1

NASA TECHNICAL MEMORANDUM NASA TM-75581

PIVOTING OUTPUT UNIT CONTROL SYSTEMS ACTIVATED BY JACKS

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Translation of "Dispositifs de commande a organes de sortie pivottants entraines a partir de verins," Patent Application No. 76 06636, French Patent Office, Paris, France, Filing Date March 9, 1976, Disclosure Date October 7, 1977

10 pp.

(NASA-TM-75581) PIVOTING OUTPUT UNIT CONTROL SYSTEMS ACTIVATED BY JACKS (National Aeronautics and Space Administration) 13 p HC A02/MF A01 CSCL 01C

N79-10066

Unclas
G3/08 33888

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546 OCTOBER 1978

PIVOTING OUTPUT UNIT CONTROL SYSTEMS ACTIVATED BY JACKS

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The invention concerns control systems with two coaxial output /1* units which pivot simultaneously with respect to two fixed units and are activated by two opposed, straight coaxial jacks. These systems can especially be used for controlling aircraft flaps.

Such devices are already known in which the receptor unit of each of the two jacks is angularly connected, on the one hand to the matching fixed unit by a first group of slides and, on the other, to the matching pivoting unit by a second group of slides set at an angle with respect to the slides of the first group.

In a system of this type, the fixed unit and the pivoting units are arranged alternately in succession and are positioned in the axial direction, with respect to one another, by the transverse bearing surfaces, while the receptor units of the two jacks are located inside the said fixed and pivoting units. From this general arrangement it follows that the existence offered by the pivoting units gives rise to axial reactions which must be absorbed by the transverse bearing surfaces mentioned above, which obviously is expressed by a loss in efficiency for the control system. Moreover, this system can be criticized for lacking rigidity and for being relatively complicated and difficult to manufacture.

The purpose of the invention is to make a control system of the type in question which does not present the above mentioned drawbacks of the known system which has just been described.

To this end, in the system as per the invention, the two fixed units are rigidly attached to the two ends of a fixed longitudinal

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*Numbers in the margin indicate pagination in the foreign text.

piece, and the two pivoting units are rigidly attached to the two ends of a pivoting longitudinal piece, the pivoting longitudinal piece and the fixed longitudinal piece being coaxially mounted, one inside the other, and each extending over the entire length of the system, while the receptor units of the two jacks are located between the fixed longitudinal piece and the pivoting longitudinal piece. Thanks to this particular design, the opposed axial reactions produced by the two pivoting units mutually cancel each other out and internal forces produced in the interior of one and the same /2 piece remain, namely the longitudinal piece to which the two pivoting units are rigidly attached, such that the set of pivoting pieces is not subjected to an axial stress with respect to the set of fixed pieces. On the contrary, it can be considered as in a floating mount in the axial direction and, as a result, positioned axially without entailing stresses, i.e. without a loss of efficiency. Such a solution results in a very rigid and simply constructed unit.

The invention will be better understood by reading the description below and by examining the attached drawings which show, by way of example, a method of making a control system as per the invention.

With regard to these drawings:

Figure 1 is a sectional view of the entire system. In the left half of the drawing this section was made evidently along line IG-IG of figure 4 and, in the right hand of the drawing, evidently along line ID-ID.

Figure 2 is plan-view of figure 1.

Figure 3 is a profile view seen from the direction indicated by arrow III in figure 1.

Figures 4, 5 and 6 are cross-sectional views along lines IV-IV, V-V and VI-VI respectively of figure 1.

The aircraft flap control system shown in its entirety in figure 1-3 basically consists of a tube-shaped fixed unit (1) inside of which a pivoting unit (2) is coaxially mounted. The system is practically symmetrical with respect to a median transverse plane passing through line VI-VI of figure 1.

The fixed assembly (1) consists of a tubular body (5) on the two ends of which are attached two fixed units respectively [6]. Each of these two fixed units is designed to be rigidly attached to the structure of the wing of the aircraft and, for this purpose, it has a fork (11) through the branches of which pass two axles (12, 13), the latter holding one end of a small connecting rod (14), the other end of which has a borehole (15) capable of receiving a pin mounted in a corresponding fork (not shown) rigidly attached to the structure of the wing of the aircraft. The body (5) also has tapped attachment holes (16) (also see figure 6).

The pivoting assembly (2) includes a pivoting longitudinal piece /3 (21) on the two ends of which are respectively attached two pivoting units (22) each pivoting unit (22) consists of a hub (23) attached to the corresponding edge of the pivoting longitudinal piece (21) and an arm (24) designed to receive a corresponding part of a flap of the aircraft. Each of the two hubs (23) is centered in the corresponding fixed unit (6) by a roller bearing (27).

The pivoting movements of assembly (2) are ensured by two coaxially opposed straight-line hydraulic jacks (29) the cylinders of which are annular. The outside wall of these cylinders consists of the fixed body (5) itself and the inside wall of a tubular piece (31), the head common to the cylinders of the two jacks being indicated by (32). The piston (33) of each jack is of corresponding annular shape and is rigidly attached to a tubular piston rod (34) which slides tightly in an annular space left between two pieces (35, 36) both of which constitute the corresponding outside cylinder head of each jack.

The receptor unit of each of the two jacks consists of an assembly of the two carriages (41) each of which are connected angularly, on the one hand, to the corresponding fixed unit (6) by a first group of double slides (42, 43) (also see figure 4) provided with bearing balls and, on the other hand, to hub (23) of the corresponding pivoting unit (22) by a second group of simple slides (46, 47) provided with bearing balls (48). The direction of the slides of the second group is at an angle with respect to the direction of the slides of the first group. In more precise terms, each piston rod (34) is thus rigidly attached to two diametrically opposed carriages (41) basically formed by two tongues located in a diametric plane on a tubular slide (51) (figure 4) housed between the borehole of the fixed body (5) and the external cylindrical surface of the hub (24). The slides of the first group (42, 43) are thus straight-line slides, while the slides (46, 47) of the second group are helical slides, such that a longitudinal translatory movement of slides (51) rigidly attached to the piston rods of the two jacks produces a pivoting movement of hubs (23) of the two pivoting units (22) in one direction or another depending on the direction of /4
movement of the slides.

Each assembly of slides (42, 43) involves a recycling circuit (54) of balls (44) housed in the corresponding fixed unit (6) and located in a geometric plane close to a plane parallel to the median longitudinal geometric plane common to the two tongues (41) of the slide. Similarly, each group of slides (46, 47) includes a recycling circuit (56) of balls (48) housed in the corresponding carriage (41) opposite each row of balls of the slides in the plane of the two tongues (41) of the slide-block.

Although the entire system is always balanced in the axial direction, because of the symmetry with respect to the median transverse plane VI-VI and, as a result, because of the fact that the helical slides are pitched counter to the two ends of the system, the pivoting assembly should be positioned axially with respect to the fixed assembly. To this end, a thrust roller bearing (57) (figure 1) is placed between the inside end of each of the two pivoting hubs (23) and the outside surface of the corresponding cylinder head (35). For safety reasons, each pivoting arm (24) has an annular cheeck (59) which can bear against the outside end face of the corresponding fixed unit (6).

Figure 6 shows how the common cylinder head (32) is rigidly attached to the body (5) by means of two pins (61) inserted into holes (62, 63) made in the body and in the cylinder head in a direction perpendicular to the longitudinal axis of the entire system.

The inside part (35) (figures 1 and 5) of each cylinder head end is attached to the corresponding end of the inside wall of the cylinder (31) by means of a screw thread (66), while the outside annular part (36) of the same cylinder head is rigidly attached to the body (5) by four pins (67) inserted in holes (68) (69) made in the body (5) and the annular piece (36) respectively perpendicular to the longitudinal axis of the assembly.

The two pivoting hubs (23) (figure 1) are attracted towards each other, against their respective roller thrust bearing (57), by a tightening system which includes: A central tie-rod (72) one end of which is provided with a head (73) while the other end terminates in a threaded part (74); a spacer ring (75) placed /5 between the shoulder of the longitudinal piece (21) and one of the pivoting hubs (23); another spacer ring (76) which rests against a shoulder of the other pivoting hub (23); a threaded socket (77) mounted on the corresponding threaded end of the longitudinal piece (21) and with internal longitudinal grooves (78); a sleeve (79) which has grooves interlocking with grooves (78) and an end tenon (81) inserted in a matched slot of the end of the longitudinal piece (21) to provide for rotation locking of the threaded socket (77), and finally a nut (82) fitted onto the threaded end (74) of the central tie-rod (72) and equipped with a plate lock (83).

The two hydraulic jacks are double-acting and are provided with a common central orifice (91) made in the body (5) and which opens into the two chambers (92, 93) of the cylinders of the two jacks, as well as two orifices on the ends (95, 96) which open into the opposide ends of the two cylinders respectively. The annular spaces involved, in each jack, between the tubular piston rod (34) and, on the one hand, the outside wall of the cylinder formed by the body (5) and, on the other hand, the interior wall (31) of the cylinder, i.e. the two chambers (97,98) and connected by radial holes (99) made in the piston rod (34) flush with the piston (33).

The system operates as follows: If pressurized fluid is introduced, for example, through the central common orifice (21), the two pistons are caused to move away from each other and carry with them the carriages (41) which, guided by the ball slides (42, 43) of the first group, slide in the fixed assembly (1), without pivoting, with respect to the latter, but which, by means of slides (46, 47) of the second group, cause the interior assembly (2) to pivot in an angle corresponding to the path length of the carriages. During this movement, the fluid contained in the chambers such as (97, 98) of the jacks returns to the reservoir through the orifices in the ends (95, 96).

If the pressurized fluid were introduced through the end orifices (95, 96), while the common central orifices (91) was connected to the reservoir, the pistons would move, by contrast, toward each other and carry with them the carriages (41) which /6
would then cause a pivoting movement of the interior assembly (2) in the opposite direction.

Note that the axial reactions produced by the two pivoting units (22), as a result of the helical slide (46, 47), mutually cancel each other out, since it is in internal forces in the opposite direction which are produced in the interior assembly kept under tension by the central tie-rod (72) and capable of resisting both stretching and compression depending on the pivoting direction, such that no harmful axial pressure is produced between the fixed units and the pivoting units.

Of course, the invention is not limited to the design described and illustrated. It can be modified in many ways, depending on the intended applications, but without thereby going beyond the framework of the invention.

Claims

1. Control system with two coaxial output units pivoting /7
simultaneously with respect to two fixed units and activated by two opposed coaxial straight-line jacks, usable especially for controlling aircraft flaps, in which the receptor unit of each of the two jacks is angularly connected, on the one hand, to the corresponding fixed unit by a first group of slides and, on the other, to the pivoting unit by a second group of slides set at an angle with respect to the slides of the first group, characterized by the fact that the two fixed units (6) are rigidly attached to the two ends of a fixed longitudinal piece (5) and the two pivoting units (22) are rigidly attached to the two ends of a pivoting longitudinal piece (21), the pivoting longitudinal piece and the fixed longitudinal piece being coaxially mounted one inside the other and each extending over the entire length of the system, while the receptor units (41) of the two jacks (29) are arranged between the fixed longitudinal piece (5) and the pivoting longitudinal piece (21).

2. Device according to claim one, characterized by the fact that the two jacks (29) are double-action hydraulic jacks and their annular cylinders (5, 31) arranged end to end have a common median head (32) rigidly attached to the exterior fixed longitudinal piece (5) and two end heads (35, 36) each passed through by a tubular piston rod (34) which is rigidly attached to the piston (33) of the corresponding jack and which constitutes the above mentioned receptor unit angularly connected, by slides (42, 43) and (46, 47) to the fixed longitudinal piece (5) and the pivoting longitudinal piece (21), the

annular spaces (97, 98) included between the cylinder faces opposite each cylinder and the corresponding tubular piston rod (34) being interlinked by radial connection passages (99).

3. Device as per any one of claims 1 or 2, characterized by the fact that the ball-bearing type slides, including, on the one hand, two diametrically opposed longitudinal rows of balls (48) arranged between the cylindrical surface of the interior longitudinal piece (23) and the borehole of a slide-block (51) surrounding the said piece and connected to the corresponding piston rod (34), as well as a recycling circuit (56) of balls housed in the said slide-block opposite each of these two longitudinal rows of balls and, on the other hand, on both sides of each of these two recycling circuits (56), another longitudinal row of balls (54) placed between a face (42) of a longitudinal tongue (41) of the slide-block (51) and a paired longitudinal interior face (43) of the corresponding fixed unit (6), as well as, for each of these four other longitudinal rows of balls, another recycling circuit (54) of balls housed in the said fixed organ in a geometric plane close to a plane parallel to the median longitudinal geometric plane, common to the two tongues (41) of the slide-block (51).

PL-I-3

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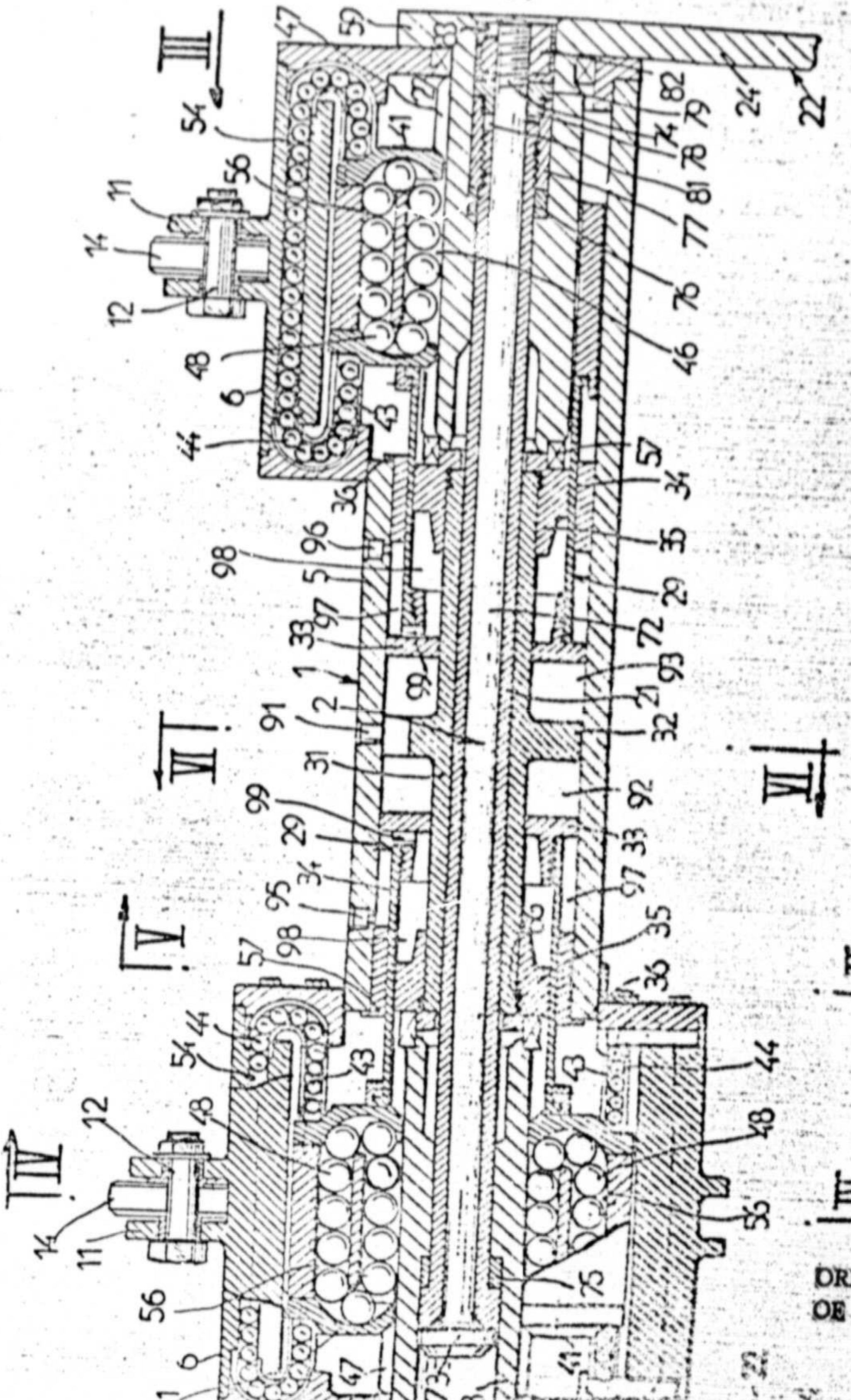

FIG.1

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PL II-3

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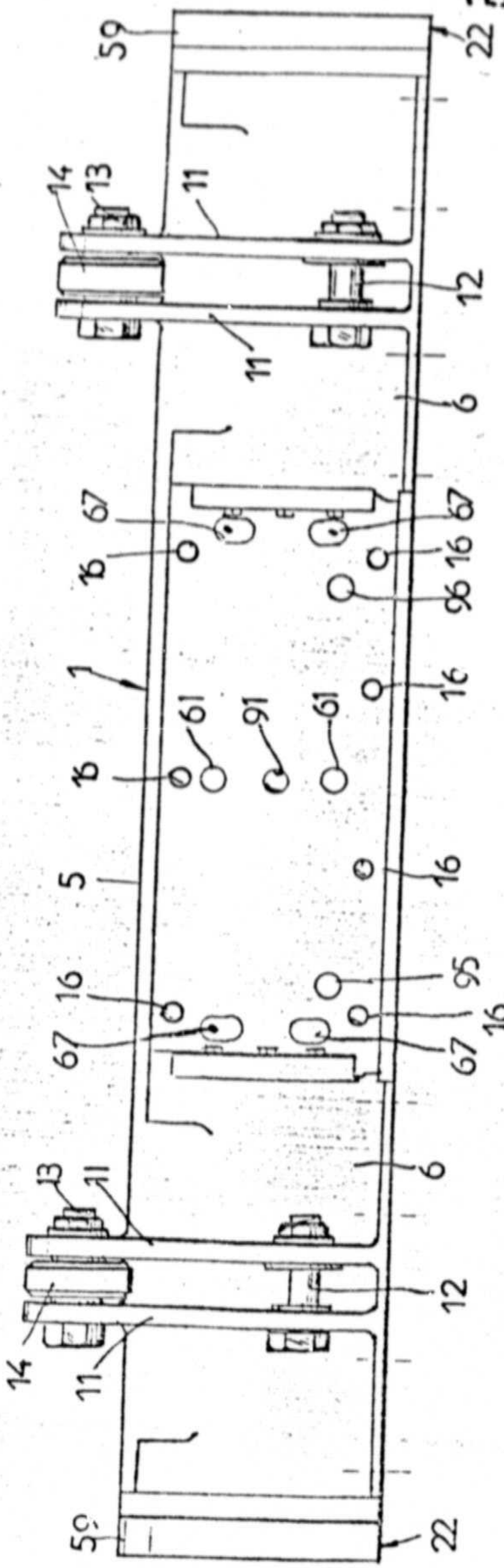

FIG.2

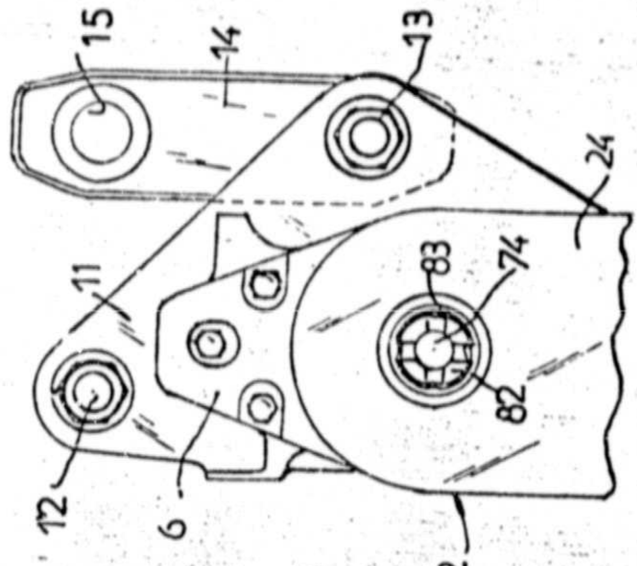

FIG.3

PH.III-3

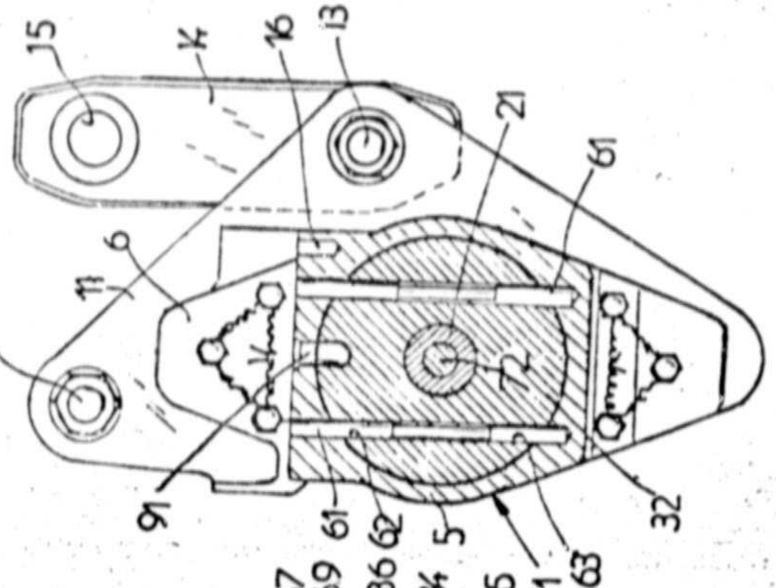

FIG.6

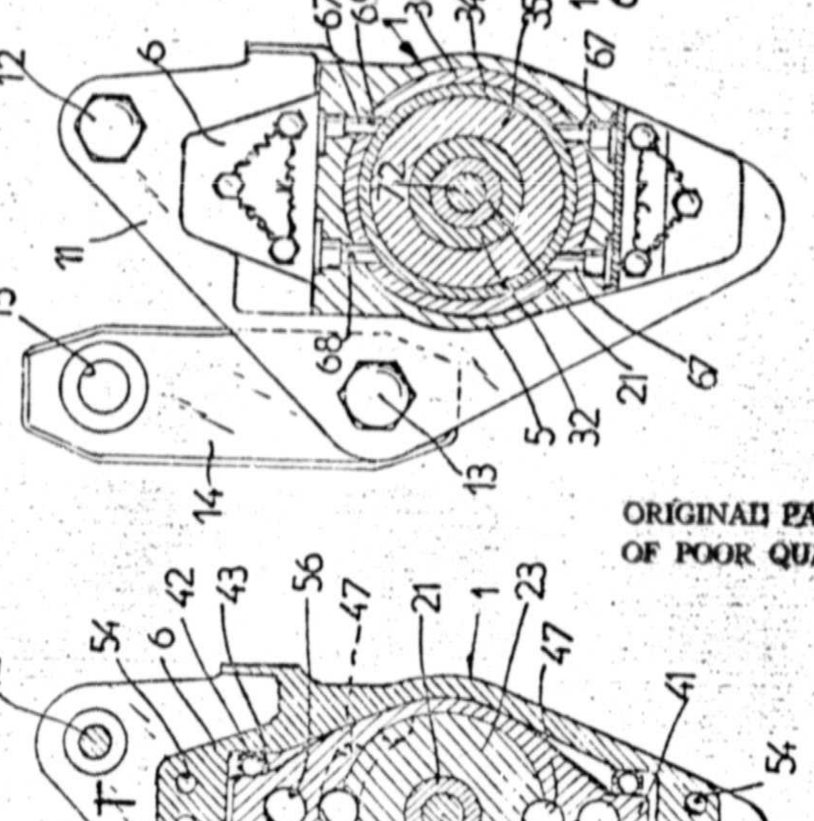

FIG.5

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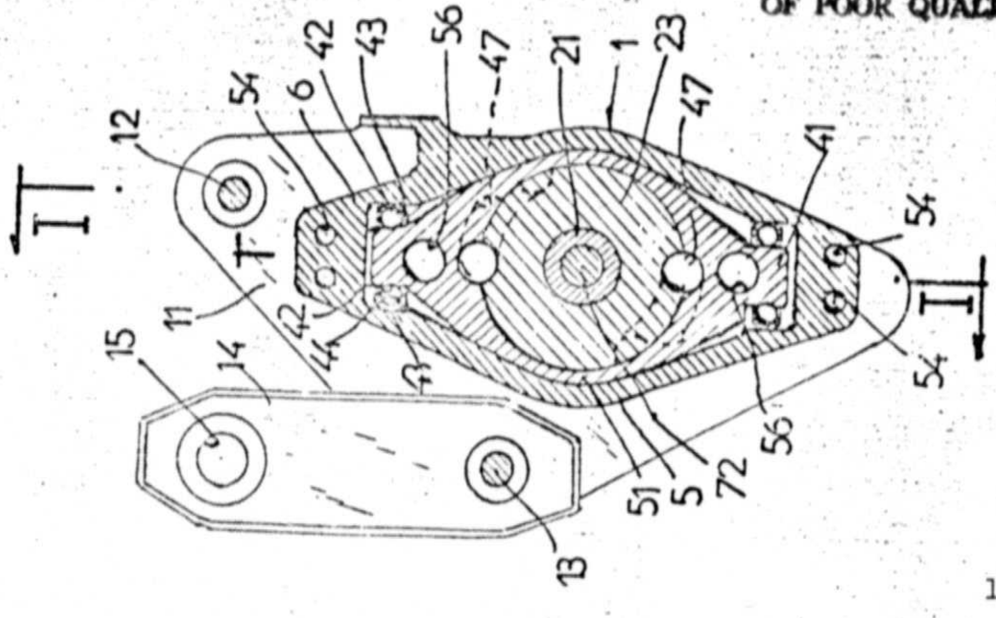

FIG. 4