

[54] **HEALD SEPARATING APPARATUS**

[75] Inventors: **Takao Dohi; Nobuhisa Oishi**, both of Shiga, Japan

[73] Assignee: **Todo Seisakusho Ltd.**, Kyoto-shi, Japan

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[51] Int. Cl. .... **D03j 1/14**

[58] Field of Search ..... 28/46, 45, 44, 42, 28/43

[56]

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*Primary Examiner*—James Kee Chi

*Attorney*—Kurt Kelman

[57]

**ABSTRACT**

A specified heald is separated automatically from groups of the healds in a predetermined order stored in a punched tape.

**1 Claim, 8 Drawing Figures**

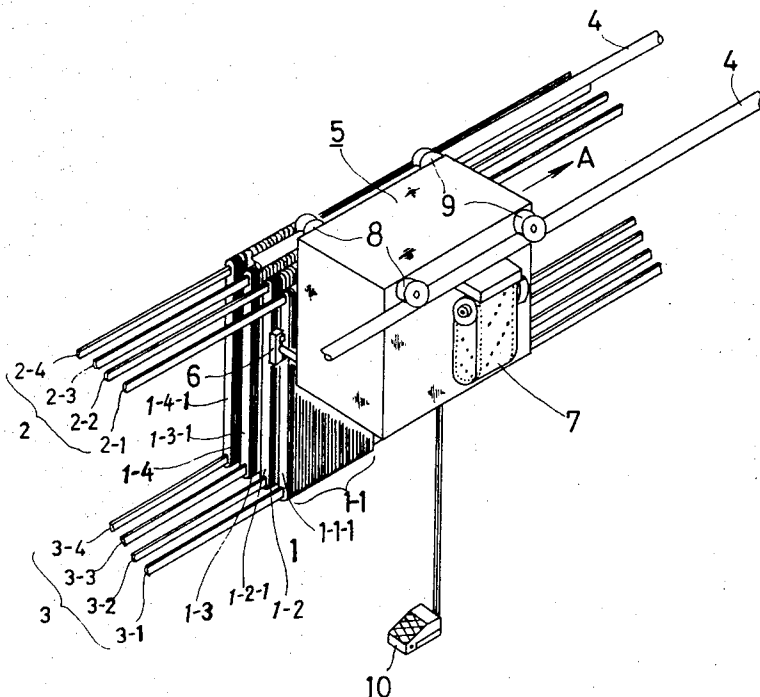


Fig. 1

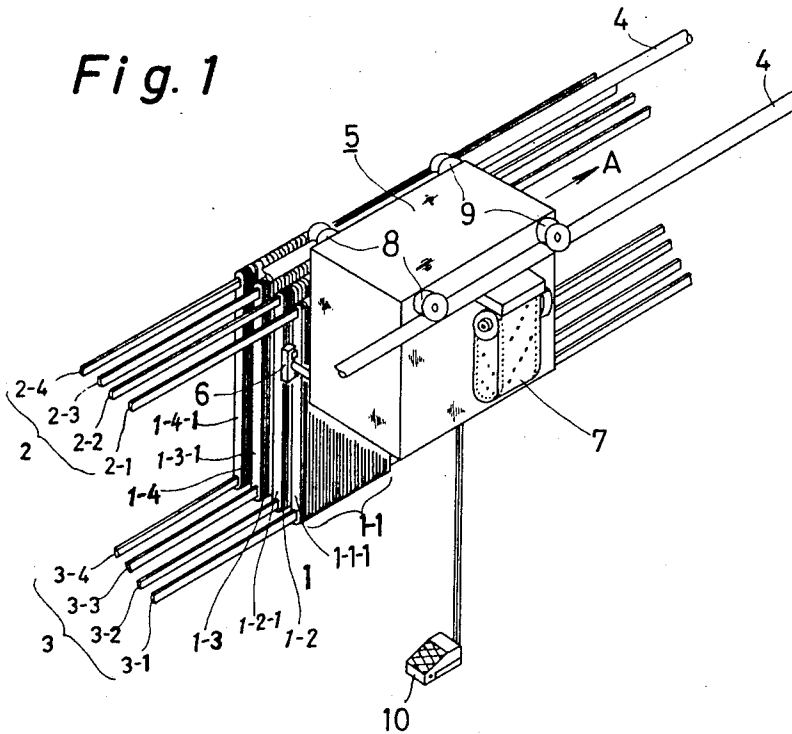
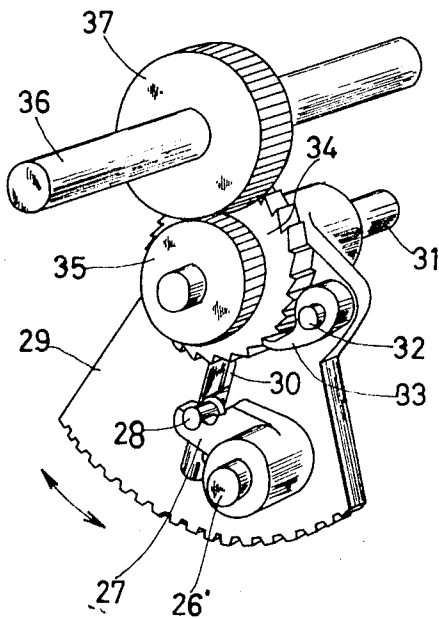


Fig. 2(b)



INVENTORS

TAKAO DOHI  
NOBUHISA OISHI

BY

Kurt Helman

AGENT

Fig. 2(a)

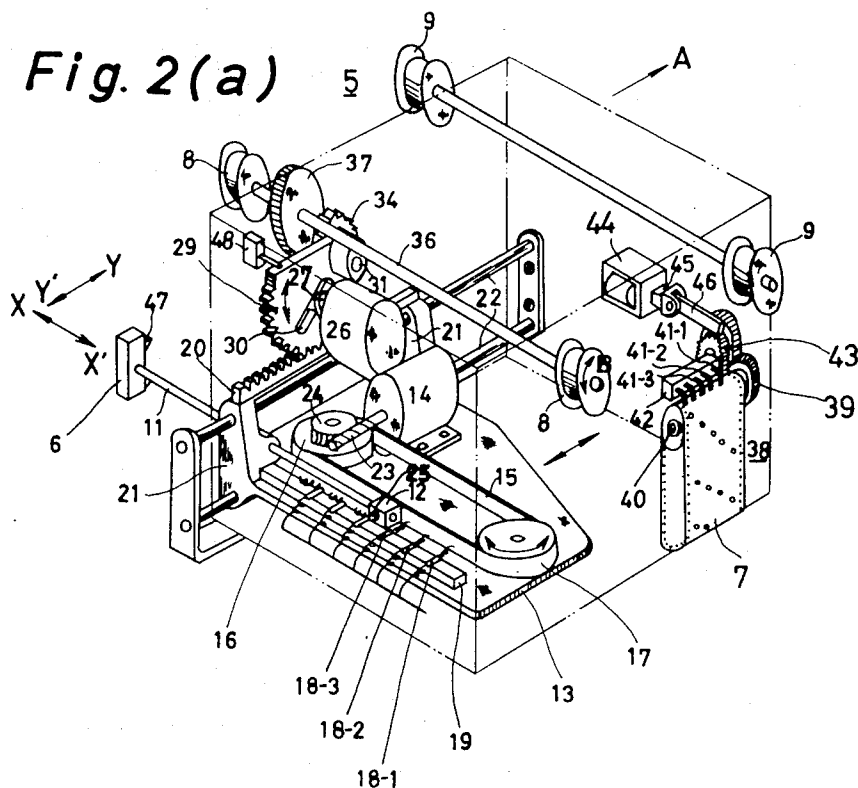
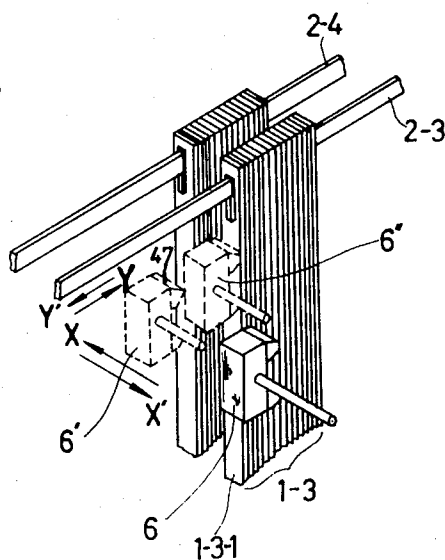


Fig. 3



INVENTORS

TAKAO DOHI  
NOBUHISA OISHI

BY

Kurt Kelman

AGENT

Fig. 2(c)

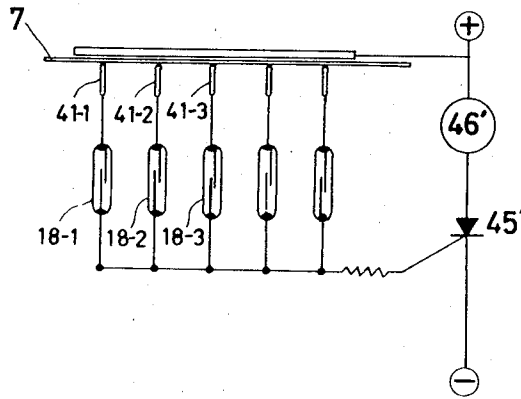


Fig. 4(a)

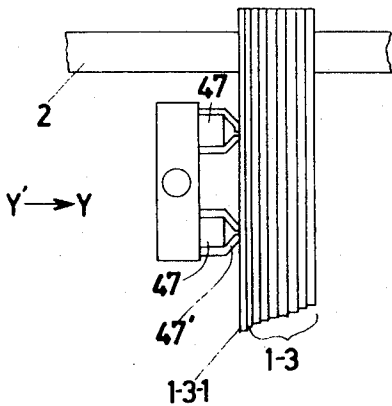


Fig. 4(b)

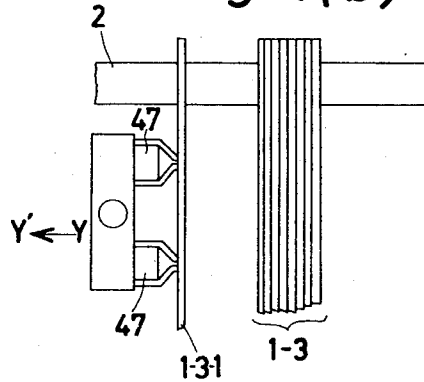
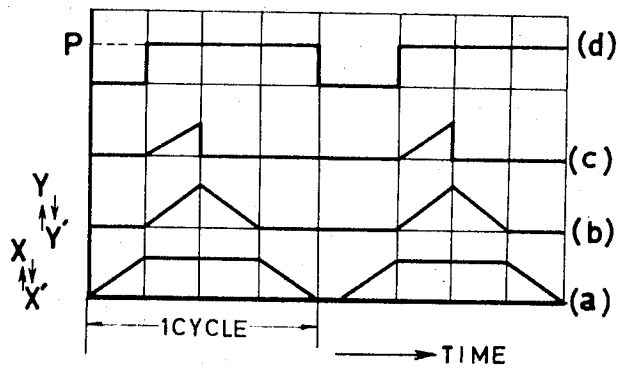


Fig. 5



INVENTORS

TAKAO DOHI  
NOBUHISA OISHI

BY

Kurt Helman

AGENT

## HEALD SEPARATING APPARATUS

### BACKGROUND OF THE INVENTION

The present invention relates to separation of healds in healding operation which is one of the warp prepar-

ing processes. Heretofore, in the conventional healding operation, warps and droppers are separated with machines while healds are separated by manual operations. Particularly when the healds are to be separated from the groups of the healds in a number of heald frames, the order of the heald frames to be separated is so complicated that it requires a great amount of skill to memorize the order and separate the healds correctly. Therefore, a machine capable of separating such healds automatically has been awaited for a long time.

Accordingly, the object of the present invention is to provide an apparatus adapted to separate the healds automatically wherein the order of the healds to be separated is stored in a punched tape and the healds are separated one by one in the order stored in the tape.

### SUMMARY OF THE INVENTION

When a pulse motor rotates a selector moves to locate a driving piece of a bracket to make a contact with a positioning contact. The pulse motor stops and a single-rotation motor rotates to move another selector together with a chassis. An attracting magnet provided on the surface of the selector contacts closely to a specified heald. A sector gear moves a carriage to separate the specified heald.

When the selector begins to move a solenoid of a tape reader is energized to attract a movable shaft. After the selector is returned to its original position finishing on cycle and the pulse motor is stopped the solenoid is switched off and the movable shaft is returned to its original position to feed a punched tape by one pitch.

### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the apparatus according to the present invention in actual use;

FIGS. 2 (a), (b) and (c) are perspective views of the essential portions of the apparatus;

FIGS. 3, 4 (a) and 4 (b) illustrate actions of the essential portions of the apparatus; and

FIG. 5 is a time chart showing the heald separating motion of the apparatus.

### DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIG. 1, the reference numeral 1 indicates groups of heald through which upper and lower heald bars 2, 3 for holding the healds are inserted. A numeral 4 indicates rails on which a heald separating carriage 5 (hereinafter referred to as a "carriage") is suspended. 6 is a heald selector (hereinafter referred to as a "selector"), 7 is a punched tape, elements 8 are driving rollers for moving the carriage 5 along the rails 4. Elements 9 are guide rollers and 10 is a pedal switch for operating the carriage 5. The groups of healds 1 are held by the heald bars 2 and 3 inserted therethrough, and the heald bars 2, 3 and the rails 4 are fixed to the positions by appropriate means. The carriage 5 is suspended on the rails 4 by the rollers 8 and 9 and is moved automatically gradually in the direction indicated by arrow A at each time when a piece of the heald is separated by the

selector 6. The selector 6 is positioned at the midheight between the upper and lower heald bars 2 and 3 and is moved in the directions firstly of arrow X, then arrow Y, and then arrow Y' (opposite to Y) and lastly arrow X' (opposite to X) as shown in FIGS. 2 and 3. (Though the Figures show the case wherein the directions X—X' and Y—Y' cross each other in right angle, the angle of the movement of the selector 6 is not limited to right angle only. The selector is made movable in any direction.)

In FIG. 2, the selector 6 is fixed to one end of a rod 11, and a bracket 12 is also fixedly provided to the other end thereof. An attracting magnet piece 47 is mounted to the heald group side of the selector 6. On the chassis 13 are provided a pulse motor 14, two pulleys 16, 17 having a belt 15 hanged thereon, an insulated base plate 19 on which positioning contacts 18-1~18-n for the selector 6 are mounted, and two brackets 21, 21 on the upper surface of which is fixed a rack 20. The chassis 13 is moved reciprocatingly in Y—Y' direction being guided by guide shafts 22, 22. When the pulse motor 14 rotates, its rotation is transmitted to the pulley 16, since worm 23 provided at the leading end of the shaft of the pulse motor 14 is intermeshed with worm wheel 24 fixed concentrically to the shaft of the pulley 16. The bracket 12 is fixed to a point of the belt 15 stretched around the both pulleys 16 and 17. The bracket 12 is provided with a contact driving piece 25 for actuating the positioning contacts 18-1~18-n. Accordingly, when the pulse motor 14 rotates and the belt 15 is moved by rotation of the pulley 16, the selector 6 at the end of the rod 11 fixed to the bracket 12 is moved in X direction. Numeral 26 indicates a single-rotation motor fixedly provided on the frame of the carriage 5. Crank 27 is fixedly provided at the left end of the shaft 26' of the motor 26. Pin 28 at the leading end of the crank 27 is inserted into crank slot 30 of sector gear 29 and movably fitted to it. The sector gear 29 is disposed so as to intermesh with the rack 20 fixedly provided to the brackets 21 fixed to the chassis 13. Therefore, when the single-rotation motor 26 rotates, the sector gear 29 takes a crank movement in the arrowed direction around the shaft 31. As illustrated in FIG. 2 (b) in detail, ratchet wheel 34 movably fitted into the shaft 31 of the sector gear 29 intermeshes with spring feeding ratchet 33 pivoted at a point 32 of the sector gear 29, and gear 35 fixedly provided at the side of the ratchet wheel 34 concentrically to it intermeshes with gear 37 fixed to shaft 36. At both ends of the shaft 36 are fixed the driving rollers 8 suspended on the rails 4. Therefore, when the single-rotation motor 26 rotates, the sector gear 29 takes crank motion to the arrowed direction through the crank 27, and at this time the entire chassis 13 fixed integrally with the rack 20 takes reciprocal movement by the stroke of the length of the crank 27 in Y—Y' direction. And, when the sector gear 29 is moved by a stroke, the feeding ratchet 33 advances the rotation of the ratchet wheel 34 by one tooth so that the shaft 36 is rotated by the advancement to move the entire carriage 5 slightly forward along the rails 4 through the driving rollers 8. Tape reader 38 comprises a driving drum 40 having gear 39 at one end thereof, an insulated base plate 42 provided with tape reader elements 41-1 to 41-n, a solenoid 44 having a movable shaft 45 for rotary feeding the driving drum 40 through ratchet gear 43, and the punched tape 7 wherein the order of

the heald groups to be separated is stored, said tape reader elements 41-1 ~ 41-n being electrically connected to the positioning contacts 18-1 ~ 18-n as shown in FIG. 2 (c), wherein 45' is an SCR, 46' is a relay to cut off the pulse motor 14, and 7 is a punched tape. Lead switch is used in the positioning contacts 18-1 ~ 18-n and a magnet piece is exemplarily used in the contacts driving piece 25. Beside these, however, other elements, for example, proximity switches and photoelectric switches, may be used.

The operation of the heald separating apparatus according to the present invention is described below with reference to FIGS. 3, 4 and 5. At first, the selector 6 rests at the nearest position, namely at the position wherein the driving piece 25 of the bracket 12 contacts with the positioning contact 18-1 (indicated by 6 in FIG. 3). When operator switches on the pedal switch 10 and the tape reader 38 reads, for example, the reader element 41-3, the pulse motor 14 rotates in a positive direction, the selector 6 moves in the direction of the arrow X and, accordingly, when the driving piece 25 of the bracket 12 contacts with the positioning contact 18-3, the pulse motor 14 stops at this position (at the position 6' of the selector shown by dotted lines in FIG. 3; in other words, the position on the extension line in the row direction of the upper and lower heald bars 2-3 and 3-3, the third from the frontmost bars 2 and 3). When the pulse motor 14 is stopped, the single-rotation motor 26 is switched on, and the selector 6' is moved integrally with the chassis 13 in the direction of the arrow Y through the crank 27, the sector gear 29 and the rack 20, and the attracting magnet 47 provided on the surface of the selector contacts closely to the heald 1-3-1 which is the frontmost of the heald group 1-3 in the third row as shown in FIG. 4 (a) and FIG. 3 wherein shown as the selector 6''. At the same time, the feeding ratchet 33 fixedly provided on the sector gear 29 rotates the ratchet wheel 34 thereby to rotate the driving roller 8 in the direction of the arrow B through the gears 35 and 37 and to move the entire carriage 5 in the direction of the arrow A by the distance corresponding to one tooth. Further rotation of the single-rotation motor 26 rotates the sector gear 29 in the inverted direction through the crank 27. Therefore, the selector 6 is moved in the direction of the arrow Y' through the rack 20 to be returned to the position shown by numeral 6' in FIG. 3. 3. Following this, the attracting magnet 47 mounted on the selector 6 attracts a piece of the heald 1-3-1 at the frontmost of the heald group 1-3 in the first row as shown in FIG. 4 (b) and is moved in the direction of the arrow Y'. When the switch 48 is made off by the sector gear 29, the single-rotation motor 26 stops. Then, the pulse motor 14 begins reverse rotation and the selector 6 is moved in the direction of the arrow X' to be returned to its original position. When the driving piece 25 of the bracket 12 contacts with the positioning contact 18-1, the pulse motor 14 is stopped. When the selector 6 begins to move in the Y-Y' direction, the solenoid 44 of the tape reader is energized to attract the movable shaft 45. Then, when the selector 6 is returned to its original po-

sition finishing one cycle and the pulse motor 14 is stopped, the solenoid 44 is switched off and the movable shaft 45 is returned to its original position in front. At that time, the lever 46 at the end of the shaft 45 moves the gear 43 forward by the distance corresponding to one tooth. ( Remark: When the movable shaft 45 is attracted, the gear 43 is kept from rotation by the ratchet assembly. ) Therefore, the punched tape 7 is fed by one pitch, the tape reader elements read the order of the healds to be separated and the pedal switch 10 is made. In this manner, the heald is automatically and successively separated from the heald groups in the order stored in the punched tape through the operation process explained above. The heald separated in said process is carried to the intersecting point of the axes X and Y and the selector 6 is returned to its original position leaving the heald there.

A cycle of the operation of the heald separating apparatus according to the present invention has been explained above. Now, FIG. 5 is a time chart of operation of each part. In the Figure, (a) indicates movement of the selector 6 in X-X' direction, (b) indicates movement in Y-Y' direction, (c) indicates movement of the feeding ratchet 33, (d) indicates movement of the movable shaft 45 of the solenoid 44, and point P indicates the position of the movable shaft 45 of the solenoid 44 in the condition attracted. The operator put the yarn through the heald separated by the selector 6 as described above and keeps the heald from the passage of the selector so that the movement of the selector will not be obstructed. Repeating such movements, the selector 6 separates the heald one by one automatically in the order stored in the tape. Therefore, the apparatus according to the present invention has such an advantage that the separating operation is much surer than in the manual operation of the prior art and that the error in the order of the healds to be separated can hardly occur. Accordingly, this apparatus can be utilized in the industry with much better advantages than in the conventional apparatuses. The attractive force of the magnet 47 is adjusted so as to attract only one piece of the heald by the yokes 47' provided at both N and S poles.

What is claimed:

1. An apparatus for separating a heald from the heald groups held by a plurality rows of heald bars inserted therethrough, wherein a carriage is suspended on the rails provided in parallel with the heald bars, said carriage automatically separating the heald from the heald bars successively in the order stored in advance and moving the heald along the rails through the steps of moving forward the heald selector having an attracting magnet piece in accordance with the signal of the tape reader for reading the order of the healds to be separated toward the row of the heald group read by said tape reader, advancing the selector toward the frontmost of the heald group of said row along the row and attracting a piece of the heald at the frontmost of the heald group with said heald selector, and then returning the selector to the original position.

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