United States Patent

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[54] A SHEET GRIPPING DEVICE FOR A ROTARY PRINTING PRESS

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** **101/409**, 271/82

[51] **Int. Cl.** **B41f 21/04**

[58] **Field of Search** 101/408, 409, 410, 411, 412, 101/246; 271/82, 79, 85

[56] **References Cited**

UNITED STATES PATENTS

600,938 3/1898 Uebelacker 308/36.1

FOREIGN PATENTS OR APPLICATIONS

1,103,352 3/1961 Germany 101/409
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310,177 4/1929 Great Britain 101/410

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[57] **ABSTRACT**

A sheet gripping device for a rotary printing press includes a pivotal gripper finger which is moved into and out of gripping engagement with an abutment surface by reciprocating movements of a gripper shaft on which the gripper finger is supported. The surface area engageable by the gripper finger in its gripping position and the rotational axes of the shaft and the gripper finger are located on a substantially rectilinear line when the gripper finger is in engagement with the abutment surface.

7 Claims, 5 Drawing Figures

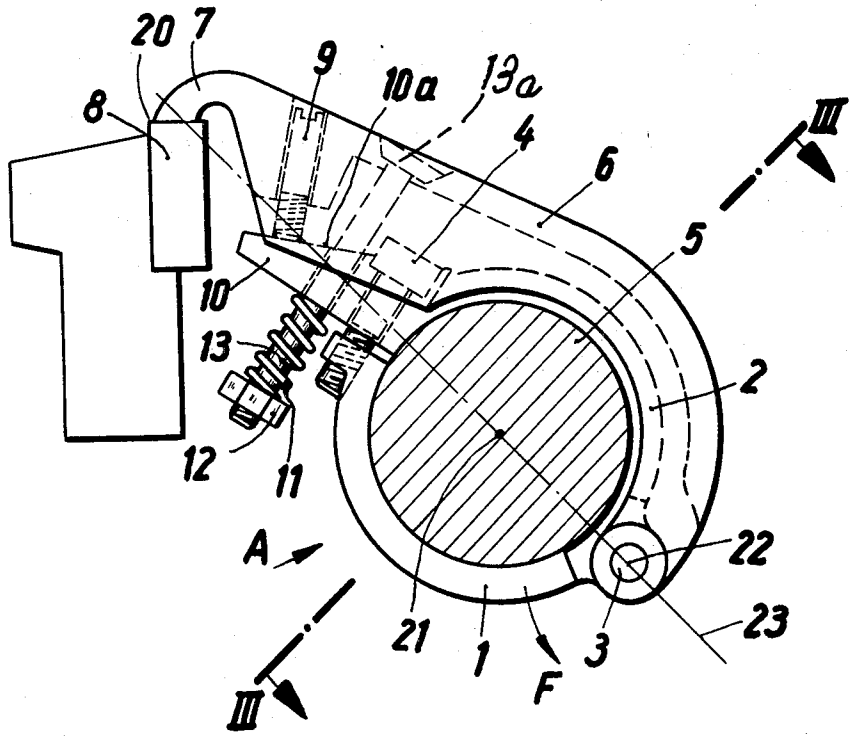


Fig.1

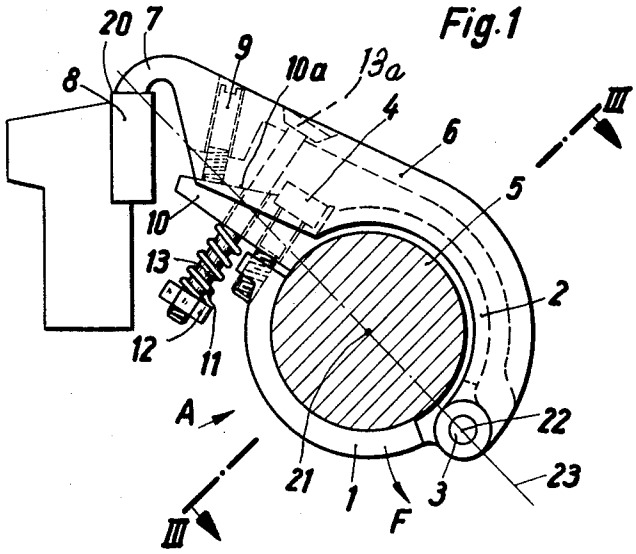


Fig.2

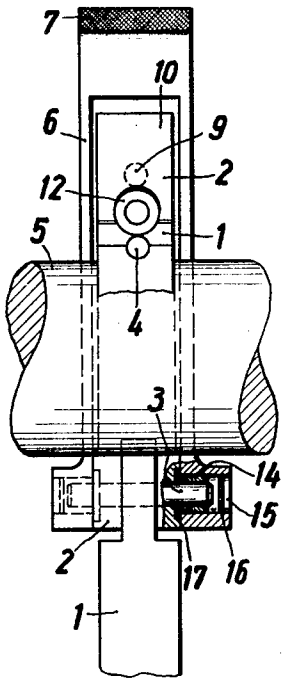
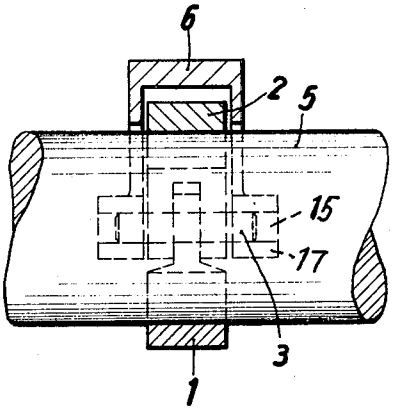


Fig.3



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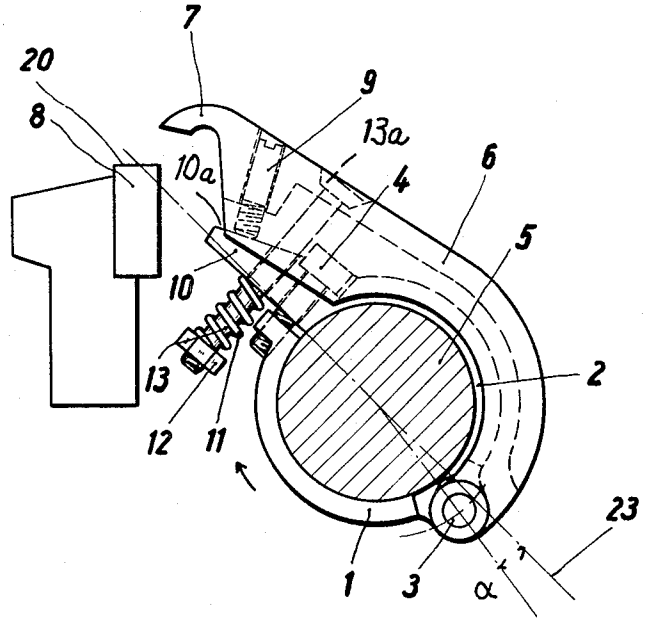

Fig. 4

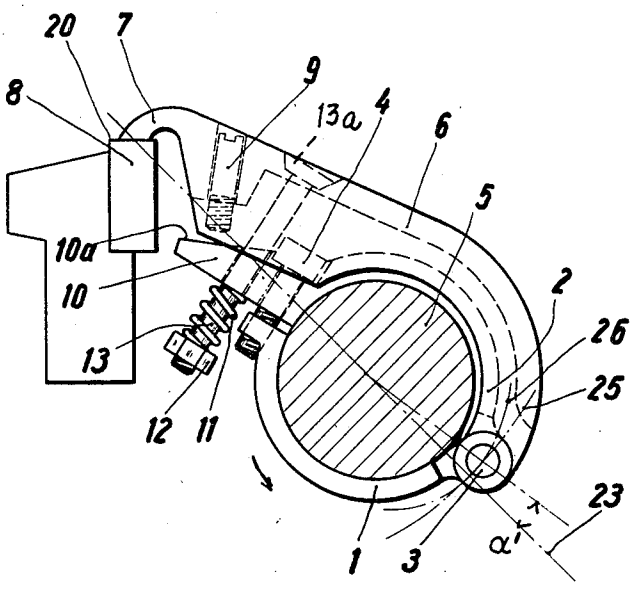

Fig. 5

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A SHEET GRIPPING DEVICE FOR A ROTARY PRINTING PRESS

The invention relates to a sheet gripping device for a sheet using rotary printing press, and more particularly, to a sheet gripping device in which a spring loaded gripper finger coacts with a gripper abutment surface and clamping members clamped upon a reciprocating gripper shaft support the gripper finger pivotal about an axis parallel to the axis of the gripper shaft for movement of the gripper finger into and out of sheet gripping engagement with the abutment surface.

BACKGROUND

There are known sheet gripping devices of the general kind above referred to in which a plurality of spring loaded gripper fingers are mounted on a gripper shaft. The gripper fingers are pivoted toward the gripper closing direction by a spring disposed between the tripper finger and a gripper clamping means. Such pivotal movement of the gripper fingers is limited either by the coaction of stops on the gripper fingers and the clamping means gripper open or by engagement of the gripper fingers, and more specifically, of the tips of the gripper fingers with a gripper support gripper closed. The gripping force of the individual gripper fingers corresponds in such arrangement to the loading and the dimensioning of the springs associated with the individual gripper fingers and to the individually adjustable spring elongation which, in turn, corresponds to the distance by which the gripper fingers, more specifically, the tips of the gripper fingers become separated from the stops on the clamping means, taking into account the ratio of the involved leverage.

It is essential with gripping devices of this kind that there is no component of movement of the tip of the gripper finger with reference to the plane of a sheet to be gripped during the gripper closing movement. In other words, it is of great importance that the gripper fingers do not "push" a sheet to be gripped.

In some sheet gripping devices as now known, such pushing movement of the gripper fingers is not eliminated. A pushing movement occurs for instance with the sheet gripping device according to British Pat. No. 310,177. The device according to this patent comprises a clamping member clamped upon the gripper shaft. A gripper finger is hinged to this clamping member and is spring-biased relative thereto. The gripper finger unavoidably begins to push in the direction of the plane of the gripped sheet when the rotation of the gripper shaft is continued to produce the required gripping force after the tip of the gripping finger has first engaged the sheet since such continued turning of the gripper shaft causes displacement of the point at which the gripper finger is hinged to the clamping member. As is evident, with a gripping device of this kind, it is not possible to obtain precisely registered printing.

Due to this disadvantage of gripping devices of the kind shown in British Pat. No. 310,177 there are now widely used in practice, gripping devices in which the gripper fingers are journaled upon the gripper shaft. The bearings for the gripper fingers are generally in the form of a closed bore which makes difficult the mounting of the gripper fingers. They can only be successively slid upon the gripper shaft from one end thereof after the gripper shaft has been detached from the press. Moreover, it is not possible to use close tolerances for the bearings as the bearings on the gripper shaft cannot be lubricated and also not be protected against the ingress of paper dust particles and other particles.

Moreover, the movements of the gripper fingers relative to the gripper shaft while only through a short distance are very rapid. As a result, the gripper fingers tend to become seized on the gripper shaft and thus lose the effect of the spring action. It is, of course, highly desirable to prevent such seizure of the gripper fingers and the resulting damage to the expensive gripper shaft, and for that reason wide tolerances are used for the bearings. However, the use of wide tolerances has, in turn, the disadvantage that it precludes a transfer of the sheets by the gripper fingers with accurate registry.

THE INVENTION

It is a broad object of the invention to provide a novel and improved sheet gripping device of the general kind above referred to, the gripper fingers of which can be conveniently and rapidly exchanged and which permits transfer of sheets by the gripper fingers with accurate registry.

A more specific object of the invention is to provide a novel and improved sheet gripping device of the general kind above referred to in which pushing of the gripper fingers relative to the support or abutment surface therefor during the final turning movement of the gripper shaft is effectively avoided. Accordingly, the gripping device according to the invention is free of the aforepointed out disadvantages.

SUMMARY OF THE INVENTION

The aforepointed out objects, features and advantages, and other objects, features and advantages which will be pointed out hereinafter and are set forth in the appended claims, are obtained by locating the pivot axis of the gripper finger, the area of the support surface with which the gripper finger is engageable and the rotational axis of the gripper shaft disposed intermediate said area so that said axes and said area are on a substantially straight line when the gripper finger is moved into engagement with the area. Moreover, the axis of the gripper shaft is disposed intermediate the support surface for the gripper finger and the pivot axis of the gripper finger. In such arrangement the pivotal axis of the gripper fingers moves along a circular path about the rotational axis of the gripper shaft when the same is turned to effect the gripping action. This circular path for a certain distance closely coincides with an ideal circular path which has as center the area upon which the gripper fingers rest when engaged with the support surface. Accordingly, the gripper finger will be only slightly displaced when the gripper shaft is turning to produce the required gripping pressure. In other words, substantial pushing of a sheet by the tip of the gripper finger is effectively avoided.

The arrangement of the invention has the further advantage that the force at the hinge for the gripper finger which holds the same in its closed and also in its open position in equilibrium can be low.

According to another aspect of the invention sealing elements are provided for sealing the hinge means for the gripper fingers. Such sealing means effectively reduce the danger of a seizure at bearings of the hinge means by the ingress of dust particles, and hence the bearing tolerances can be made considerably closer than heretofore possible. Moreover, a sealed bearing can be readily lubricated.

In the accompanying drawing, a preferred embodiment of the invention is shown by way of illustration and not by way of limitation.

In the drawing:

FIG. 1 is an elevational diagrammatic view, partly in section, of a sheet gripping device according to the invention showing the device in an intermediate operational stage;

FIG. 2 is an elevational view of FIG. 1 seen in the direction of arrow A;

FIG. 3 is a section taken on line III—III of FIG. 1;

FIG. 4 is an elevational view similar to FIG. 1, showing the device in its fully open position; and

FIG. 5 is an elevational view similar to FIGS. 1 and 4, showing the device in its fully closed or gripping position.

Referring now to the figures more in detail, the exemplified sheet gripping device comprises a clamping means formed by two curved clamping members 1 and 2 which encompass a gripper shaft 5. The clamping members are joined at one end by a hinge means including a pivot pin 3 which pivotally seats a gripper member in the form of a gripper finger 6 of generally U-shaped cross section. The other ends of clamping members 1 and 2 are pressed toward each other by tightening a screw bolt 4 thereby clamping the two members to the shaft and thus securing pivot pin 3 in a fixed spatial position relative to the shaft so that the pin will participate in angular movements of the shaft. The shaft should be visualized as being reciprocated

through a predetermined angle by suitable drive means (not shown). Such reciprocating movements of the gripper shaft are common practice with sheet gripping devices of the kind here involved and hence a showing of drive means suitable for the purpose is not essential for the understanding of the invention.

As it is shown in FIGS. 2 and 3, gripper finger 6 straddles clamping member 2. FIG. 2 also shows in detail bearing means included in the hinge means for the gripper finger. There is shown a bearing 14 which may be a dry or permanently lubricated bearing, or it may be a bearing requiring lubrication. A bearing bore 15 for pivot pin 3 is closed off by suitable and conventional sealing elements 16 and 17.

The free end of clamping member 2 which is located between the branches of gripper finger 6 is formed with an extension 10. The gripper finger is biased in counterclockwise direction, that is, toward extension 10 by a spring assembly comprising a coil spring 11 fitted upon a bar 13 slidably extended through extension 10. The bar is held in the gripper finger by a head 13a and has threaded upon its other end a nut 12. The coil spring is interposed between extension 10 and nut 12. As is evident, the setting of nut 12 controls the spring force with which gripper finger 6 is biased in counterclockwise direction. The extension is formed with a slanted abutment surface 10*a* engageable with a set screw 9 threaded into the gripper finger. As is also evident, the setting of screw 9 limits the extent of the possible movement of the gripper finger in counterclockwise direction by the action of spring 11 for a purpose which will be explained hereinafter.

The gripper finger 6 terminates at its free end in a tip 7 coacting with a support or abutment surface 20 on a stationarily mounted support member 8.

The operation of the sheet gripping device as hereinbefore described is as follows:

Let it be assumed that the device is in the fully open position of FIG. 4, in which tip 7 is separated from support surface 20. To close the device, shaft 5 is turned in counterclockwise direction. Gripper finger 6 will follow such turning by the corresponding displacement of pivot pin 3 and also by the action of spring 11, with set screw 9 abutting against surface 10*a* of extension 10. After a predetermined angular movement of the shaft, tip 7 reaches the position of FIG. 1 in which the tip rests on surface 20 but no gripping pressure is applied as yet. A further angular movement of the shaft in the same direction brings the device into the final position of FIG. 5 in which the tip 7 engages surface 20 with gripping pressure. As may be observed, the tip of screw 9 is now separated from surface 10*a* as the gripper finger could no longer follow the continued turning of shaft 5 when the device was advanced from the position of FIG. 1 to the position of FIG. 5.

To return the device from the closed position of FIG. 5 to the open position of FIG. 4, shaft 5 is turned in clockwise direction through the required distance.

The support surface 20, and more specifically, the limited small area thereof which is engageable with tip 7, the rotational axis of shaft 5 and the rotational axis of pin 3, are located on a common rectilinear line 23 when the device is in the position of FIG. 1. As previously described, it is due to such spatial disposition of the support surface and the two axes that no extensive and thus undesirable pushing movement of tip 7 relative to surface 20 can occur when the device is advanced from the position of FIG. 1 into the position of FIG. 5.

FIG. 4 shows the angle a through which shaft 5 is clockwise turned for movement of the device from the position of FIG. 1 into the position of FIG. 4. Similarly, FIG. 5 indicates the angle α' through which the shaft is counterclockwise turned for advancement of the device from the position of FIG. 1 into the position of FIG. 5.

FIG. 5 shows a circular path 25 representing the path along which the axis of pivot pin 3 would move if it were turned about the area surface 20 on which the gripper finger tip 7 resets as shown in FIGS. 1 and 5. A movement along this path would cause the gripper finger tip to remain at rest on support surface 20. In other words, movement of the axis of pin 3 along path 25 constitutes an ideal condition. Actually, the axis of pivot pin 3 moves along a circular path 26 when the gripper shaft 5 and with it pin 3 are turned. The resulting angle a' as shown in FIG. 5 represents the turning of gripper shaft 5 and pivot pin 3 as are necessary to produce the pressure between the gripper finger tip 5 against surface 20 that is required to grip a sheet. The turning angle α' is limited by the set distance between screw 9 and abutment surface 10*a* is therefor as shown in FIG. 5.

As it is evident from FIG. 5 travel of the axis of pivot pin 3 along the circular path 26 rather than along the ideal circular path 25 is satisfactory since the two circular paths nearly coincide for the distance through which the axis of pin 3 moves when shaft 5 is turned to effect closing of the gripping device, that is, movement of the device from the position of FIG. 4 into the position of FIG. 5.

While the invention has been described in detail with respect to a certain now preferred example and embodiment of the invention, it will be understood by those skilled in the art, after understanding the invention, that various changes and modifications may be made without departing from the spirit and scope of the invention, and it is intended, therefore, to cover all such changes and modifications in the appended claims.

What is claimed is:

1. A sheet gripping device for a rotary printing press, said device comprising in combination:
- a gripper shaft mounted for reciprocating angular movement;
- a member having an abutment surface stationarily mounted laterally of said shaft;
- a gripper member engageable at one end with said surface to grip a sheet between said members;
- hinge means including a pivot pin pivotally supporting said gripper member at the other end thereof; and
- mounting means securing said hinge means to the gripper shaft for reciprocating movement of the hinge means in unison therewith;
- said pivot pin and said support surface being positioned on opposite sides of the gripper shaft with the pivot pin parallel to the axis of the shaft, the gripper member being pivotal about said pivot pin between a gripper closed position in which the gripper member engages said abutment surface and a gripper open position in which the gripper member is separated from the abutment surface;
- the area of the abutment surface engageable by the gripper member and the axes of the gripper shaft and the pivot pin being located on a common substantially rectilinear line when the gripper member is in juxtaposition with the abutment surface.

2. The device according to claim 1 wherein the axis of the pivot pin in response to an angular movement of the shaft is crosswise displaced along a circular path as defined by a circle having the shaft axis as center, said displacement of the pivot pin axis moving the gripper member into pressure engagement with said abutment surface for gripping a sheet therebetween.

3. The device according to claim 1 wherein said hinge means includes sealing means sealing said pivot pin against access of moisture and impurities.

4. The device according to claim 1 and comprising spring means coacting with said mounting means and said gripper member to bias the latter toward engagement with said abutment surface.

5. The device according to claim 1 wherein said mounting means comprises a pair of curved clamping member encompassing said shaft and hinged together at one end, the hinged ends of the clamping members mounting said hinge means, and releasable locking means engaging the other ends of the clamping members for pulling said ends toward each other thereby clamping the clamping members to the shaft and thus securing the hinge means and also the pivot pin in position.

6. The device according to claim 5 wherein one of said clamping members has an extension at said other end thereof, said spring means including a loaded coil spring abutting against said gripper member and said extension.

7. The device according to claim 6 and comprising a setting means interposed between the gripping member and the extension for varying the extent of the pivotal movement of the gripper member in response to an angular movement of the shaft by varying the setting of said setting means.

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