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(54) Dobby.

(57) A dobby (10) including a vertical lever (18) connected with a heald frame (12) and having hook levers (28a, 28b) respectively and pivotally secured to both ends thereof, knife hooks (32a, 32b) respectively and pivotally attached to both ends of a swing lever (34a, 34b), which is swung in such a way that both ends thereof move alternately toward and away from the vertical lever (18), and engageable with their corresponding hook levers (28a, 28b), and a command device adapted to control the engagement between the hook levers (28a, 28b) and their corresponding knife hooks (32a, 32b) so as to move the heald frame (12) up and down for production of fabric of a desired pattern. The knife hooks (32a, 32b) are eccentrically and pivotally secured on their corresponding end portions of the swing lever (34a, 34b) in order to ensure smooth engagements between the hook levers (28a, 28b) and their corresponding knife hooks (32a, 32b) without developing any excessive swinging of the swing lever (34a, 34b). Each of the knife hooks (32a, 32b) is actuated in such a manner that, when its corresponding end portion of the swing lever (34a, 34b) assumes its most-advanced position relative to the vertical lever (18), the knife hook (32a, 32b) provided at its corresponding end portion of the swing lever (34a, 34b) assumes an eccentric position biased toward its corresponding hook lever (28a, 28b).

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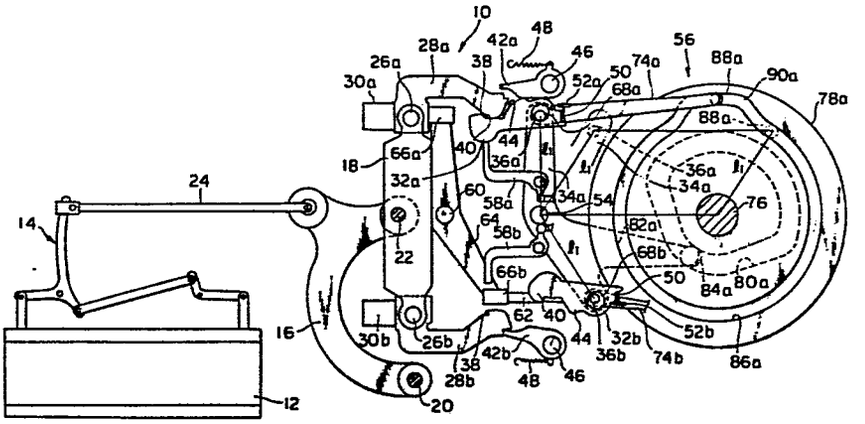
FIG. 1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66b
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80a
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16
30b
26b
44
32b
52b
42b
36b
74b
38
86a
28b
48
46
20
12

DOBBY

This invention relates to a dobby, and more specifically to a dobby capable of moving a heald frame up and down for production of fabric of a desired pattern without causing the heald frame to undergo any unnecessary jumping motion.

A dobby is generally equipped with a jack lever, to which a heald frame is connected, and a vertical lever to which the jack lever is in turn pivotally connected. A pair of upper and lower hook levers is pivotally secured to both ends of the vertical lever respectively. The hook levers are respectively engageable with an upper and lower knife hooks attached in a pair and pivotally to a swing lever which is swung periodically. In accordance with the swinging motion of the swing lever, the knife hooks are alternately actuated toward their respective positions where they are engageable with their corresponding hook levers. The engagement between the hook levers and their corresponding knife hooks is controlled by a command device. An engagement of one of the hook levers with its corresponding knife hook results in the pulling of the heald frame to an upper position via the vertical lever and jack lever. Accordingly, the up-and-down motion of the heald frame

is controlled in accordance with a pattern which is read by the command device.

In the above-described conventional dobby, the swinging motion of the swing lever is set excessively so as to keep a clearance between each knife hook and its corresponding hook lever when the knife hook, which is actuated toward the hook lever, assumes its advanced position, with a view toward ensuring smooth engagement between the knife hook and its corresponding hook lever.

This excessive swinging motion of the swing lever may not be transmitted to the heald frame and may not raise any problem so long as the upper and lower knife hooks are alternately brought into engagement with their corresponding hook levers. If the lower knife hook assuming the advanced position is for example brought into engagement with the lower hook lever when the upper knife hook has been brought into engagement at its advanced position with the upper hook lever and has then been moved to its retreated position so as to pull up the heald frame, the heald frame is continually held at the upper position irrespective of the swinging motion of the swing lever. However, the swing lever lifts the heald frame excessively beyond a predetermined level via the upper knife hook while the lower knife hook is still in engagement with the lower hook lever. As a result, the heald frame is

caused to undergo a jumping motion.

This jumping motion of the heald frame develops an impactive vibration, whereby causing cut-off of warp yarns which extend through the heald frame.

An object of this invention is thus to provide a dobby capable of suitably controlling the up-and-down motion of a heald frame without causing the heald frame to undergo any unnecessary jumping motion.

In one aspect of this invention, there is thus provided a dobby including a vertical lever pivotally connected at a central portion thereof with a jack lever coupled with a heald frame and at both end portions thereof with hook levers, a swing lever periodically swung so that both end portions thereof move alternately toward and away from the vertical lever, knife hooks pivotally connected via shafts to their corresponding end portions of the swing lever and engageable with their corresponding hook levers and a command device adapted to control the engagement between the hook levers and their corresponding knife hooks so as to move the heald frame up and down for production of fabric of a desired pattern, which dobby is characterized in that the dobby further comprises an actuation mechanism to actuate the knife hooks in synchronization with the swinging

motion of the swing lever, the knife hooks are eccentrically supported on their corresponding shafts, and the actuation mechanism actuates the knife hooks in such a manner that, when the end portions of the swing lever assume their respective most-advanced positions relative to the vertical lever, the knife hooks provided respectively at the end portions of the swing lever assume eccentric positions biased toward their corresponding hook levers.

In the present invention, the knife hooks undergo eccentric motions relative to the swing lever so as to permit the knife hooks to form clearances at their advanced positions between the knife hooks per se and their corresponding hook levers. Therefore, it is unnecessary to make the swing lever itself to undergo any excessive swinging motion which would induce the jumping of the heald frame, thereby ensuring smooth engagement between the hook levers and their corresponding knife hooks.

The above and other objects, features and advantages of the present invention will become apparent from the following description and the appended claims, taken in conjunction with the accompanying drawings.

Fig. 1 is a schematic side elevation of a dobby according to one embodiment of this invention;

Fig. 2 is a perspective view of the upper knife hook illustrated in Fig. 1;

Fig. 3 is a perspective view, showing the actuation mechanism of the dobby; and

Figs. 4 to 6 are side elevations, illustrating the motion of the upper knife hook in various stages.

In Fig. 1, the dobby according to this invention is applied as a positive dobby. A dobby 10 includes a jack lever 16 coupled via a conventionally well-known link mechanism 14 with a heald frame 12 which is supported displaceably up and down on an unillustrated loom frame, and a vertical lever 18 connected to the jack lever 16. The jack lever 16 has a C-like configuration as a whole and is pivotally connected at one end thereof with a stationary shaft 20 supported on the unillustrated loom frame. The other end of the jack lever 16 is pivotally secured, via a pivot 22, to a central part of the vertical lever 18. A connecting rod 24, which extends out from the link mechanism, is pivotally connected to the jack lever 16 at a point adjacent to the other end of the jack lever 16.

An upper hook lever 28a and lower hook lever 28b are pivotally and respectively connected to both ends of the vertical lever 18 via their corresponding pivots 26a,26b. The hook levers 28a,28b extend parallel to each other at one side of the vertical lever 18. At the other side of the vertical lever 18, stoppers 30a, 30b which are respectively supported on the unillustrated loom frame are provided in such a manner that the hook levers 28a,28b can be brought into contact with their corresponding stoppers 30a,30b. Both stoppers 30a,30b control the upright position of the vertical lever 18.

Knife hooks 32a,32b are provided corresponding to the hook levers 28a,28b. The knife hooks 32a,32b are turnably supported on their corresponding shafts 36a,36b which are in turn rotatably supported between upper end portions of the swing levers 34a,34b (see Fig. 3) and between lower end portions of the swing levers 34a,34b respectively. The knife hooks 32a,32b are respectively provided with hook portions 40,40 which are engageable with their matching hook portions 38,38 provided respectively at the free ends of their corresponding hook levers 28a,28b. The knife hooks 32a,32b also have cam faces 44,44 which are engageable respectively with hook stoppers 42a,42b.

The hook stoppers 42a,42b are turnable about their corresponding pivots 46,46 supported on the

unillustrated loom frame and are exerted with the tensile forces of their corresponding coil springs 48,48 as turning forces directed respectively towards the points of engagement between the hook levers 28a,28b and their corresponding knife hooks 32a,32b. Each of the hook stoppers 42a,42b is, as illustrated with respect to the lower hook lever 28b, kept in contact with its corresponding hook lever so as to hold the hook lever while the knife hook is kept out of engagement with its corresponding hook lever. Each of the hook stoppers 42a,42b is, as illustrated with respect to the upper hook lever 28a, is on the other hand released from its engagement with its corresponding hook lever by means of the cam face of the knife hook as soon as the hook lever has been brought into engagement with the knife hook.

The knife hooks 32a,32b receive the tensile forces of their corresponding coil springs 50,50 as turning forces which are exerted about their corresponding shafts 36a,36b in directions away from their corresponding hook levers 28a,28b. Stoppers 52a,52b, to which one ends of the springs 50,50 are respectively connected, are supported on the swing levers 34a,34b movably together with the swing levers 34a,34b. As illustrated with respect to the upper knife hook 32b in Fig. 1, the stoppers 52a,52b may be brought into abutment against their

corresponding knife hooks 32a,32b.

The swing levers 34a,34b are swingable as a unitary member about a central shaft 54 which extends centrally through the swing levers 34a,34b, and are periodically swung about the central shaft 54 by means of a drive mechanism 56. The distance (ℓ_1) between the center of the central shaft 54 and that of one of the shafts, i.e., the shaft 36a is equal to the distance (ℓ_1) between the center of the central shaft 54 and that of other shaft, i.e., the shaft 36b. Owing to the above-described swinging motion of the swing levers 34a,34b, both end portions of the swing levers 34a,34b are alternately moved toward and away from the vertical lever 18. When both end portions of the swing levers 34a,34b are at their advanced positions, the knife hooks 32a,32b provided at the end portions are engageable with their corresponding hook levers 28a,28b. When the knife hooks 32a,32b are managed to engage with their corresponding hook levers 28a,28b by means of needles 58a,58b of a command device which has conventionally been well-known in the art, the knife hooks 32a,32b are turned about their corresponding shafts 36a,36b toward their corresponding hook levers 28a,28b and are then kept in engagement.

When the end portions of the swing levers 34a,34b move from their advanced positions to their retreated

positions in the above state, the swing levers 34a,34b pull the hook levers 28a,28b rightwards as seen in Fig. 1 via their corresponding knife hooks 32a,32b with which the hook levers 28a,28b are respectively kept in engagement. If the upper knife hook 32a is for example selectively brought into engagement with its corresponding upper hook lever 28a and the upper hook lever 28a is thus pulled, the vertical lever 18 turns clockwise about the lower pivot 26b. This turning motion of the vertical lever 18 causes the jack lever 26 to lift the heald frame 12 to the upper position via the link mechanism 14. If the lower knife hook 32b is on the other hand selectively brought into engagement with its corresponding lower hook lever 28b and the lower hook lever 28b is hence pulled, the vertical lever 18a turns counterclockwise about the upper pivot 26a. This turning motion of the vertical lever 18 causes the jack lever 26 to lift the heald frame 12 to the upper position via the link mechanism 14.

In the case of a passive dobby, the lowering of the heald frame 12 to the lower position is effected by the tensile force of a biasing spring. In the case of the illustrated positive dobby 10 on the other hand, the lowering of the heald frame 12 to the lower position is effected by the swinging motions of an upper return knife 66a and lower return knife 66b fixed on a swing

lever 64 which is supported via a pivot 60 on the unillustrated loom frame and is coupled via a connecting rod 62 with the swing lever 34a. The swinging motions of the upper and lower return knives 66a,66b are synchronized with that of the swing lever 34a.

In order to ensure smooth engagement between the hook levers 28a,28b and their corresponding knife hooks 32,32b, the knife hooks 32a,32b are eccentrically supported on their corresponding shafts 36a,36b. Namely, as apparent from Fig. 2 which shows the relationship between the upper knife hook 32a and its corresponding shaft 36a clearly, an eccentric shaft 68a is rotatably fit over the shaft 36a so that the former shaft surrounds the latter shaft. Over the eccentric shaft 68a, the knife hook 32a is rotatably fit with a bearing 70 interposed therebetween. The eccentric shaft 68a has a journal 72 which is concentric with the shaft 36a, on which journal 72 an arm 74a is fixedly secured at one end thereof. The lower knife hook 32b is pivotally supported on its corresponding shaft 36b via an eccentric shaft 68b (see Fig. 3) and bearing which are similar to those employed for the upper knife hook 32a. On a journal of the eccentric shaft 68b which receives the shaft 36b therein, one end of an arm 74b (see Fig. 3) is fixedly secured.

Accordingly, it is possible to displace the upper

knife hook 32a leftwards relative to the shaft 36a as seen in Fig. 1 by turning the arm 74a counterclockwise about the shaft 36a and thus turning the eccentric member 68a about the shaft 36a. On the other hand, by turning the arm 74b clockwise about the shaft 36b, the eccentric shaft 68b can be turned about the shaft 36b and the lower knife hook 32b can hence be displaced leftwards relative to the shaft 36b in Fig. 1.

An actuation mechanism for the arms 74a,74b is built in the drive mechanism 56 so as to actuate the arms 74a,74b in synchronization with the swing arms 34a,34b.

The drive mechanism 56 is, as shown in Fig. 3, provided with a pair of circular cam wheels 78a,78b fixed at both ends of a drive shaft 76. Therefore, the cam wheels are integrally driven and rotated in the same direction and at the same speed. In the outer surfaces of the cam wheels 78a,78b, drive cam grooves 80a,80b for the swing levers 34a,34b are respectively formed surrounding the drive shaft 76. In the cam groove 80a of one of the cam wheels, i.e., the cam wheel 78a, there is received a roller 84a provided at the free end of an arm portion 82a which extends as an integral member from one of the swing levers, i.e., the swing lever 34a (see Fig. 1). On the other hand, a roller 84b provided at the free end of an arm portion 82b which extends as an integral member

from the other swing lever 34b is received in the cam groove 80b of the other cam wheel 78b. Both cam grooves 80a,80b have the same shape and the swing levers 34a,34b undergo as a unitary unit one reciprocal swinging motion while the cam wheels 78a,78b rotate once.

In the inner surfaces of the cam wheels 78a,78b, cam grooves 86a,86b for their corresponding knife hooks are formed surrounding the drive shaft 76. The cam grooves 86a, 86b are formed substantially along base circles each having a center coincided with the center of rotation of the drive shaft 76 and a radius equal to the distance (ℓ_1) from the central shaft 54 of the swing levers 34a,34b to each of the shafts 36a,36b.

In the cam groove 86a of one of the cam wheels, i.e., the cam wheel 78a, there is received a cam roller 88a provided at the other end of the arm 74a for the upper knife hook 32a. The cam groove 86a includes an outwardly-deviated groove portion 90a, which extends radially and outwardly, in order to receive the roller 88a when the upper end portions of the swing levers 34a,34b are at their advanced positions respectively. On the other hand, a cam roller 88b provided at the other end of the arm 74b for the lower knife hook 32b is received in the cam groove 86b of the other cam wheel 78b. The cam groove 86b includes an outwardly-deviated groove portion, which extends radially and outwardly

similar to the cam groove 86a, in order to receive the roller 88b therein when the lower end portions of the swing levers 34a,34b are respectively at the advanced positions. The outwardly-deviated groove portion of the cam groove 86b has a phase difference of 180? relative to the outwardly-deviated groove portion 90a of the cam groove 86a.

The distances between the centers of the shafts 36a,36b of the arms 74a,74b and their corresponding cam rollers 88a,88b are each equal to the distance between the center of the central shaft 54 and drive shaft 76. Accordingly, lines connecting the central axes of one of the shafts, i.e., the shaft 36a, central shaft 54, drive shaft 76 and cam roller 88a and lines connecting the central axes of the other shaft 36b, central shaft 54, drive shaft 76 and cam roller 88b form parallelograms of the same shape respectively, when the rollers 88a,88b of the arms 74a,74b are in their corresponding cam grooves 86a,86b other than the outwardly-deviated groove portions (see Fig. 1).

Therefore, when the rollers 88a,88b are respectively in the cam grooves 86a,86b other than the outwardly-deviated groove portions thereof, the arms 74a,74b do not cause the eccentric shafts, to which the arms are connected, to turn about their corresponding shafts 36a,36b. Accordingly, the knife hooks 32a,32b do not undergo any

eccentric motions about their corresponding shafts 36a, 36b. If the hook knife 32a supported on the upper end portion of the swing lever 34a moves for example from its retreated position (A) to its advanced position (B) in accordance with a swinging motion of the swing lever 34a, the arm 74a is swung counterclockwise, as seen in Fig. 4, about the shaft 36a because the cam roller 88a of the arm 74a engages with the outwardly-deviated groove portion 90a of the cam groove 86a at the advanced position. Owing to the swinging motion of the arm 74a, the eccentric shaft 68a is turned counterclockwise over an angle α about the shaft 36a at the advanced position B. As a result, the upper knife hook 32a undergoes a leftward eccentric motion over a distance h toward the upper hook lever 28a as illustrated by phantom lines in Fig. 4.

When the upper knife hook 32a is turned at the eccentric position about the shaft 36a by the needle 58a of the command device so as to engage with the upper hook lever 28a, the upper knife hook 32a and upper hook lever 28a are brought into mutual contact as shown in Fig. 5. Since a clearance of the above-mentioned distance h is maintained between the hook portion 40 of the upper knife hook 32a and the hook portion 38 of the upper hook lever 28a in the above state, the knife hook 32a is smoothly turned toward its position of engagement.

Thereafter, when the cam roller 88a of the arm 74a has moved from the outwardly-deviated groove portion 90a to the base circle portion of the cam groove 86a, the arm 74a causes the eccentric shaft 68a to turn clockwise about the shaft 36a, thereby causing the knife hook 32a to retreat from the eccentric position over the distance h. As a result, as illustrated in Fig. 6, the hook portion 28a of the upper hook lever 28a is brought into contact with the hook portion 40 of the upper knife hook 32a. The heald frame 12 is thus lifted toward the upper position by a subsequent retreating motion of the knife hook 28a.

The above-described eccentric motion of the upper knife hook at its advanced position is repeated in the same manner by the lower knife hook at its advanced position.

Therefore, it is possible to ensure the smooth engagement between the hook levers 28a,28b and their corresponding knife hooks 32a,32b without inducing any excessive swinging of the swing levers 34a,34b.

Furthermore, the lower knife hook 32b temporarily undergoes the above-mentioned eccentric motion in order to establish the spacing h between the knife hook 32b per se and the lower hook lever 28b when the lower knife hook 32b, which assumes its advanced position, engages with the lower hook lever 28b so as to hold the heald

frame 12 continuously at the raised position after, for example, the upper knife hook 32a has engaged at its advanced position with the upper hook lever 28a and then moved to its retreated position so as to lift the heald frame 12. Accordingly, the lower knife hook 32b and lower hook lever 28b can be brought into mutual engagement without causing the swing arms to undergo any excessive swinging motion while maintaining the engagement between the upper knife hook 32a and upper hook lever 28a. Consequently, the heald frame can be moved smoothly in accordance with the command from the command device without causing the heald frame 12 to undergo such a jumping motion as seen in a loom equipped with a conventional dobby.

As a drive mechanism for the swing arms 34a,34b, it is possible to employ a pair of eccentric cam wheels fixed on the drive shaft 76 with their phases deviated in place of the cam grooves of the cam wheels 78a,78b in order to apply a clockwise and counterclockwise turning forces alternately to each of the swing arms so as to swing the swing arms simultaneously, with a view toward achieving a still faster operation. It may also be appreciated that a variety of drive mechanisms may be used in place of these cam mechanisms.

Although the above embodiment has been described using the dobby according to this invention as a positive

dobby, it may also be appreciated that the dobby of this invention can be applied as a passive dobby.

According to this invention, it is feasible, as mentioned above, to achieve smooth engagement between the knife hooks and their corresponding hook levers without need for any excessive swinging motion of the swing levers - which excessive swinging motion will become a cause for the jumping motion of the heald frame - by causing the knife hooks supported pivotally via shafts on their corresponding swing levers to undergo temporary eccentric motions at their advanced positions.

Therefore, the present invention can avoid vibrations, impacts and cut-off of warp yarns due to jumping of a heald frame and can also achieve an increased operation speed for a dobby and hence an improved work efficiency.

Having now fully described the invention, it will be apparent to one of ordinary skill in the art that many changes and modifications can be made thereto without departing from the spirit or scope of the invention as set forth herein.

CLAIMS:

1. A dobby (10) including a vertical lever (18) pivotally connected at a central portion thereof with a jack lever (16) coupled with a heald frame (12) and at both end portions thereof with hook levers (28a, 28b), a swing lever (34a, 34b) periodically swung so that both end portions thereof move alternately toward and away from the vertical lever (18), knife hooks (32a, 32b) pivotally connected via shafts (36a, 36b) to their corresponding end portions of the swing lever (34a, 34b) and engageable with their corresponding hook levers (28a, 28b), a command device adapted to control the engagement between the hook levers (28a, 28b) and their corresponding knife hooks (32a, 32b) so as to move the heald frame (12) up and down for production of fabric of a desired pattern, characterized by an actuation mechanism to actuate the knife hooks (32a, 32b) in synchronization with the swinging motion of the swing lever (34a, 34b), wherein the knife hooks (32a, 32b) are eccentrically supported on their corresponding shafts (36a, 36b), and the actuation mechanism actuates the knife hooks (32a, 32b) in such a manner that, when the end portions of the swing lever (34a, 34b) assume their respective most-advanced positions relative to the vertical lever (18), the knife hooks (32a, 32b) provided respectively at the end portions of the swing lever (34a, 34b) assume eccentric positions biased toward their corresponding hook levers (28a, 28b).

2. The dobby according to Claim 1, characterized in that the actuation mechanism is built in the drive mechanism (56) for the swing lever (34a, 34b).

3. The dobby according to Claim 2, characterized in that the knife hooks (32a, 32b) are respectively turnable about eccentric shafts (68a, 68b) which are rotatably fit over their corresponding shafts (36a, 36b).

4. The dobby according to Claim 3, characterized in that each of the eccentric shafts (68a, 68b) has a bearing (70) concentric with its corresponding shaft (36a, 36b) and one end of its corresponding arm (74a, 74b), which extends out from the actuation mechanism, is fixedly secured to the bearing (70).

5. The dobby according to Claim 4, characterized in that the actuation mechanism has a pair of rotary cam wheels (78a, 78b), each of which cam wheels (78a, 78b) defines in one of the side surfaces thereof a cam groove (80a, 80b) formed surrounding a drive shaft (76) of the cam wheel (78a, 78b) for the swing lever (34a, 34b) and also defines in the other side surface thereof a cam groove (86a, 86b) formed surrounding the drive shaft (76) of the cam wheel (78a, 78b) for its corresponding knife hook (32a, 32b).

6. The dobby according to Claim 5, characterized in that the cam groove (86a, 86b) for the knife hook (32a, 32b) receives a cam roller (88a, 88b) rotatably supported on the other end of the arm (74a) and the cam groove (80a, 80b) for the swing lever (34a, 34b) receives a cam roller (84a, 84b) rotatably supported on an arm portion (82a, 82b) formed on the swing lever (34a, 34b).

7. The dobby according to Claim 6, characterized in that the cam groove (86a, 86b) for the knife hook (32a, 32b) is a substantially circular, annular groove concentric with the drive shaft (76), the distance between the center of a central shaft (54) of the swing lever (34a, 34b) and that of one (36a) of the shafts of the swing lever (34a, 34b) is the same as that between the center of the central shaft (54) of the swing lever (34a, 34b) and that of the other shaft (36b) of the swing lever (34a, 34b) and is equal to the radius of the annular groove (86a, 86b), so that the one (36a) of the shafts, the cam roller (88a, 88b) of the arm, and the drive shaft (76) of the cam wheel (78a, 78b) and the central shaft (54) of the swing lever (34a, 34b) form a parallelogram.

8. The dobby according to Claim 7, characterized in that the annular groove (86a, 86b) includes an outwardly-deviated groove portion (90a), which extends radially and outwardly from the base circle of the annular groove (86a, 86b), to impart an eccentric motion to the knife hook (32a, 32b) via the arm (74a, 74b).

FIG. I

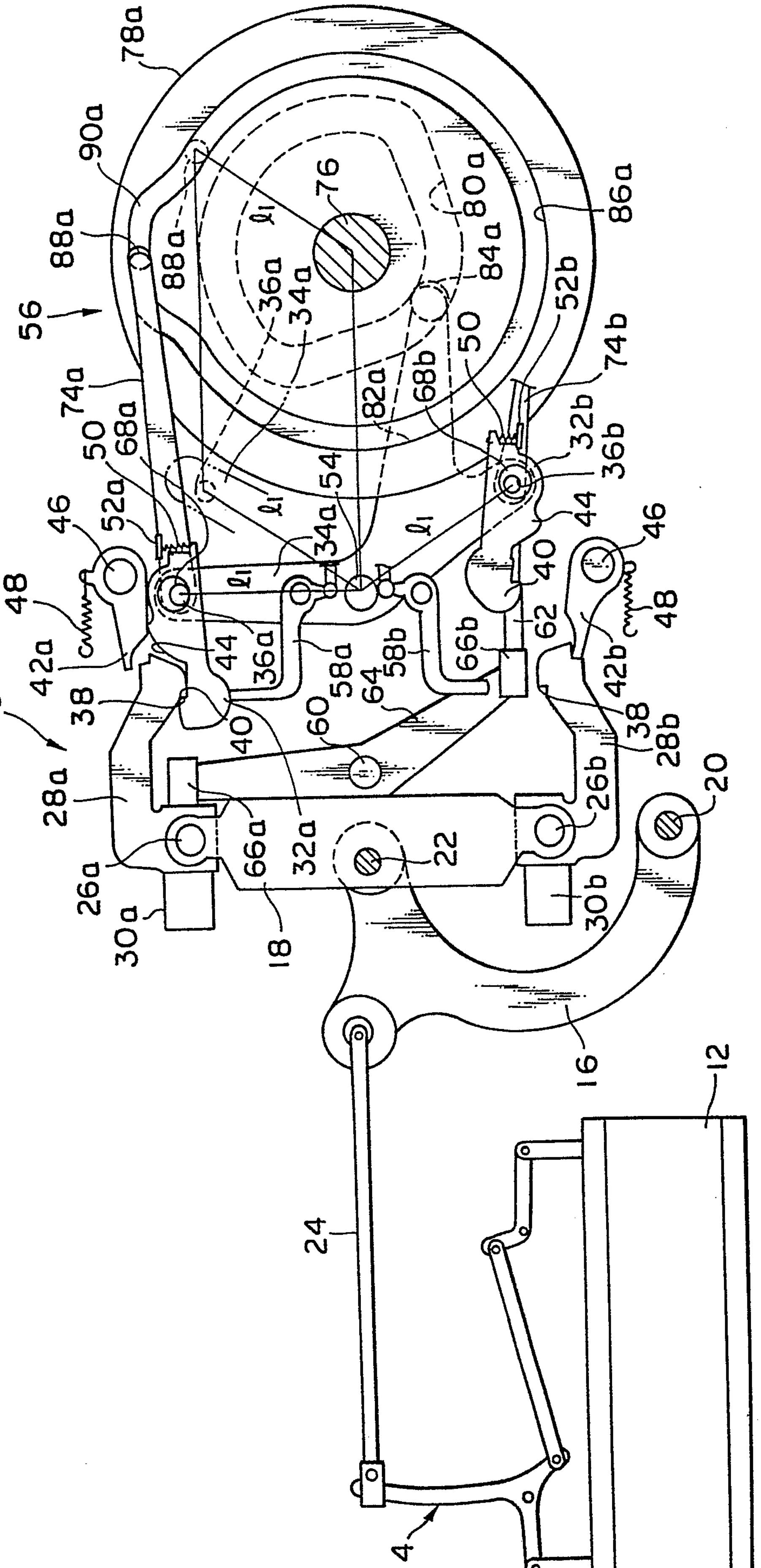
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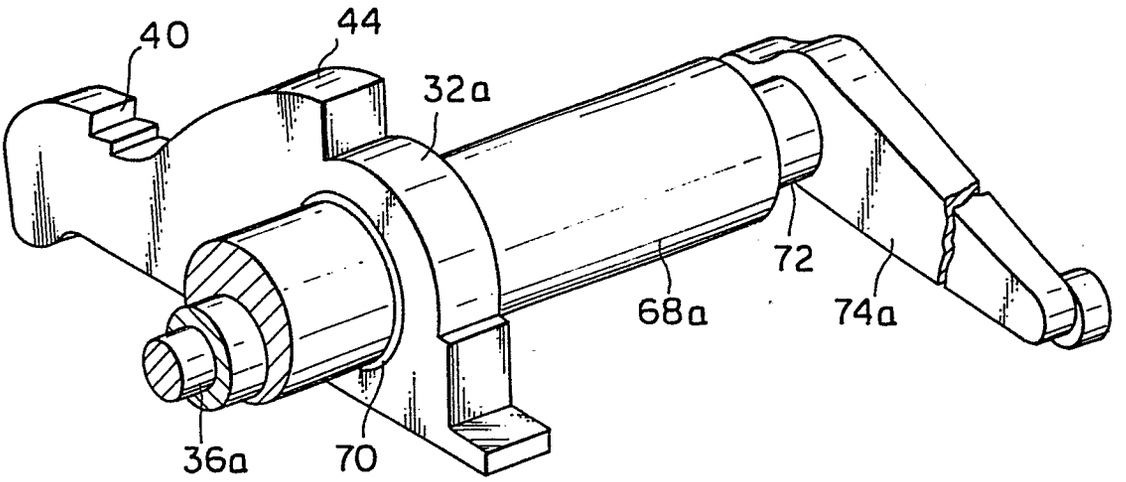
FIG. 2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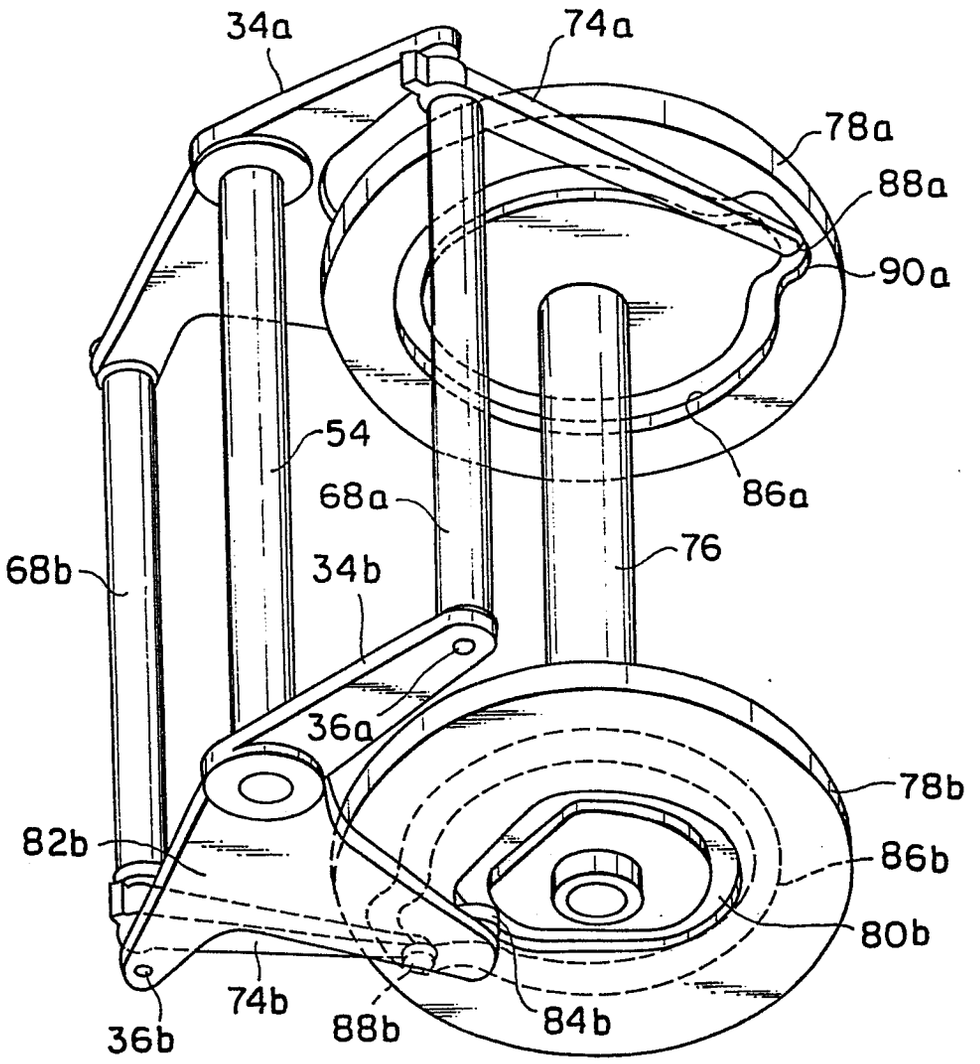
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FIG. 4

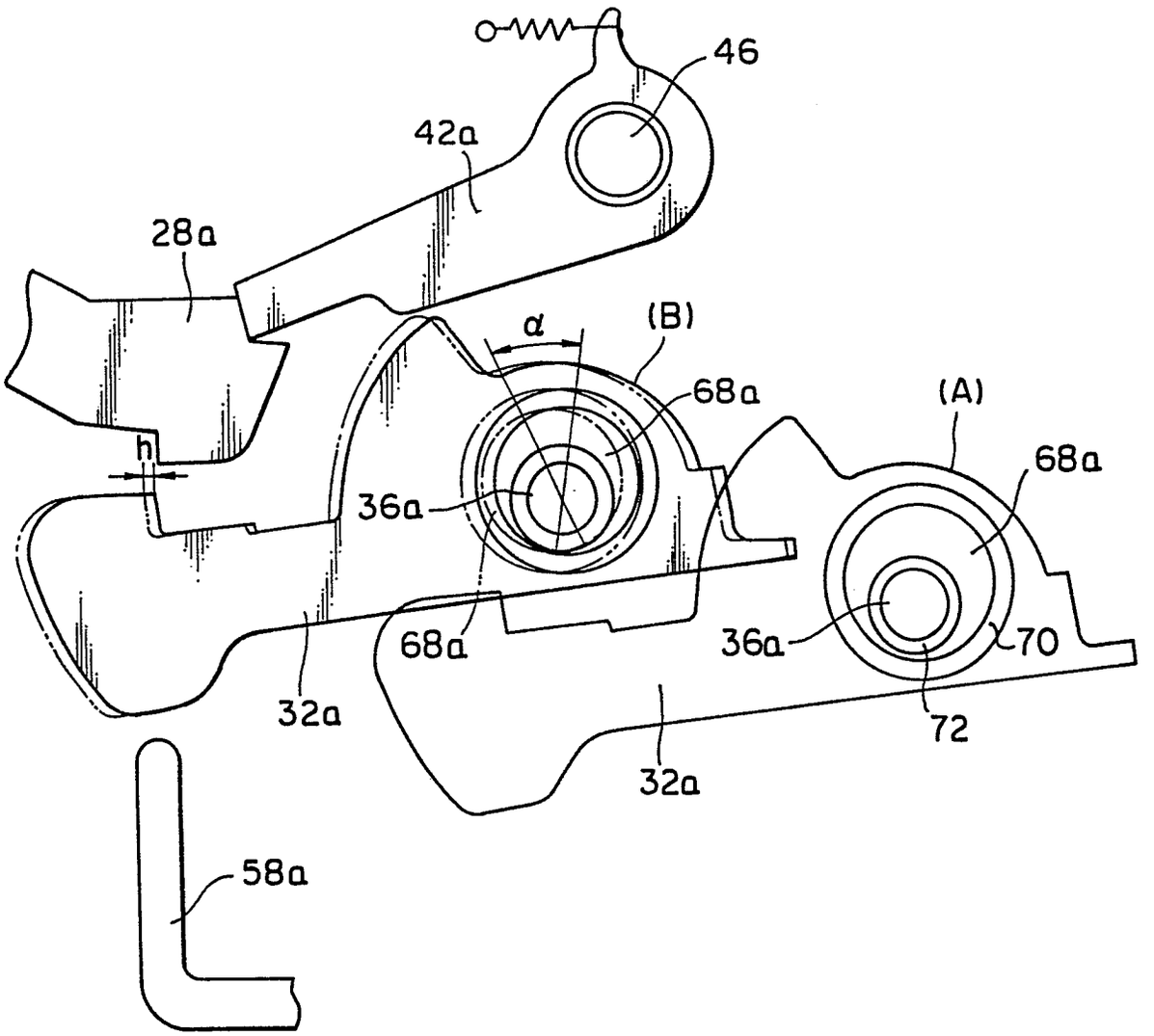

FIG. 5

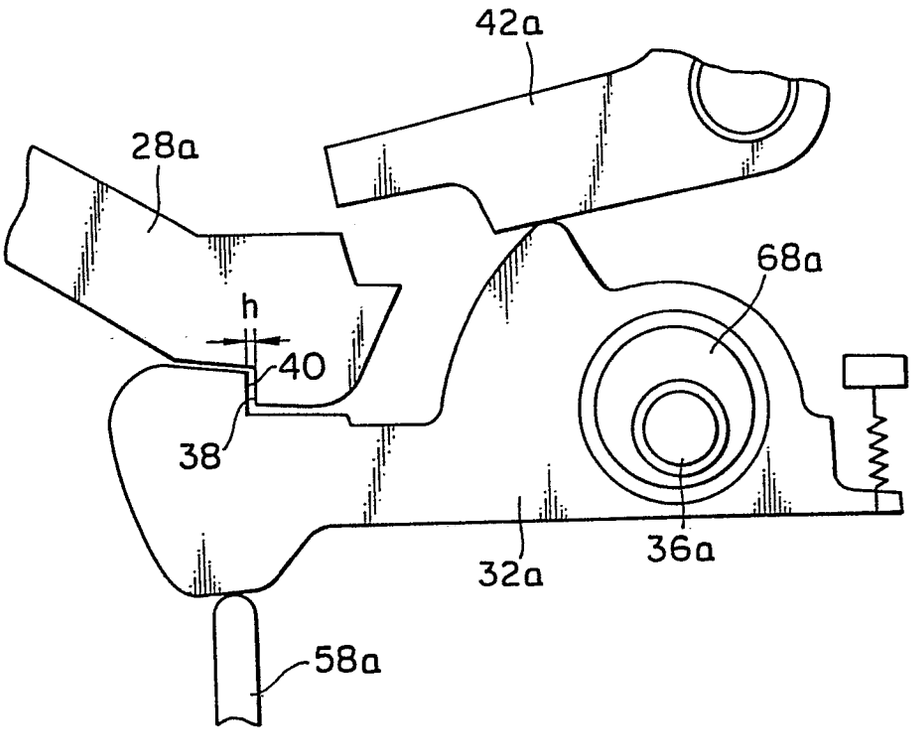

FIG. 6