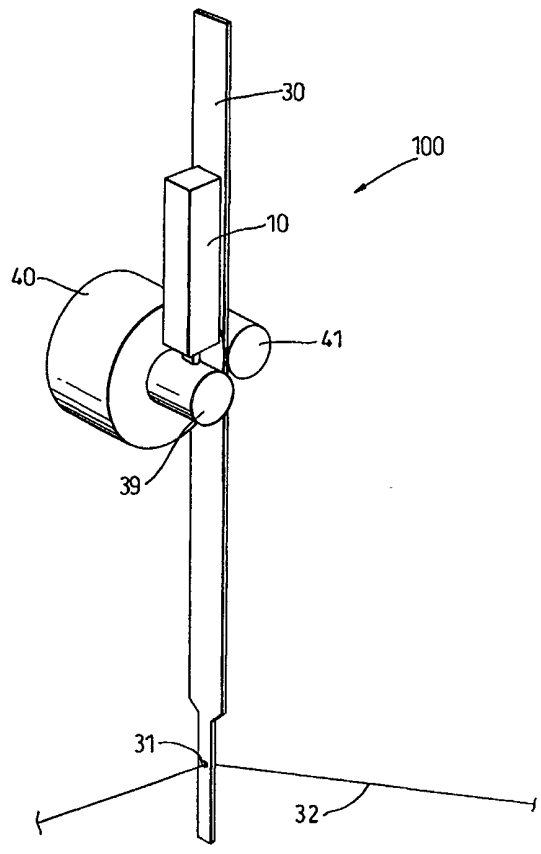


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(21) International Application Number: PCT/GB99/03104 (22) International Filing Date: 17 September 1999 (17.09.99) (30) Priority Data: 9820314.4 18 September 1998 (18.09.98) GB (71) Applicant (for all designated States except US): BONAS MACHINE COMPANY LIMITED [GB/GB]; Dukesway, Team Valley Trading Estate, Gateshead, Tyne & Wear NE11 0LF (GB). (72) Inventor; and (75) Inventor/Applicant (for US only): WARDLE, Mike [GB/GB]; 27 Chillingham Drive, Chester-Le-Street, County Durham DH2 3TJ (GB). (74) Agent: DEALTRY, Brian; Eric Potter Clarkson, Park View House, 58 The Ropewalk, Nottingham NG1 5DD (GB).		(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i>
(54) Title: MOTIVE DRIVE FOR WARP SELECTION		
(57) Abstract		
A motive assembly for moving a plurality of warp yarns (32) in a loom between upper and lower shed positions, the motive assembly including a plurality of selectively controllable ultrasonic cyclic motors (10), each of which is drivingly connected to one or a group of said warp yarns (32) for moving the warp yarn(s) (32) between upper and lower shed positions. 		

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MOTIVE DRIVE FOR WARP SELECTION

The present invention relates to a motive assembly for selectively controlling shedding of warp threads in a loom.

5

According to a general aspect of the present invention there is provided a motive assembly for moving a plurality of warp yarns in a loom between upper and lower shed positions, the motive assembly including a plurality of selectively controllable ultrasonic cyclic motors, each of which is drivingly connected to one or a group of said warp yarns for moving the warp yarn(s) between upper and lower shed positions.

10

Preferably the ultrasonic cyclic motor is a piezo motor, preferably operating at a frequency of between 20-140 KHz.

15

The motor may be drivingly connected to the warp yarn by a rigid elongate heald rod which is driven by the motor. The motor may directly contact the elongate heald rod in order to displace it longitudinally. Alternatively, the motor may drive the heald rod indirectly via a transmission means such as a drive gear or wheel.

20

Various aspects of the present invention are hereinafter described with reference to the accompanying drawings, in which :-

25

Figure 1 is a schematic perspective view of a first embodiment according to the present invention;

Figure 2 is a side view of the first embodiment showing additional detail;

Figure 3 is a side view similar to figure 2 showing a modification to the first embodiment.

Figure 4 is an end view of a second embodiment according to the present invention.

5 Figure 5 is a view of the assembly showing a heald rod connected to a harness;

Figure 6 is a side view of a third embodiment according to the present invention;

Figure 7 is a side view of a fourth embodiment according to the
10 present invention; and

Figure 8 is a schematic diagram illustrating the principle of operation of an ultrasonic motor as used in the present invention;

Referring initially to figure 8, there is shown an ultrasonic motor
15 10 including a casing 11 which houses a drive finger 12. The drive finger 12 is arranged to cyclically move along a cyclic path from a retracted position A (as shown) to an extended position B (shown in broken lines) and then whilst in its extended position, to the position C and then retracted to position D and then whilst in its retracted position, to position
20 A.

The finger 12 is driven at high speed through the cycle of positions A,B,C and D, preferably by piezo-electric elements (not shown) housed within the casing 11.

25

The direction of movement through the cycle may be A to B to C to D or may be reversed, viz A to D to C to B depending upon the applied electrical current.

By placing a member 14 to be driven in the path of the finger 12 whilst it moves between positions B to C (or vice versa), it is possible for the finger 12 to drive, in a stepwise manner, the member 14 in the same direction of travel.

5

This type of motor operates at high speeds, typically at cycles of between 20 to 140 KHz. The motor typically has a cross-sectional dimension of about 8 mm x 4 mm and a length of about 25 mm.

10 A first embodiment 100 of the invention is illustrated in Figures 1 and 2.

In this embodiment, a rigid and elongate rigid heald rod 30 is directly connected to a heald eye 31 through which a single warp yarn 32
15 passes.

A drive wheel 40 having a frictional surface for frictionally driving the heald rod 30 is provided for movement of the heald rod 30. The drive wheel 40 is rotated by a motor 10 driving a shaft 39 upon which wheel 40
20 is fixedly mounted. A reaction roller 41 is resiliently urged towards wheel 40 to maintain frictional contact between the wheel 40 and heald rod 30.

The roller 41 is resiliently urged by biasing means 44 which may be a spring 45 or other compression material. If desired, the roller 41 may
25 be replaced by a static member, such as a ceramic plate, which makes sliding contact with the heald rod 30.

Preferably, as shown in Figure 2, upper and lower guides 50,51 are provided for guiding longitudinal movement of the heald rod 30. The

guides 50, 51 not only positively define the longitudinal path of movement of the heald rods but also provide support against lateral flexure of the rod. Such support enables relatively thin heald rods 30 to be used.

5 Preferably, sensing means (not shown) are provided for co-operation with the heald rod 30 in order to sense the longitudinal position of the heald rod 30 in order to determine when it has reached its upper and/or lower shed position.

10 Preferably when the heald rod 30 is at its upper or lower shed position, the motor 10 is de-activated with the finger 12 in its extended position. This enables the finger 12 to act as a brake to restrain movement of the heald rod 30.

15 In Figure 3 there is provided a modification to the arrangement shown in figures 1 and 2 wherein an additional motor 10' is provided for driving shaft 39.

20 Preferably, as seen in Figures 1 to 3, the motors 10,10' are arranged to extend in the direction of movement of the heald rod 30. This enables a compact arrangement to be achieved and helps to achieve a high density of warp yarns.

25 A further modification is shown in Figure 4 wherein more than one motor 10 is arranged along the shaft 39. This modification applies to the arrangements shown in both figures 1 and 3.

In Figure 5, the heald rod 30 is shown as being connected to a harness 60 of flexible cords 61. This enables a single heald rod 30 to control movement of a group of warp yarns.

5 A further modification to the arrangements shown in Figures 1,3 and 4 is illustrated in Figure 6 wherein biasing means 70, for example in the form of a spring or an elastic cord, such as Lycra, is provided for applying tensile forces to the heald rod 30.

10 A further embodiment 200 is illustrated in Figure 7 wherein motors 10 are arranged to directly drive the heald rod 30 by the fingers 12 actually making contact therewith.

15 Preferably at least a pair of opposed motors 10a and 10b are provided operating on opposite sides of the heald rod 30.

20 As illustrated two pairs of motors are provided. However, it will be appreciated that one or more motors 10 may be positioned to one side only of the heald rod 30 and that a reaction member be located on the other side.

It will be appreciated that the heald rods and motors 10 may be directly incorporated into a loom or may be incorporated into a separate jacquard machine for siting on a loom.

25

It will be noted the shaft 39 and wheel 40 are of different diameter and so the peripheral speed of the wheel is higher than that of the shaft 39. Typically the ratio is 1:3.

However it will be appreciated that the wheel 40 may have the same or smaller diameter than the shaft 39.

CLAIMS

1. A motive assembly for moving a plurality of warp yarns in a loom between upper and lower shed positions, the motive assembly including a plurality of selectively controllable ultrasonic cyclic motors, each of which is drivingly connected to one or a group of said warp yarns for moving the warp yarn(s) between upper and lower shed positions.
2. An assembly according to Claim 1 wherein each motor includes a drive output comprising a drive finger which is driven cyclically along a cyclic path, the motor preferably operating at a frequency of between 20 to 140 KHz.
3. An assembly according to Claim 1 or 2 wherein the or each group of yarns is connected to a rigid elongate heald rod, each heald rod being driven by one or a group of said ultrasonic motors.
4. An assembly according to Claim 3 wherein said one or group of ultrasonic motors directly contact the elongate heald rod in order to displace it longitudinally.
5. An assembly according to Claim 4 wherein a number of the ultrasonic motors of said group are arranged to contact one side of the heald rod and the remainder of the ultrasonic motors of said group are arranged to contact the opposite side of the heald rod.
6. An assembly according to Claim 3 wherein said one or group of ultrasonic motors indirectly drive the heald rod via transmission means.

7. An assembly according to Claim 6 wherein the transmission means includes a drive wheel or gear which drivingly contacts the heald rod such that rotation of the wheel or gear causes longitudinal movement of the heald rod.

5

8. An assembly according to any of Claims 3 to 7 wherein each heald rod includes a heald eye to enable the heald rod to be connected to a warp yarn.

10 9. A jacquard machine including a motive assembly according to any preceding claim.

10. A loom including a motive assembly according to any of Claims 1 to 8.

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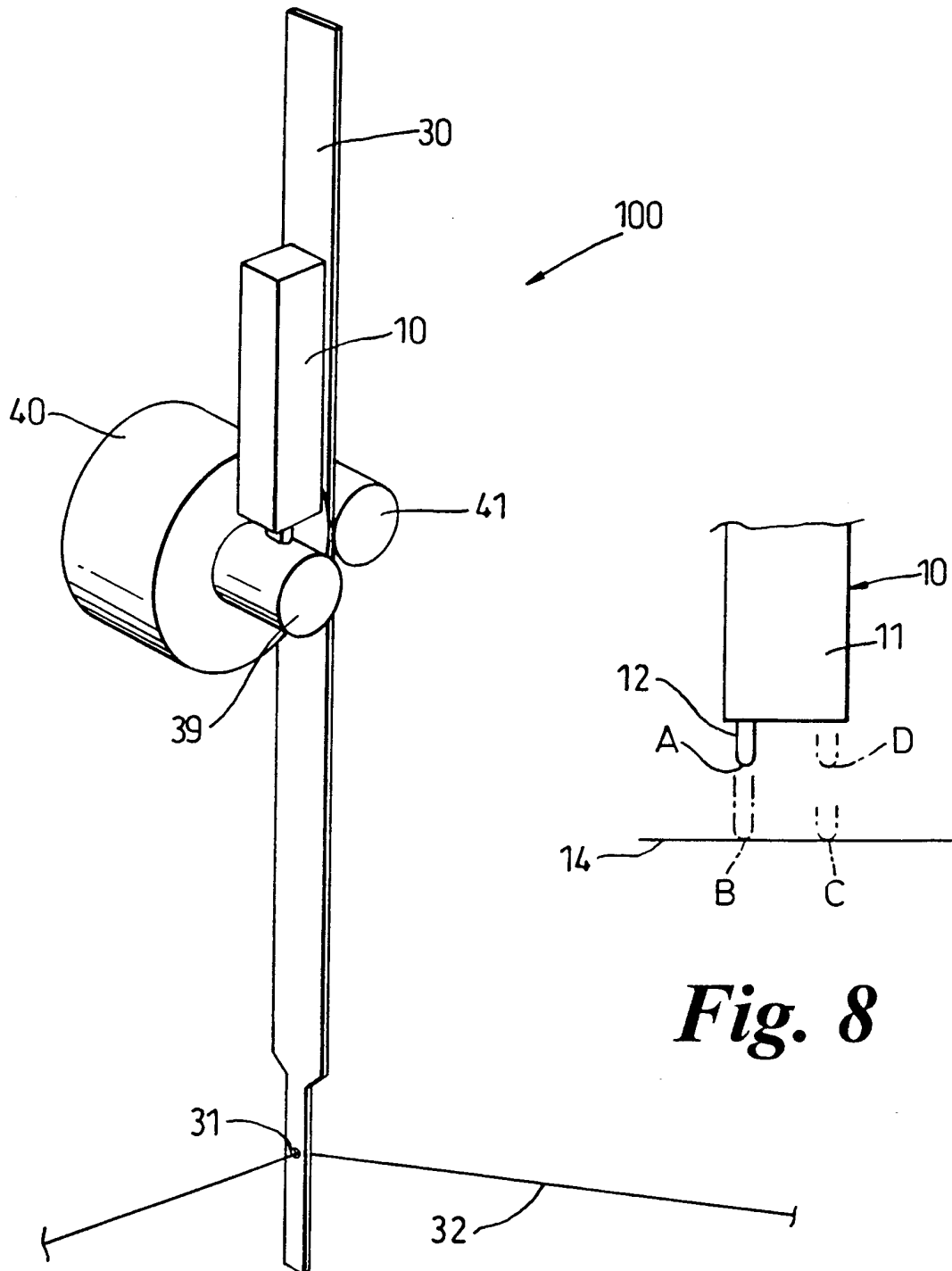


Fig. 8

Fig. 1

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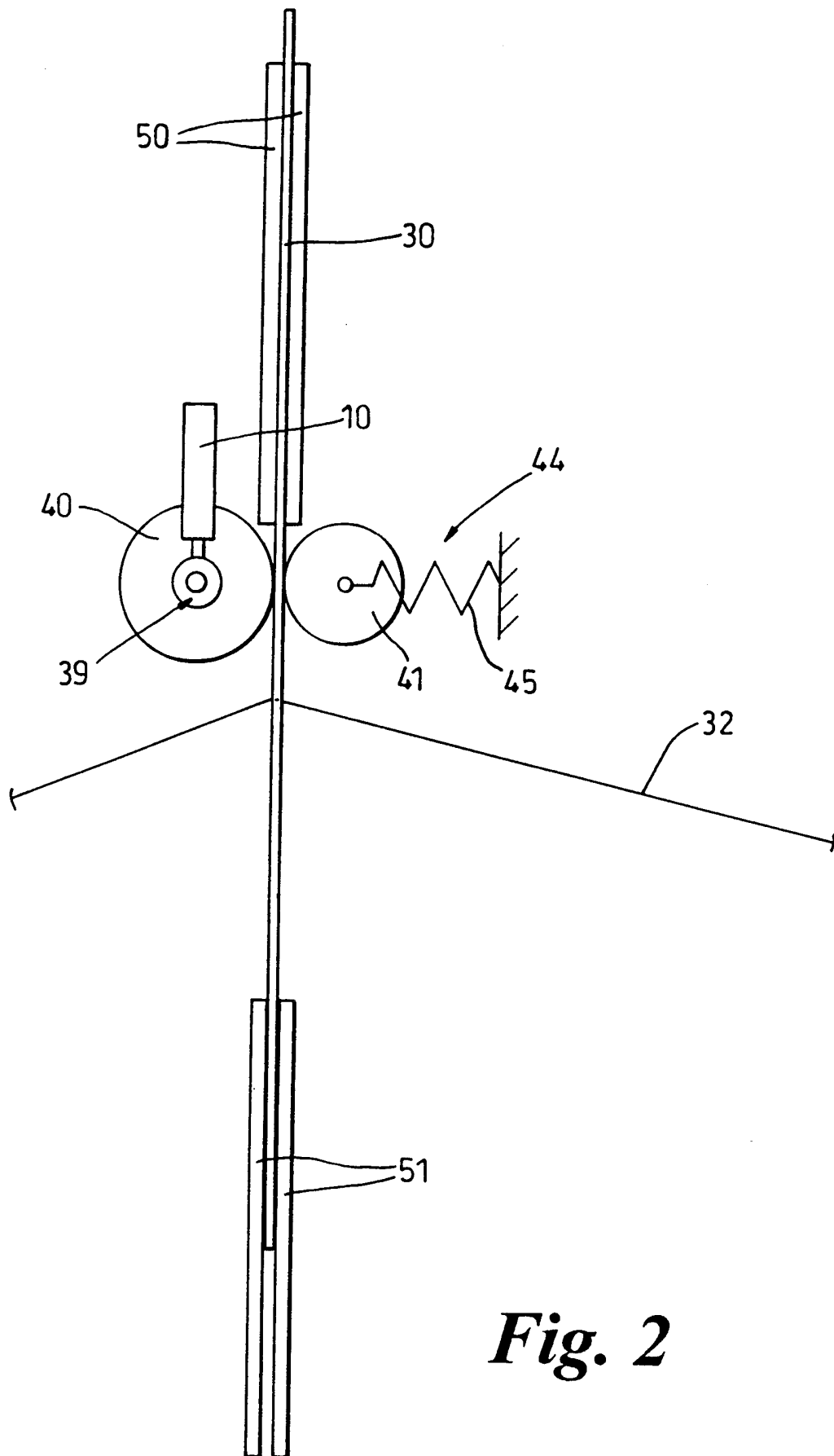


Fig. 2

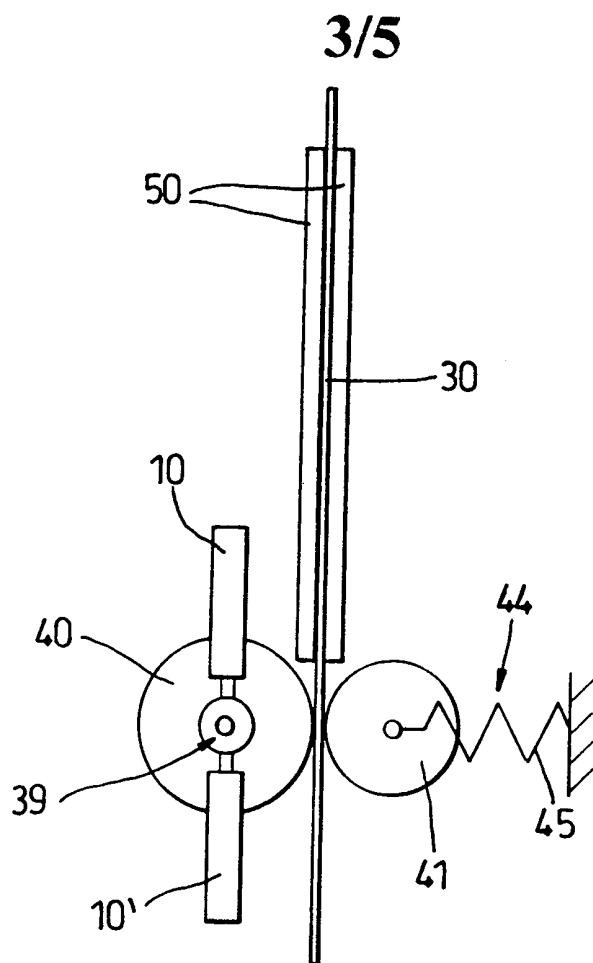


Fig. 3

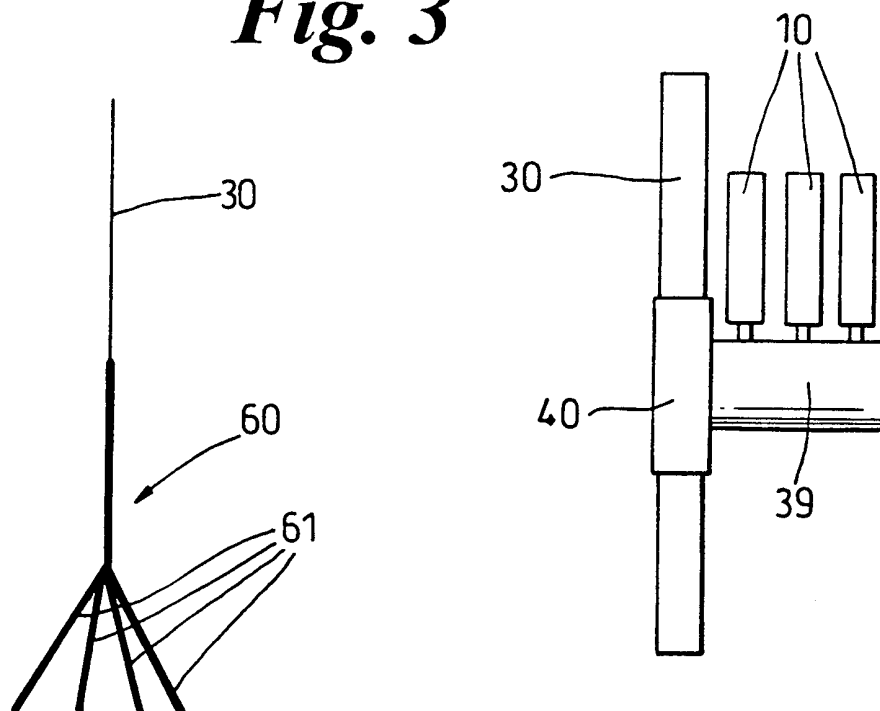
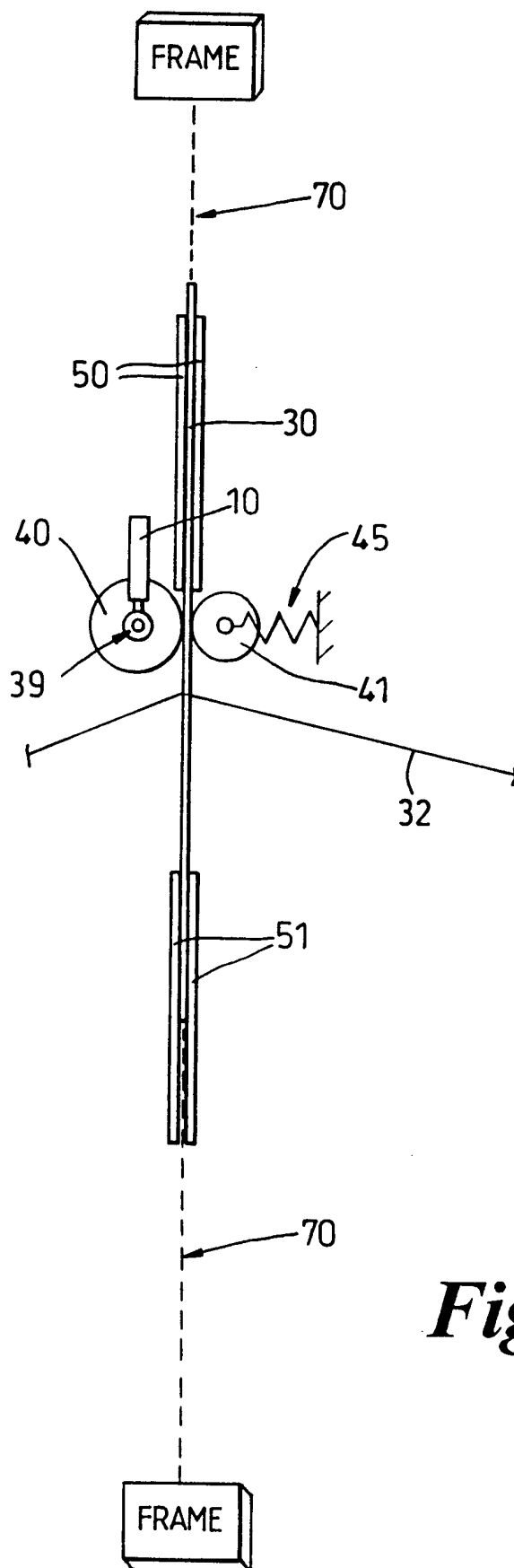


Fig. 4

Fig. 5

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**Fig. 6**

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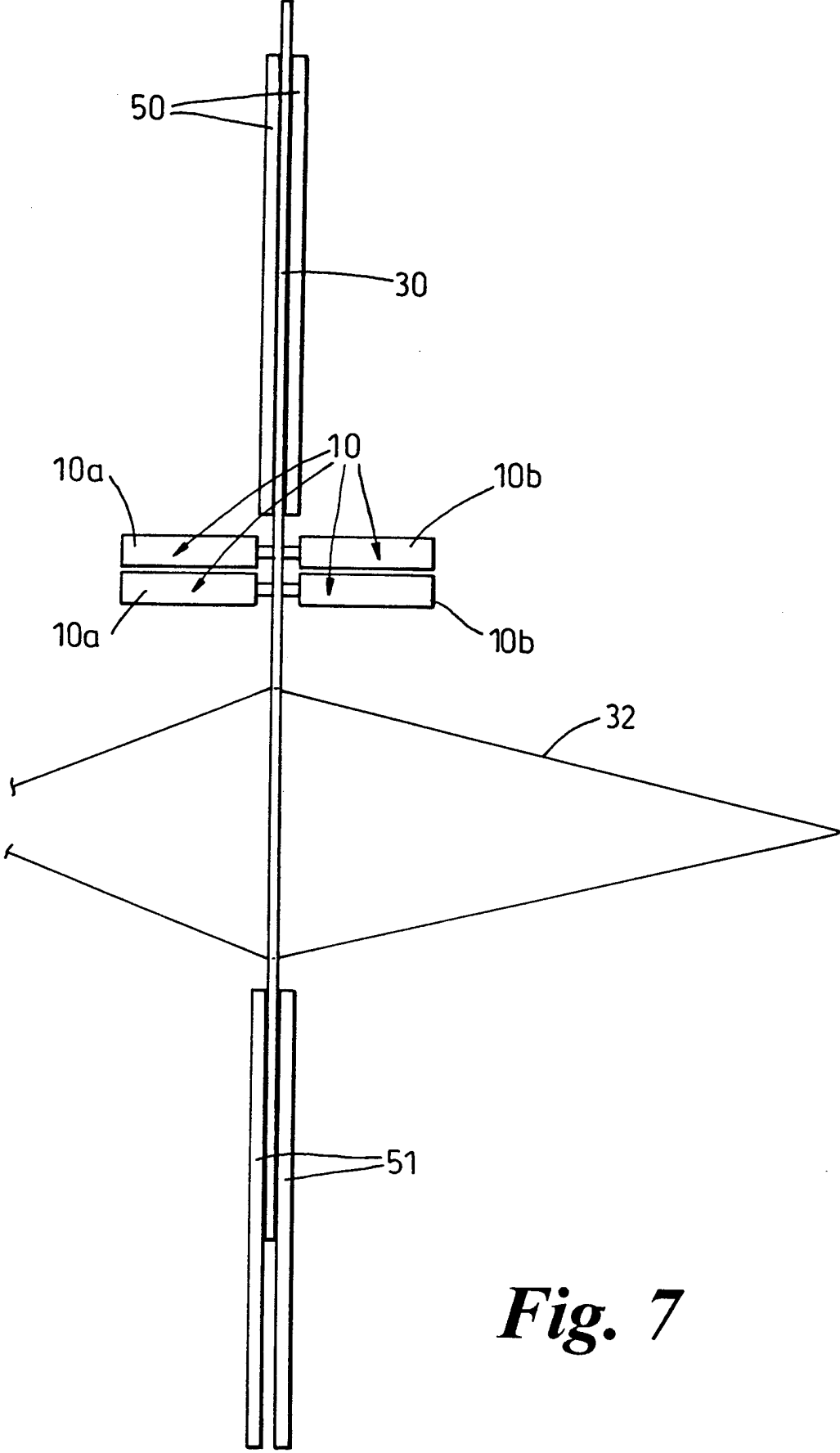


Fig. 7

INTERNATIONAL SEARCH REPORT

International Application No.

PCT/GB 99/03104

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 D03C3/20 D03C13/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 D03C H01L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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