Paper-Retaining Mechanism

This invention relates to a paper-retaining mechanism, in particular a paper-retaining mechanism allowing retention and retrieval of sheets of hole-punched paper.

According to a first aspect of the present invention, there is provided a paper-retaining mechanism including a base, at least two post members secured to said base, at least two arch members joined with each other for simultaneous movement, wherein said arch members are movable relative to said post members between a closed position in which said arch members are in contact with said post members to form two closed rings and an open position in which said arch members are out of contact with said post members wherein said rings are open, a plate member joined with and extending from said base, and a lever assembly operable to move said arch members between said closed and open positions, wherein said lever assembly includes at least an arm member and a link member, wherein said arm member is engaged with said plate member for relative pivotal movement about a first axis, wherein said link member is engaged with said plate member for relative pivotal movement about a second axis, wherein said link member is engaged with an extension member received within a slot of said arm member for relative sliding movement, wherein when said arch members are in said closed position, said arm member is pivotable in a first direction and away from said base to cause said link member to pivot in said first direction to allow said arch members to pivot to said open position, and wherein when said arch members are in said open position, said arm member is pivotable in a second direction which is opposite to said first direction to cause said link member to pivot in said second direction to thereby cause the arch members to pivot to said closed position.

According to a second aspect of the present invention, there is provided a paper-retaining device including a paper-retaining mechanism engaged with a substrate, said paper-retaining mechanism including a base, at least two post members secured to said base, at least two arch members joined with each other for simultaneous movement, wherein said arch members are movable relative to said post members between a closed position in which said arch members are in contact with said post members to form two closed rings and an open position in which said arch members are out of contact with said post members wherein said rings are open, a plate member joined with and extending from said base, and a lever assembly operable to move said arch members between said closed and open positions, wherein said lever assembly

includes at least an arm member and a link member, wherein said arm member is engaged with said plate member for relative pivotal movement about a first axis, wherein said link member is engaged with said plate member for relative pivotal movement about a second axis, wherein said link member is engaged with an extension member received within a slot of said arm member for relative sliding movement, wherein when said arch members are in said closed position, said arm member is pivotable in a first direction and away from said base to cause said link member to pivot in said first direction to allow said arch members to pivot to said open position, and wherein when said arch members are in said open position, said arm member is pivotable in a second direction which is opposite to said first direction to cause said link member to pivot in said second direction to thereby cause the arch members to pivot to said closed position.

Embodiments of the present invention will now be described, by way of examples only, with reference to the accompanying drawings, in which:

Fig. 1 is an exploded view of a paper-retaining mechanism according to a first embodiment of the present invention;

Fig. 2 is a front perspective view of the mechanism of Fig. 1 in a ring-closed configuration;

Fig. 3 is a rear perspective view of the mechanism of Fig. 2;

Fig. 4 is a front view of the mechanism of Fig. 2;

Fig. 5 is a left side view of the mechanism of Fig. 4;

Fig. 6 is a top view of the mechanism of Fig. 4;

Fig. 7 is a rear view of the mechanism of Fig. 4;

Fig. 8 is a front perspective view of the mechanism of Fig. 1 in a ring-open configuration;

Fig. 9 is a rear perspective view of the mechanism of Fig. 8;

Fig. 10 is a front view of the mechanism of Fig. 8;

Fig. 11 is a left side view of the mechanism of Fig. 10;

Fig. 12 is a right side view of the mechanism of Fig. 10;

Fig. 13 is a top view of the mechanism of Fig. 10;

Fig. 14 is an exploded view of a paper-retaining mechanism according to a second embodiment of the present invention;

Fig. 15 is a front perspective view of the mechanism of Fig. 14 in a ring-closed configuration;

Fig. 16 is a rear perspective view of the mechanism of Fig. 15;

Fig. 17 is a partial front view of the mechanism of Fig. 15;

Fig. 18 is a left side view of the mechanism of Fig. 17;

Fig. 19 is a rear view of the mechanism of Fig. 17;

Fig. 20 is a top view of the mechanism of Fig. 19;

Fig. 21 is a front perspective view of the mechanism of Fig. 14 in a ring-open configuration; and

Fig. 22 is a rear perspective view of the mechanism of 21.

Fig. 1 shows various parts forming a paper-retaining mechanism, generally designated as 10, according to a first embodiment of the present invention. The paper-retaining mechanism 10 is of the type generally known as "lever-arch type file mechanism".

The mechanism 10 includes a generally planar base 12 and a support plate 14 extending upwardly away from the base 12. The support plate 14 is fixedly joined with the base 12. For example, the support plate 14 may be stamped out from a sheet of metal from which the base 12 is originally formed.

Two posts 16 are fixedly secured to the base 12. A pair of arches 18 are integrally formed and joined with each other *via* an intermediate portion 20, so that the arches 18 and the intermediate portion 20 are movable simultaneously with one another. The arches 18 are engaged with the base 12 by claws 22, so that the arches 18 are pivotable relative to the posts 16 and the base 12 between a first position (called the "closed position") in which free ends 18a of the arches 18 and free ends 16a of the posts 16 are in contact and mate with each other to form two closed rings (wherein the paper-retaining mechanism 10 is said to be in a "ring-closed configuration") and a second position (called the "open position") in which the free ends 18a of the arches 18 and the free ends 16a of the posts 16 are out of contact with each other, so that the rings are open (wherein the paper-retaining mechanism 10 is said to be in a "ring-open configuration").

A leaf spring 24 is engaged with the base 12 so that it acts on the intermediate portion 20 from below, to bias the arches 18 to the open position.

The mechanism 10 includes a lever assembly with a manually operable lever arm 26 which is engaged with the support plate 14 *via* a rivet 28 so that the lever arm 26 is pivotable

relative to the support plate 14 about an axis A-A which is generally parallel to and fixed relative to the base 12. A cover 29 (which may be made of a soft material, such as rubber or plastic material) is provided for covering an operating free end 26a of the arm 26 for providing comfort in use. In use, a user applies force on the operating free end 26a of the arm 26 to cause the arches 18 to pivot between the open position and the closed position so as to selectively open or close the two rings.

The lever assembly further includes a link 30 in the form of a thin plate with three holes 30a, 30b, 30c. A roller actuator 32 is engaged with the hole 30c of the link 30 by a rivet 34, so that the roller 32 is carried by and freely rotatable relative to the link 30 about an axis B-B which is parallel to and movable relative to the axis A-A. When the mechanism 10 is in the ring-closed configuration, the roller 32 sits on an upwardly protruding portion 46 (see Fig. 4) of the intermediate portion 20 and keeps the arches 18 in the closed position against the biasing force of the leaf spring 24. When the mechanism 10 is moved to the ring-open configuration, the roller 32 rides on part of the intermediate portion 20 and away from the upwardly protruding portion 46 so as to allow the leaf spring 24 to flex upwardly to move the arches 18 to the open position.

A rivet 36 is engaged with a hole 38 of the support plate 14 and the hole 30b of the link 30 for engaging the link 30 with the support plate 14, so as to allow the link 30 to pivot relative to the support plate 14 about an axis C-C which is parallel to the axis A-A and fixed relative to the base 12.

The arm 26 has a slot 40 in which a roller 42 is received for relative sliding movement. The roller 42 is engaged with the hole 30a of the link 30 *via* a rivet 44, so that the link 30 is engaged with the arm 26 *via* the roller 42, which extends from the link 30 into the slot 40.

Figs. 2 to 7 show the mechanism 10 in the ring-closed configuration, and the arm 26 is in a lower stable position (as compared with the upper stable position in which the arm 26 occupies when the mechanism 10 is in the ring-open configuration, to be discussed below). When in this ring-closed configuration, the shortest distance l between the roller 42 and the base 12 is longer than the shortest distance k between the axis C-C and the base 12. The shortest distance j between the base 12 and the axis A-A about which the lever arm 26 is

pivotable relative to the support plate 14 is shorter than the shortest distance *k* between the axis C-C and the base 12. The roller actuator 32 acts on the upwardly protruding portion 46 of the intermediate portion 20 to keep the arches 18 in the closed position, against the biasing force of the leaf spring 24.

It can also be seen in Fig. 7 that, when the mechanism 10 is in the ring-closed configuration, the slot 40 is slanted relative to the base 12 from a lower end 50 to an upper end 52, in which the shortest distance between the lower end 50 and the base 12 is shorter than the shortest distance between the upper end 52 and the base 12. In addition, the shortest distance between the operating free end 26a of the arm 26 and the lower end 50 is shorter than the shortest distance between the operating free end 26a of the arm 26 and the upper end 52. Furthermore, the axis C-C about which the link 30 is pivotable relative to the support plate 14 is always between the slot 40 and the operating free end 26a of the arm 26, whether the arm 26 is in the lower stable position or the upper stable position, to be discussed below.

When in this ring-closed configuration, the arm 26 is pivotable about the axis A-A (see Fig. 1) away from the base 12 and in the direction indicated by the arrow F (see Fig. 4), whereby the slot 40 of the arm 26 is caused to pivot in the same direction, but towards the base 12. As the roller 42 is then at the upper end 52 of the slot 40, movement of the slot 40 towards the base 12 will cause the roller 42 to move towards the base 12, whereupon the link 30 is also brought into pivotal movement in the same direction indicated by the arrow F about the axis C-C (see Fig. 1). When the link 30 thus pivots in the direction indicated by the arrow F, the roller actuator 32 carried by it is brought into corresponding pivotal movement, away from the upwardly protruding portion 46 of the intermediate portion 20, towards a ring through which the arm 26 extends, and also towards the operating free end 26a of the arm 26.

When the roller actuator 32 is thus away from the upwardly protruding portion 46 of the intermediate portion 20, the leaf spring 24 acts on the intermediate portion 20 to pivot the arches 18 away from the posts 16 to the open position, to thereby open the rings.

When the mechanism 10 is thus in its ring-open configuration, as shown in Figs. 8 to 13, the arm 26 is in its upper stable position, and may be pivoted towards the base 12 in the direction indicated by the arrow G in Fig. 10 (which is opposite to the direction indicated by

the arrow F in Fig. 4). As the roller 42 is then at the lower end 50 of the slot 40, pivoting of the arm 26 in the direction indicated by the arrow G will pivot the slot 40 upwardly and away from the base 12, thus bringing the roller 42 and the link 30 into corresponding pivoting movement in the same direction. The link 30 will be so pivoted until the roller actuator 32 returns to the position as shown in Figs. 2 to 7, in which it sits on and acts on the upwardly protruding portion 46 of the intermediate portion 20 to keep the arches 18 in the closed position. During this return movement of the roller actuator 32, the roller 32 moves away from the ring through which the arm 26 extends, and also away from the operating free end 26a of the arm 26. During this movement, the roller actuator 32 pivots the arches 18 towards the posts 16 until the free ends 18a of the arches 18 mate with and contact the free ends 16a of the posts 16 to close the rings, thus returning the mechanism 10 to the ring-closed configuration.

Fig. 14 shows various parts forming a paper-retaining mechanism, generally designated as 100, according to a second embodiment of the present invention.

The mechanism 100 also includes a generally planar base 102 and a support plate 104 extending upwardly away from the base 102. The support plate 104 is fixedly joined with the base 102. For example, the support plate 104 may be stamped out from a sheet of metal from which the base 102 is originally formed, such that the support plate 104 is integral with the base 102.

Two posts 106 are fixedly secured to the base 102. A pair of arches 108 are integrally formed and joined with each other *via* an intermediate portion 110, so that the arches 108 and the intermediate portion 110 are movable simultaneously with one another. The arches 108 are engaged with the base 102 by two claws 112, so that the arches 108 are pivotable relative to the posts 106 and the base 102 between a first position (called the "closed position") in which free ends 108a of the arches 108 and free ends 106a of the posts 106 are in contact and mate with each other to form two closed rings (wherein the paper-retaining mechanism 100 is said to be in a "ring-closed configuration") and a second position (called the "open position") in which the free ends 108a of the arches 108 and the free ends 106a of the posts 106 are out of contact with each other, so that the rings are open (wherein the paper-retaining mechanism 100 is said to be in a "ring-open configuration").

A leaf spring 114 is engaged with the base 102 so that it acts on the intermediate portion 110 from below, to bias the arches 108 to the open position.

The mechanism 100 includes a lever assembly with a manually operable lever arm 116 which is engaged with the support plate 104 *via* a rivet 118 so that the arm 116 is pivotable relative to the support plate 104 about an axis R-R which is generally parallel to and fixed relative to the base 102. In use, a user applies force on an operating free end 116a of the lever arm 116 to cause the arches 108 to pivot between the open position and the closed position so as to selectively open or close the two rings.

The lever assembly further includes a link 120 in the form of a generally triangular thin metal plate with three holes 120a, 120b, 120c. A roller actuator 122 made of a plastic material is engaged with the hole 120c of the link 120 by a rivet 124, so that the roller 122 is carried by and freely rotatable relative to the link 120 about an axis S-S which is parallel to and movable relative to the axis R-R. When the mechanism 100 is in the ring-closed configuration, the roller 122 sits on an upwardly protruding portion 136 (see Fig. 17) of the intermediate portion 110 and keeps the arches 108 in the closed position against the biasing force of the leaf spring 114. When the mechanism 100 is moved to the ring-open configuration, the roller 122 rides on part of the intermediate portion 110 and away from the upwardly protruding portion 136 so as to allow the leaf spring 114 to flex upwardly to move the arches 108 to the open position.

A rivet 126 is received with a hole 128 of the support plate 104 and the hole 120b of the link 120 for engaging the link 120 with the support plate 104, so as to allow the link 120 to pivot relative to the support plate 104 about an axis T-T which is parallel to the axis R-R and fixed relative to the base 102.

The lever arm 116 has a slot 130 in which a plastic roller 132 is received for relative sliding movement. The roller 132 is engaged with the hole 120a of the link 120 *via* a rivet 134, so that the link 120 is engaged with the lever arm 116 *via* the roller 132, which extends from the link 120 into the slot 130.

Figs. 15 to 20 show the mechanism 100 in the ring-closed configuration, and the lever arm 116 is in a lower stable position (as compared with the upper stable position in which the arm 116 occupies when the mechanism 100 is in the ring-open configuration, to be discussed below). When in this ring-closed configuration, the shortest distance *m* between the roller 132 and the base 102 is shorter than the shortest distance *n* between the base 102 and the axis T-T about which the link 120 is pivotable relative to the support plate 104. The shortest distance *p* between the base 102 and the axis R-R about which the lever arm 116 is pivotable relative to the support plate 104 is shorter than the shortest distance *m* between the roller 132 and the base 102. The roller actuator 122 acts on the upwardly protruding portion 136 of the intermediate portion 110 to keep the arches 108 in the closed position, against the biasing force of the leaf spring 114.

It can also be seen in Figs. 17 and 19 that, when the mechanism 100 is in the ring-closed configuration, the slot 130 is slanted relative to the base 102 from a lower end 140 to an upper end 142, in which the shortest distance between the lower end 140 and the base 102 is shorter than the shortest distance between the upper end 142 and the base 102. In addition, the shortest distance *w* between the operating free end 116a of the arm 116 and the lower end 140 is longer than the shortest distance *y* between the operating free end 116a of the arm 116 and the upper end 142. Furthermore, the slot 130 is always between the axis T-T about which the link 120 is pivotable relative to the support plate 104 and the operating free end 116a of the arm 116, whether the lever arm 116 is in the lower stable position or the upper stable position, to be discussed below.

When in this ring-closed configuration, the arm 116 is pivotable about the axis R-R (see Fig. 14) away from the base 102 and in the direction indicated by the arrow D (see Fig. 17), whereby the slot 130 of the arm 116 is caused to pivot in the same direction and away from the base 102. As the roller 132 is then at the lower end 140 of the slot 130, movement of the slot 130 away from the base 102 will cause the roller 132 to move away from the base 102, whereupon the link 120 is also brought into pivotal movement in the same direction indicated by the arrow D about the axis T-T (see Fig. 14). When the link 120 thus pivots in the direction indicated by the arrow D, the roller actuator 122 carried by it is brought into corresponding pivotal movement, away from the upwardly protruding portion 136 of the intermediate portion 110, towards a ring through which the arm 116 extends, and also towards

the operating free end 116a of the arm 116.

When the roller actuator 122 is thus away from the upwardly protruding portion 136 of the intermediate portion 110, the leaf spring 114 acts on the intermediate portion 110 to pivot the arches 108 away from the posts 106 to the open position, to thereby open the rings.

When the mechanism 100 is thus in its ring-open configuration, as shown in Figs. 21 and 22, the arm 116 is in its upper stable position, and may be pivoted by a user towards the base 102 in the direction indicated by the arrow E in Fig. 17 (which is opposite to the direction indicated by the arrow D in Fig. 17). As the roller 132 is then at the upper end 142 of the slot 130, pivoting of the arm 116 in the direction indicated by the arrow E will pivot the slot 130 downwardly and towards the base 102, thus bringing the roller 132 and the link 120 into corresponding pivoting movement in the same direction. The link 120 will be so pivoted until the roller actuator 122 returns to the position as shown in Figs. 15 to 20, in which it sits on and acts on the upwardly protruding portion 136 of the intermediate portion 110 to keep the arches 108 in the closed position. During this return movement of the roller actuator 122, the roller 122 moves away from the ring through which the arm 116 extends, and also away from the operating free end 116a of the arm 116. During this movement, the roller actuator 122 pivots the arches 108 towards the posts 106 until the free ends 108a of the arches 108 mate with and contact the free ends 106a of the posts 106 to close the rings, thus returning the mechanism 100 to the ring-closed configuration.

Each of the paper-retaining mechanisms 10, 100 may be fixedly or detachably engaged, e.g. by means of screws or rivets, to a substrate made of metal, metal alloy, cardboard or the like, to form a paper-retaining device.

It should be understood that the above only illustrates an example whereby the present invention may be carried out, and that various modifications and/or alterations may be made thereto without departing from the spirit of the invention. It should also be understood that various features of the invention which are, for brevity, described in the context of a single embodiment, may be provided separately or in any appropriate sub-combinations.

CLAIMS

1. A paper-retaining mechanism including:

a base,

at least two post members secured to said base,

at least two arch members joined with each other for simultaneous movement, wherein said arch members are movable relative to said post members between a closed position in which said arch members are in contact with said post members to form two closed rings and an open position in which said arch members are out of contact with said post members wherein said rings are open,

a plate member joined with and extending from said base, and

a lever assembly operable to move said arch members between said closed and open positions,

wherein said lever assembly includes at least an arm member and a link member,

wherein said arm member is engaged with said plate member for relative pivotal movement about a first axis,

wherein said link member is engaged with said plate member for relative pivotal movement about a second axis,

wherein said link member is engaged with an extension member received within a slot of said arm member for relative sliding movement,

wherein when said arch members are in said closed position, said arm member is pivotable in a first direction and away from said base to cause said link member to pivot in said first direction to allow said arch members to pivot to said open position, and

wherein when said arch members are in said open position, said arm member is pivotable in a second direction which is opposite to said first direction to cause said link member to pivot in said second direction to thereby cause the arch members to pivot to said closed position.

2. A mechanism according to Claim 1 wherein when said arch members are in said closed position, the shortest distance between said base and said extension member of said link member is longer than the shortest distance between said base and said second axis about which said link member is pivotable relative to said plate member.

3. A mechanism according to Claim 1 or 2 wherein said second axis about which said link member is pivotable relative to said plate is between said slot and an operating free end of said arm member.

4. A mechanism according to Claim 1 wherein when said arch members are in said closed position, the shortest distance between said base and said extension member of said link member is shorter than the shortest distance between said base and said second axis about which said link member is pivotable relative to said plate member.

5. A mechanism according to Claim 1 or 4 wherein said slot is between said second axis about which said link member is pivotable relative to said plate and an operating free end of said arm member.

6. A mechanism according to any of the preceding claims wherein said link member carries an actuator, wherein said arch members are joined with each other *via* an intermediate portion for simultaneous movement, wherein when said arch members are in said closed position, said actuator acts on said intermediate portion to keep said arch members in said closed position, and wherein upon pivotal movement of said arm member in said first direction, said actuator moves towards a ring through which said arm member extends.

7. A paper-retaining device including a paper-retaining mechanism according to any of the preceding claims engaged with a substrate.