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(54) **Motor-driven chain block.**

(57) A motor-driven chain block (1) has a load sheave (6) supported rotatably between a pair of side plates (2, 3) by a load sheave shaft (6*a*) and has a chain guide (8) for the chain (7) carried on the load sheave (6). The chain guide (8) is supported rotatably on the side plates (2, 3) by short cylindrical support shafts (17, 18) coaxial with the load sheave shaft (6*a*) and is provided with a resilient biasing means for biasing the chain guide (8) to its neutral position. A switching means (23) is arranged to stop the drive motor (4) upon rotation of the chain guide (8) away from its neutral position.

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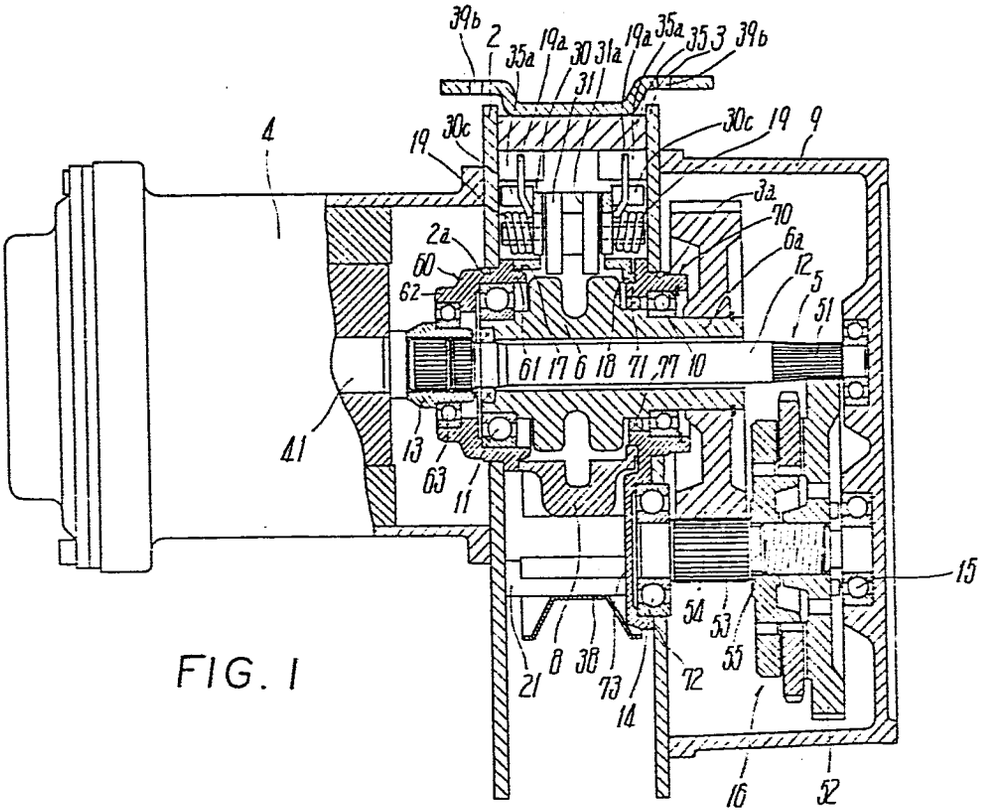
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FIG. 1

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CHAIN BLOCK

This invention relates to a motor-driven chain block, and more particularly to a motor-driven chain block which comprises a chain block body provided with a pair of side plates, a motor and reduction gears in association therewith; a load sheave rotatably supported at the side plates of the chain block body and having a load sheave shaft at the output end of the reduction gears; and a chain guide having a chain guide passage for restraining a chain carried on the load sheave against floating.

Generally, this kind of motor-driven chain block is provided with a chain guide fixed to side plates; a controller having a constriction passage adapted for permitting the chain to pass therethrough only in its correct attitude, disposed below a chain guide passage of the chain guide, and supported so as to be vertically movable on a mounting frame provided across the side plates; and a spring interposed between the controller and the chain guide so as to normally bias the controller downwardly. The controller, when struck by a stop member at one end of the chain or by a twisted chain portion, is actuated to depress and turn off a limit switch through a limit lever so as to stop an electric motor used to drive the chain.

In this type of construction, the vertical disposition of the chain guide and controller results into a relatively large vertical external extent of the chain block and in turn a substantial separation between a suspension point of the chain block body and the lifting hook at the chain end when this is in its upper limit position, thereby creating the problem in that the effective load lifting distance is limited. In addition a controller mounting frame and a push-down spring are required to operate the limit switch with the result that the chain block is made up of an increased number of parts. Also, in a case where the chain, when operated, brings with it into the chain guide

a foreign object, such as mud, or enters the chain guide in a seized condition of the chain links caused by lack of lubricating oil from frictional heating, the limit switch does not operate at all thereby resulting in damage of the chain guide by the chain.

It is an object of the present invention to avoid or minimize one or more of the above disadvantages.

The present invention provides a motor-driven chain block comprising a chain block body having a pair of side plates, a load sheave journalled on said side plates and having a load sheave shaft drivingly connected to a motor and a chain guide having a chain guide passage formed and arranged to restrain a chain carried on said load sheave against floating up characterised in that said side plates each having a short generally cylindrical support shaft means coaxial with said load sheave shaft, said chain guide being rotatably supported on said support shaft means and being provided with a resilient biasing means formed and arranged for biasing said chain guide to a neutral position thereof, and said chain block body being provided with a switch means formed and arranged for operation so as to stop said motor upon rotation of said chain guide from the neutral position.

Thus with a chain block of the present invention there is no need to dispose the controller below the chain guide as in a conventional chain block. The separation between the suspension point and load hook position at its upper limit are kept to a minimum whereby the effective lifting range of the load hook is maximised. When the chain guide is struck by a chain stop member at an end of the chain upon completion of lifting or lowering with the chain block, the guide rotates to actuate the switch means and stop the motor, and also even when a foreign object, such as mud, enters together with the chain into the chain guide or the chain links enter the guide in a seized condition, the guide can rotate reliably to actuate the switch means to stop the motor,

thereby preventing a breakdown of chain guide or burning out of the motor.

Moreover, the chain guide is rotatable with respect to the tubular support shaft without any significant play relative thereto, thereby ensuring operation of switching means and in turn halting of the motor.

Further preferred features and advantages of the invention will appear from the following detailed description given by way of examples of two preferred embodiments illustrated with reference to the accompanying drawings in which:

Fig. 1 is a partially sectioned elevation of a first motor-driven chain block of the invention;

Fig. 2 is a transverse sectional elevation of the chain block of Fig. 1;

Fig. 3 is a detail bottom view on an enlarged scale showing the chain guide construction passage means of the chain block of Fig. 1;

Fig. 4 is a detail side view of a support member for a guide roller in the chain block of Fig. 1;

Fig. 5 is a front elevation of the support member of Fig. 4;

Fig. 6 is a front elevation on an enlarged scale of a hanger for a chain receiving bag of the chain block of Fig. 1;

Fig. 7 is a detail side elevation of the opposite side to that of Fig. 2 showing a bearing housing of the reduction gear; and

Fig. 8 is a corresponding view of an alternative support member to that of Fig. 4.

The motor-driven chain block of Fig. 1 comprises essentially a chain block body 1 provided with a pair of opposed side plates 2 and 3 at a predetermined spacing, an electric motor 4 outside one side-plate 2, and a reduction gear mechanism 5 outside the other side plate 3 and associated with the motor 4. A load sheave 6 is journalled to the side plates 2 and 3 and has a load

sheave shaft 6a connected to the output end of the reduction gear mechanism 5. A chain guide 8 has a chain guide passage 81 (see Fig. 2) for restricting floating-up of a chain 7 carried on the load sheave 6.

A means for transmitting a driving force from the motor 4 to the load sheave 6 is so constructed that an input shaft 12 extends through the load sheave 6 and is supported rotatably on the side plates 2 and 3 and a gear cover 9 covering the reduction gears 5 via bearings 10 and 11. An output shaft 41 of the motor 4 is disposed in series with the input shaft 12 and abuts at one end against one end of input shaft 12, and a transmission cylinder 13 is provided at the abutment of input and output shafts 12 and 41 to drivingly connect them, so that rotation of the output shaft 41 is transmitted to the load sheave 6 through the reduction gear mechanism 5.

The reduction gear mechanism 5 comprises a first gear 51 fixed to the outer periphery of input shaft 12, a second gear 52 and a third gear 53 which are supported to an intermediate shaft 55, and a fourth gear 54 supported to the load sheave shaft 6a, the intermediate shaft 55 being supported rotatably between the side plate 3 and the gear cover 9 through bearings 14 and 15 respectively, the second gear 52 engaging with the first gear 51 and the third gear 53 with the fourth gear 54. Also, the second gear 52 screwthreadedly engages the intermediate shaft 55 so as to be movable axially thereof. A mechanical brake 16 for the second gear 52 is interposed between the second and third gears 52 and 53.

The above described chain block is provided, at the side plates 2 and 3, with short cylindrical support shafts 17 and 18 coaxial with the load sheave shaft 6a. The chain guide 8 is rotatably supported on the support shafts 17 and 18. A resilient biasing means 19 is provided for biasing the chain guide 8 into its neutral position. The chain block body 1 is also provided with a switching

means 20 formed and arranged to be actuated by rotation of the chain guide 8 from its neutral position, so as to stop the motor 4.

The chain guide 8 is round in its upper half and rectangular in its lower half when viewed from the front as in Fig. 2. The support shaft 17 and 18 are mounted in through bores 80 in respective sides of chain guide 8. A chain guide passage 81 is provided in the chain guide 8 and extends from both widthwise ends of the lower surface of chain guide 8 and communicates with the through bores 80 to guide the chain for movement along a generally inverted-U-shape path.

The chain guide passage 81, as shown in Fig. 3, is provided at its open side with chain guide passage constrictions 82 and 83 which are generally cruciform in section and through which the chain 7 passes when in its proper, extended, attitude but is otherwise restrained. The constriction 82 guides the chain section bearing at its lower end a load hook whilst the other constriction 83 guides the section extending from chain receiving bag.

Also, the chain guide 8, as shown in Fig. 2, is provided at one side wall with a guide roller support aperture 84 in which a guide roller 31 is mounted. A support member 30 rotatably supports the guide roller 31 therein so as to extend into the chain guide passage 81 and is mounted detachably on the one side of the chain guide 8 and supports the resilient biasing means 19. An elongate recess 85 is provided at the upper portion of the other side wall of the chain guide 8 and a stopper 86 mounted across the side plates 2 and 3 is disposed within the recess 85 for cooperation therewith to limit the range of rotational movement of the chain guide 8.

The support member 30, as shown in Figs. 4 and 5, is generally frame-form and the guide roller 31 has a circumferential chain-guiding groove 31a and is supported rotatably between a pair of opposed side walls 30a of the support member 30 via a shaft 32. The side walls 30a are

each provided on their outside surface with a cylindrical projection 30b and a further projection 30c spaced therefrom and projecting laterally thereof. The guide roller 31 is inserted into the support aperture 84 of the chain guide 8 and then the support member 30 is mounted detachably on the chain guide 8 with the aid of bolts 33 so that the chain 7 is guided by the guide groove 31a of the guide roller 31.

The biasing means 19 is conveniently in the form of coil springs 19a each comprising a coil of resilient wire rod with both ends extending radially outwardly of the coil in the same direction. A retaining member 35 has projections 35a facing the projections 30c and for keeping the chain guide 8 in its neutral position and is mounted detachably on the side plates 2 and 3 by means of bolts 36 and 37.

The springs 19a are, as shown in Fig. 4, fitted at their coiled portions onto the respective cylindrical projection 30b of the support member 30 with both ends against opposite sides of the further projection 30c and the retaining projection 35a in such a manner that the coil ends clamp the vertical opposite sides of the cylindrical and retaining projections 30c, 35a therebetween so as to bias the chain guide 8 normally into its neutral position.

The chain guide 8 is provided with a switching means 20 which detects a predetermined rotation of the chain guide 8, for example through an angle of 8° or more from the neutral position and then stops the motor 4. The switching means 20, as shown in Fig. 3, comprises a rack 21 provided in the lower portion of the chain guide 8, a pinion 22 engageable with the rack 21, and a limit switch 23 connected to the pinion 22 through an operating lever 24. The limit switch 23 is of a rotary type and employs first and second single-throw double-pole switches so that when the chain guide 8 is in its neutral position as shown in Fig. 2, both the switches are kept on; when it rotates through predetermined angle in the clockwise direction as

viewed in Fig. 2, the first switch only is switched off by the operating lever 24; and when it rotates through said predetermined angle counterclockwise only the second switch is switched off.

Incidentally, the first and second switches are not shown in the drawings but the first switch and lifting contact are connected to two lines of the three-phase three-wire system power source whilst the second switch and lowering contact are connected to a different two line combination thereof.

Also, the holding member 35 has a mounting portion 35b for a cover 38 covering above the outer periphery of load sheave 6 and a support portion 35c for a hanger 39 supporting the chain receiving bag 27.

In more detail, the cover mounting portion 35b is formed of a projection cranked inwardly from the upper portion of retaining member 35 in a stepped manner and having a threaded bore 35d, so that the cover 38 contacts at one end with the outside of mounting portion 35b and a clamping screw 40 screwthreadedly engages the threaded bore 40 for securing one side edge of said cover 38. The cover 38 has at its other side edge a rolled portion 38a which is fixedly fitted onto one connecting rod 25 of the side plates 2 and 3 at the opposite side from the holding member 35, thereby covering the whole of the chain guide 8.

The retaining portion 35c of the hanger 39 is provided at an intermediate portion with a threaded bore 35e and the hanger 39 contacts the outside of the retaining portion 35c and a clamping screw 26 engages the threaded bore 35e, to support the hanger 39.

The hanger 39, as shown in Fig. 6, is provided at an upper portion with an insertion bore 39a for the clamping screw 26 and at both lengthwise ends with generally L-shaped open upwardly support bores 39b which retain two suspension members 28, such as chains, attached to one end of the upper side of the chain receiving bag 27, two

further suspension members 28 being attached to the other end of upper side of chain receiving bag 27, being suspended from the lower ends of side plates 2 and 3 on supports 29, so as to hang the bag 27 below the side plates 2 and 3. Thus, the holding member 35 is used both to mount the cover 38 and to support the chain receiving bag 27, thereby making the chain block relatively simple in construction and easy to assemble.

In the first embodiment shown in the drawings, the support shaft 17 and 18 are integral with cylindrical bearing housings 60 and 70 having at their inner peripheries the bearings 11 and 12 for the load sheave 6 respectively, in other words, the housings 60 and 70 are fitted and fixed into through bores 2a and 3a in the side plates 2 and 3 and project at their inner ends 61,71 inwardly of the side plates 2 and 3.so that the support shafts 17 and 18 are integral with said projecting inner ends 61 and 71.

One bearing housing 60 projects at one axial end outwardly from the side plate 2 to form a projection 62 so that the bearing 63 is disposed at the inner surface of the projection 62 and serves also to support the input shaft 12, and the other bearing housing 70, as shown in Fig. 7, is provided at the outer periphery integrally with an abutting portion 72 against the side plate 3, the abutting portion 72 being provided integrally with a cylindrical bottom support portion 73 for supporting the bearing 14 of the intermediate shaft 55 and with a mounting portion 74 for the stopper pin 86 to restrict the range of angular movement of the chain guide 8.

Thus the bearing housings 60 and 70 together support the chain guide 8 and bearings 10,11,63 and 14, thereby enabling the load sheave 6, chain guide 8, input shaft 41 and intermediate shaft 55 to maintain proper concentricity.

In addition, the housing 70 is provided with mounting bores 75 for fixing thereof to the side plate 3

with the aid of set screws 76, and an oil seal 77 for preventing leakage of lubricating oil to the exterior from the gear box.

In the abovedescribed chain block, when the chain 7 is smoothly guided through the guide bore 81 in normal operation for lifting or lowering the chain by forward or reverse rotation of the motor, the chain guide 8 is subjected to no torque and maintained in its neutral position.

However, in an abnormal case where a foreign object, such as mud, attached to the chain enters the chain guide 8 and subjects the chain to a resistance against movement in excess of a predetermined value, the chain guide 8 rotates clockwise or counterclockwise corresponding to either chain lifting or lowering without play with respect to the support shafts 17 and 18 at the bearing housings 60 and 70 so that the switching means 20 actuates the first or second switch to stop the motor 4, thus reliably preventing a breakdown of chain guide 8 or burning out of the motor 4. Also, in another abnormal case where the adjacent links of the chain 7 enter the chain guide passage 81 in a seized condition caused by lack of lubricating oil from frictional heat generation or by rusting, the chain guide 8 is subjected to a rotational force and the limit switch 23 actuated immediately to stop the motor 4. In brief, the chain guide 8, when the chain 7 travelling into the guide bore 81 is subjected to a resistance against its normal operation, is rotated by a rotational force resulting from the resistance and actuates the limit switch 23 immediately to stop the motor 4.

Incidentally, when the chain 7 during the normal operation is lifted and the stop member above the lower hook abuts against the edge of chain guide bore 81 at the lower surface of chain guide 8, the chain guide 8 rotates clockwise in Fig. 2 to turn off the first switch at the limit switch 23, thereby stopping the motor 4 and

the lifting operation of chain block.

On the contrary, when the chain 7 is lowered, the stop member thereof in the chain accommodating bag 27 comes out therefrom to abut against the edge of guide bore 81 so that the chain guide 8 rotates counterclockwise to turn off the second switch to thereby stop the motor 4 and the lifting operation of chain block.

If the biasing spring 19a should be broken, it can be renewed by first removing the mounting bolts 36 and 37 from the side plates 2 and 3 to take out the retaining member 35 therefrom and unscrewing the fixing bolts 33 by use of a space between the side plates 2 and 3 to remove the support member 30 from the chain guide 8 to the exterior. Thus, the broken spring 19a is renewable readily without dismantling of the whole chain block. At the same time, the guide roller 31 can be inspected or renewed.

In addition, in the above embodiment, the projections 30b at the side walls 30a of the support member 30 are formed of projecting bearing portions for the guide roller 31, but may alternatively be formed separately from the bearing portion as shown in Fig. 8. In this case, when each projection 30b is provided outside the side wall 30a, that is, at the retaining member 35 side, each projection 30b and each spring 19a need not be inserted into the insertion bore 84 of the chain guide 8, thereby enabling the insertion bore 84 to be made smaller to result in that the support member 30 is mountable to a small-sized chain block of small chain guide.

Also, the switching means 20 is not limited to that described above and various means may be used to detect excessive rotation of the chain guide 8 and actuate the limit switch 23.

In addition, in the above description, the motor 4 is provided laterally of the load sheave 6, but could of course be disposed above it.

As may be seen from the above in the abovedescribed

chain block of the invention there is no need to dispose any part, such as the controller, below the chain guide so that the spacing between the chain block suspension point and the load hook at its upper limit position can be kept as small as possible and the lifting range of the loading hook kept as large as possible. Also, the switching means reliably operates by rotation of the chain guide to stop the motor at the finish of lifting or lowering the chain, and even when a foreign object, such as mud, enters the chain guide or adjacent chain links in a seized condition enter it, the chain guide rotates and actuates the switching means to stop the motor, thereby preventing breakdown of the chain guide or burning out of the motor.

Moreover, since the chain guide can rotate without play relative to the cylindrical support shafts, the switching means is reliably actuated to stop the motor.

Claims:

1. A motor-driven chain block comprising a chain block body (1) having a pair of side plates (2,3) a load sheave (6) journalled on said side plates (2,3) and having a load sheave shaft (6a) drivingly connected to a motor (4) and a chain guide (8) having a chain guide passage (81) formed and arranged to restrain a chain (7) carried on said load sheave (6) against floating up characterised by said side plates (2,3) each having a short generally cylindrical support shaft means (17,18) coaxial with said load sheave shaft (6a), said chain guide (8) being rotatably supported on said support shaft means (17,18) and being provided with a resilient biasing means formed and arranged for biasing said chain guide (8) to a neutral position thereof, and said chain block body (1) being provided with a switch means (23) formed and arranged for operation so as to stop said motor (4) upon rotation of said chain guide (8) from the neutral position.

2. A chain block according to claim 1, wherein is provided between said side plates (2,3) of said chain block body (1) a retaining member (35) engageable with said resilient biasing means (19) so that said biasing means (19) holds said chain guide (8) in its neutral position.

3. A chain block according to claim 1 or claim 2, wherein said chain block body (1) is provided with a cover (38) for covering the outside of said chain guide (8) and a chain accommodating bag (27) which accommodates the free end of said chain (7) carried on said load sheave (6) and has support members (28) for hanging said chain accommodating bag (27) from said chain block body (1), said retaining member (35) having a mounting portion for said cover (38) and a support portion (39) for said hanging members (28).

4. A chain block according to any one of claims 1 to 3 wherein said chain guide (8) is provided with a support member (30) which rotatably supports a guide roller (31) which projects into said chain guide passage (81), said support member (30) supporting said resilient biasing means (19) and being detachably mounted with respect to said chain guide (8).

5. A chain block according to any one of claims 1 to 4, wherein each of said side plates (2,3) is provided with a bearing housing (60,70) supporting said load sheave (6), said bearing housings (60,70) projecting at their inner ends (61,71) inwardly of said side plates (2,3) and towards each other, said projecting portions (61,71) providing said support shaft means (17,18) for supporting said chain guide (8).

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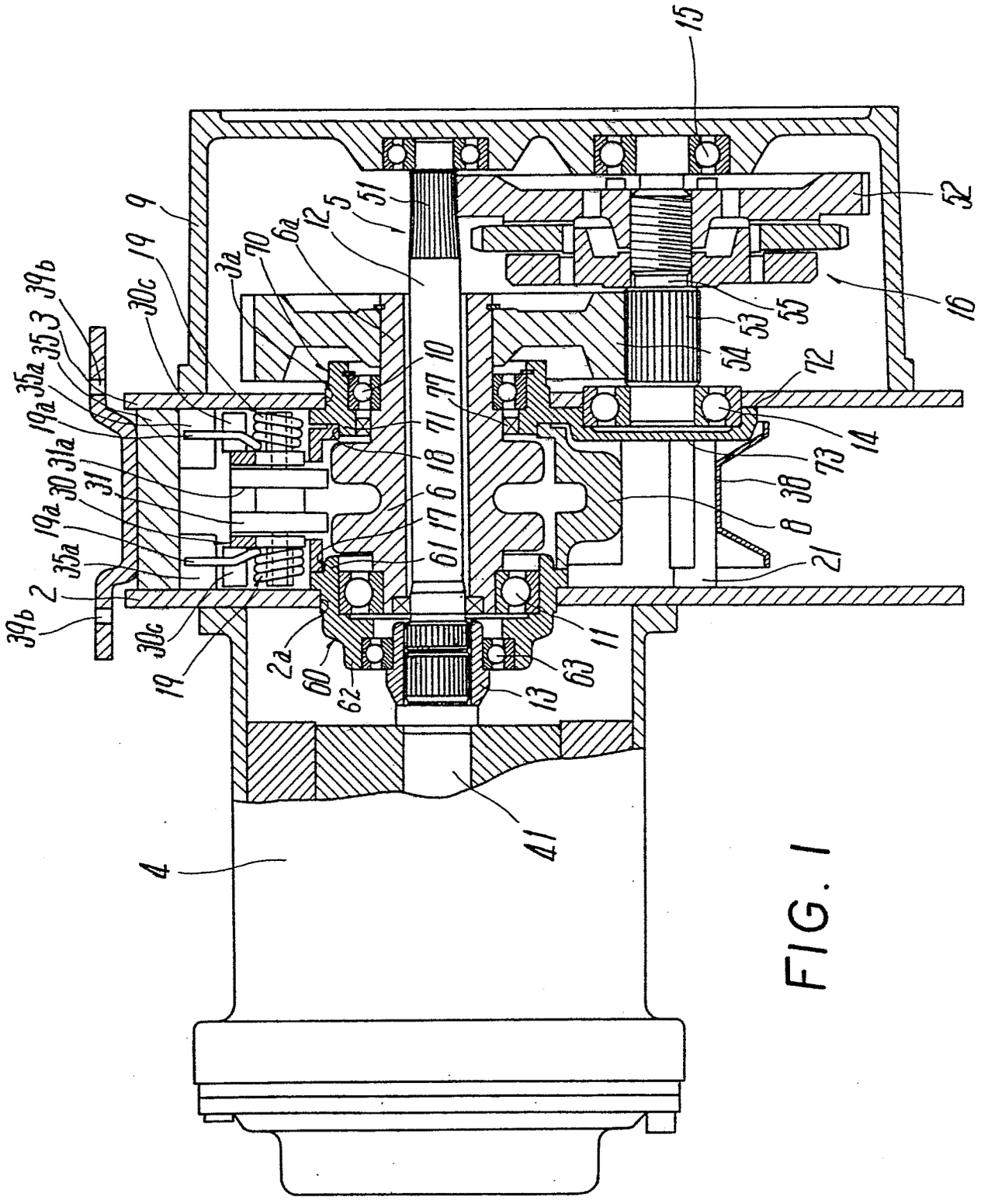

FIG. 1

FIG. 2

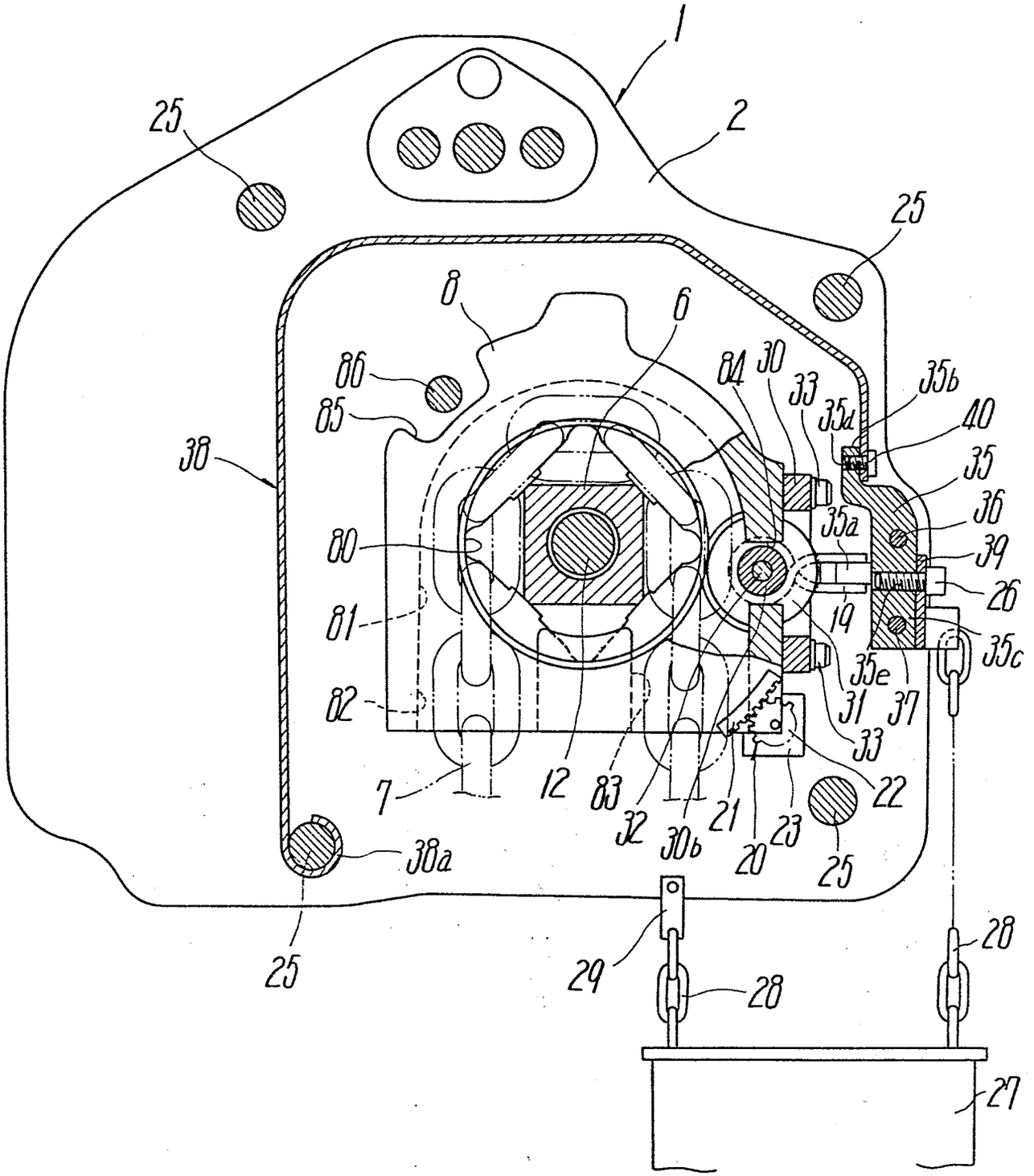
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FIG. 3

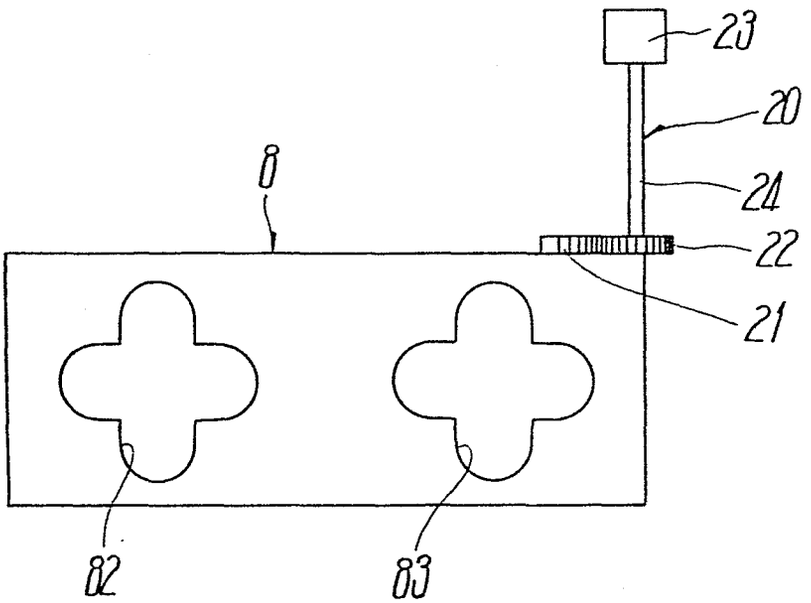


FIG. 4

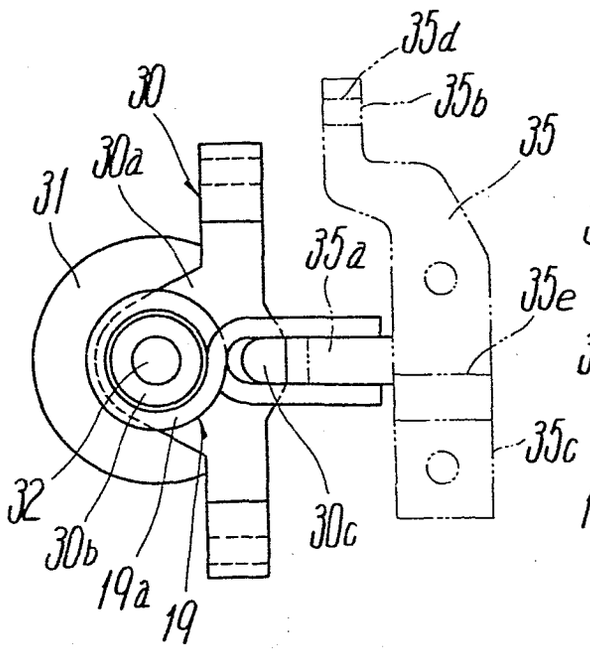


FIG. 5

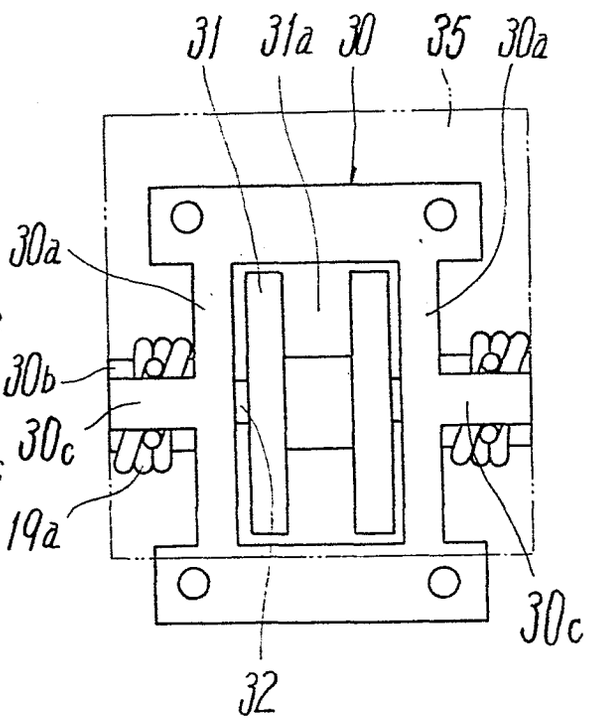


FIG. 6

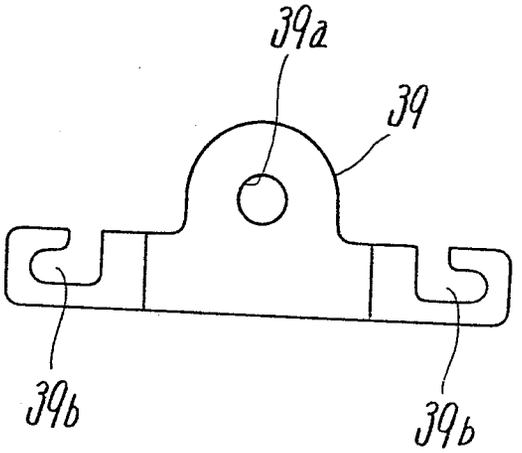


FIG. 8

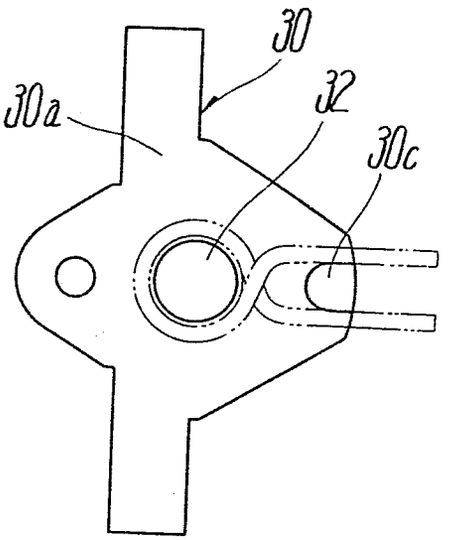
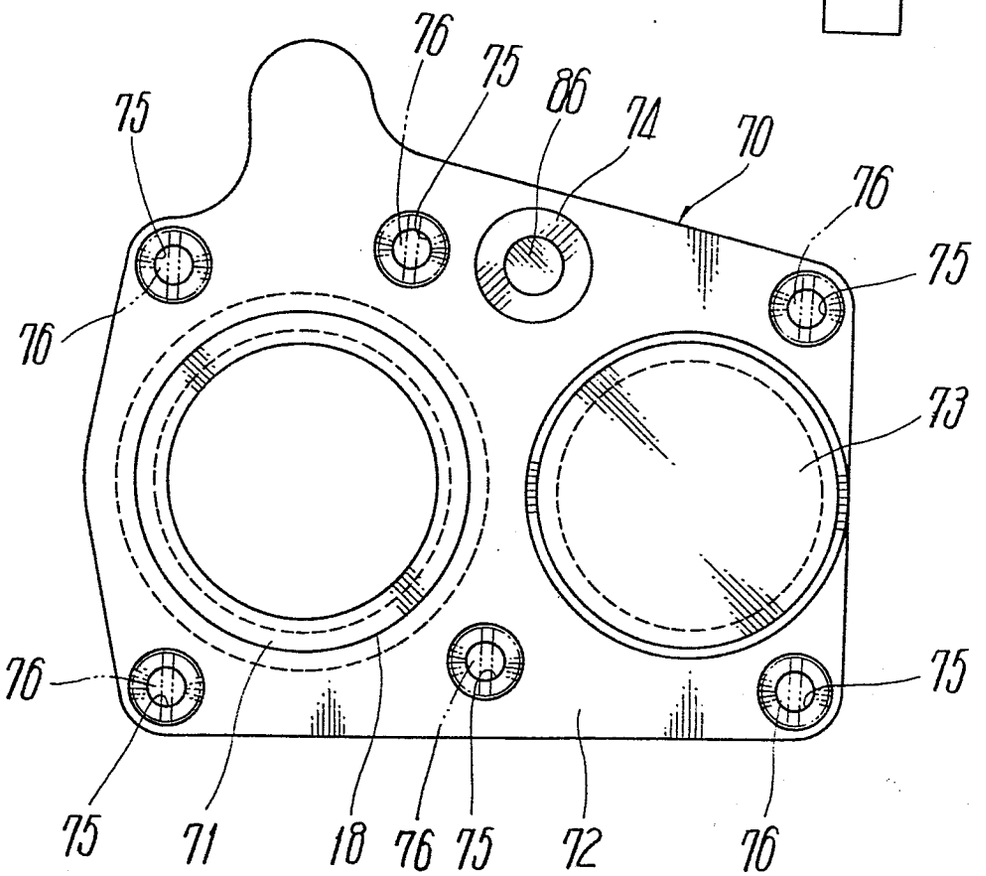


FIG. 7



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EUROPEAN SEARCH REPORT

0118302
Application number

EP 84 30 1420

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
X	GB-A- 681 723 (KULTNER) * Page 2, lines 5-98 *	1	B 66 D 3/26
A		2	
A	US-A-3 596 879 (CLARK) * Column 3, lines 8-24 *	1	
A	GB-A-2 022 049 (HITACHI) * Page 1, lines 113-121; figures 4,5 *	1,4,5	
A	US-A-4 043 538 (SCHREYER) * Column 2, lines 30-43 *	3	
A	US-A-2 529 084 (KING)		TECHNICAL FIELDS SEARCHED (Int. Cl. ³) B 66 D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	23-05-1984	KERSHAW K.

CATEGORY OF CITED DOCUMENTS

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