the book edge to which the adhesive is applied.

Referring to the drawings, there is shown a book 1 comprising a plurality of sheets to be bound at one edge thereof. The book 1 is held by a clamping device 2, which is movable along a horizontal path, guided by a spaced pair of horizontal guide rails 3. At a suitable place in the path there is provided a box 4 containing a suitable adhesive material.

The book 1 has one edge thereof arranged flat and is held between a pair of clamping plates 21 and 22 of the device 2 with the flat edge down. The plates 21 and 22

are connected by means of rods **23**. The clamping plate **21** is fixed to the rods **23**, while the other clamping plate **22** is movable relative to the rods **23** and can be secured to the rods by means of a handle **24** at any desired spaced position relative to the fixed clamping plate **21**. The detailed mechanism associated with the handle **24** can be of any well known type, so that no illustration or description will be given.

Thus, the book **1** can be clamped by the two plates **21** and **22** by adjusting the distance therebetween in accordance with the thickness of the book. A support plate **25** is secured to each side of the rods **23**. Each support plate **25** is provided with a pair of rollers **26** each rotatable about a horizontal axis and a pair of rollers **27** each rotatable about a vertical axis. These rollers engage the guide rails **3** to carry the clamping device **2** therealong.

The adhesive material contained in the box **4** is heated by a suitable electric heater not shown but provided in the box **4** so as to be kept liquidized. Leads **41** supply electric energy to the heater. A rotatable drum **42** is provided inside the box **4** so that the lower portion of the circumferential surface of the drum is dipped in the liquidized adhesive material and as it is rotated, some of the adhesive is carried upward on the drum surface. The box **4** is further provided with a scraping blade **43** which has one edge thereof spaced from the drum surface. The blade **43** can be variably positioned relative to the drum surface so as to provide a desired gap between the outer edge of the blade **43** and the drum surface. It will be easily understood that by varying the length of the gap it is possible to regulate the amount of adhesive material on the drum surface to be applied to the flat edge or back of the book.

The box **4** is supported at one longitudinal end thereof by a pair of pivot pins **44** and at the opposite end by a spring **45**. As will be easily seen, the spring resiliently counteracts the pivotal movement of the pins **44**, thereby normally holding the box in a generally horizontal position.

A roller **46** is mounted on the box **4** and so positioned in the path of a projection **33** provided on the underside of the clamping plate **21** that as the plate **21** is moved along the guide rails **3**, the projection **33** engages the roller **46** to push it down thereby causing the box **4** to pivot about the pins **44** downwardly against the resiliency of the spring **45**. The distance the box is pivoted downward is such that the surface of the drum will not be contacted by the downwardly facing flat edge of the book **1** that is coming along. When the block **33** has passed the roller **46**, the press thereon is released so that the spring **45** causes the box **4** to be restored to its original position. At this time the forward end of the coming book **1** has already passed the drum so that when the box **4** is restored in the above mentioned fashion, the drum surface touches the flat edge of the book a little rearwardly of the lower forward corner thereof, as will be described later in detail.

In the illustrated embodiment, a single motor **51** drives the clamping device **2** and the drum **42**. To this end, a sprocket wheel **52** is fixed to the output shaft of the motor **51**. A sprocket wheel **55** is mounted on the shaft of a clutch **54** and a sprocket wheel **56** is mounted on the shaft of the drum **42**. A chain **53** is passed about the three sprocket wheels **52, 55** and **56**, with a sprocket wheel **57** regulating the tension of the chain. With this arrangement, when the motor **51** is energized, the drum **42** is rotated in the direction of an arrow **47**, which is opposite to the direction of the movement of the clamping device and the book held therein.

A sprocket wheel **61** is also mounted on the shaft of the clutch **54**, and a chain **62** is provided between a pair of sprockets **64** and **65** spaced along the length of the guide rails **3**, with a sprocket **63** tensioning the chain. A chain block **66** connects the side plate **25** of the clamping plate **22** and the chain **62** between the sprockets **64** and **65**. When the clutch **54** is actuated, the sprocket **61** is connected to the sprocket **55**, so that as the motor **51** is rotated, the chain **62** runs in the direction of an arrow **67** thereby moving the clamping device **2** along the rails **3** in the same direction.

When the motor **51** is rotated, the drum **42** is rotated so that some of the adhesive in the box **4** is carried upward on the drum surface as previously mentioned. Then the clutch **54** is operated to move the clamping device **2** holding the book therein with its one flat edge facing down, so that as the surface of the edge of the book passes over the drum, the adhesive thereon is applied to the edge surface of the book. At the end of the travel of the clamping device, the handle **24** is loosened to release the book from between the clamping plates **21** and **22**. The adhesive material applied on the edge surface of the book becomes dry in a few seconds, whereupon the bookbinding is completed.

In accordance with the invention, the rotational direction of the drum **4** is opposite to the running direction of the clamping device **2** and, consequently, the book carried thereon. The scraping blade **43** is positioned at the opposite side of the drum **42** to the position of the book **1** that has not yet reached the drum. Therefore, as shown in FIG. **3** the layer **60***a* of adhesive material on the drum surface that has been carried past the gap between the edge of the scraping blade **43** and the drum surface is transferred therefrom onto the flat edge or back **1***a* of the book **1** passing over the drum surface in sliding contact therewith. The amount of adhesive material **60***a* that is applied to the back of the book is determined by the length of the gap between the edge of the blade **43** and the drum surface. This assures a substantial uniformity of application of the adhesive material along the length of the book edge. As can be easily seen, the amount of the adhesive material can be regulated by changing the relative position of the blade **43** to the drum surface thereby to change the gap therebtween.

If the blade **43** were positioned at the opposite side of the drum in FIG. **3**, it might be possible to keep constant the amount of the adhesive material to pass the blade and be transferred onto the book edge. However, if the edge surface **1***a* of the book passing the drum were pressed onto the drum surface, only a small amount of the adhesive material could be transferred onto the book edge. In order to increase the adhesive material to be transferred onto the book edge, a gap could be provided between the edge surface of the book and the drum surface. With this arrangement, however, only a portion of the adhesive material on the drum surface could be transferred onto the book edge, with the remaining portion of the adhesive material being carried by the drum surface away from beneath the book edge. Then uneven application of the adhesive material to the book edge along the length thereof would result, and such uneven application could not be avoided by changing the position of the scraping blade

relative to the drum. In accordance with this invention, however, even application of the adhesive material to the book edge can be achieved as previoulsy mentioned.

The drum **42** is rotated in the opposite direction to the direction in which the clamping device **2** is moved. If the vertical position of the drum **42** were fixed, as the edge **1**a of the book came into contact with the drum surface, the lower front corner of the book would hit and push away the adhesive material on the drum surface, so that some adhesive material would be applied to the lower portion of the forward edge surface **11** of the book as indicated at **61** in FIG. **3**. If the book were left as it was, the lower portion of the forward edge thereof would also be unnecessarily bound.

In accordance with the invention, however, immediately before the lower forward corner of the book reaches the drum surface, the projection **33** hits the roller **46** to temporarily push down the box **4** and consequently the drum **42** out of the way of the coming book and, upon passage of the lower forward corner of the book over the drum, the box with the drum is restored to the original oposition so that the edge surface **1***a* of the book touches the drum surface. This arrangement effectively prevents any application of the adhesive material onto the lower portion of the front edge surface **11** of the book.

What I claim is:

1. An apparatus for gluing together a plurality of sheets having intersecting leading edges and binding edges, comprising:

means for clamping the binding edges of the sheets together such that they are in coincidence with a first plane and the leading edges are in alignment with one another;

means for advancing the binding edges in the first plane;

adhesive applicator means displaceable between spaced positions and yieldably biased in a first position to present a surface thereof into substantial coincidence with the first plane at a point in the travel of the binding edges; and,

first and second cooperating cam means, said first cam means located on said clamping means and said second cam means located on said adhesive applicator means, said cooperating cam means being relatively engageable to displace said adhesive applicator means relatively away from the first plane against the bias thereon when the leading edges of the sheets approach said point in the direction of travel, and relatively disengageable when the leading edges have passed said point in the direction of travel.

2. An apparatus of claim **1**, wherein said adhesive applicator means includes an adhesive reservoir, and a rotatable drum mounted therein, said rotatable drum having a peripheral surface which is in substantial coincidence with the plane when the adhesive applicator means is biased in the first position.

3. An apparatus of claim **2**, wherein said first cam means projects forward of said clamping means and said leading edges in the direction of travel thereof, and wherein said second cam means is located substantially in a second plane located substantially at right angles to the first plane and passing through said point in the direction of travel.

4. An apparatus of claim **2**, including means to rotate said drum in a direction opposite to that of the direction of travel of said sheets.

5. An apparatus of claim **1**, wherein said adhesive applicator means is pivotable about an axis spaced away from said point and substantially in the first plane, and is yieldably biased to be in equilibrium in said first position.

6. An apparatus of claim **5**, including a spring for yieldably biasing said adhesive applicator means.

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