March 31, 1959 L. J-M GAMET 2,880,009

LEVER ACTUATED MACHINE-TOOL CHUCK

Filed June 4, 1956 2 Sheets-Sheet 1

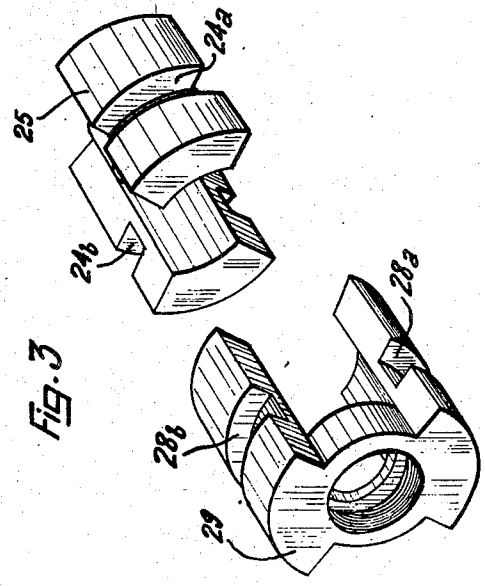


Fig. 3

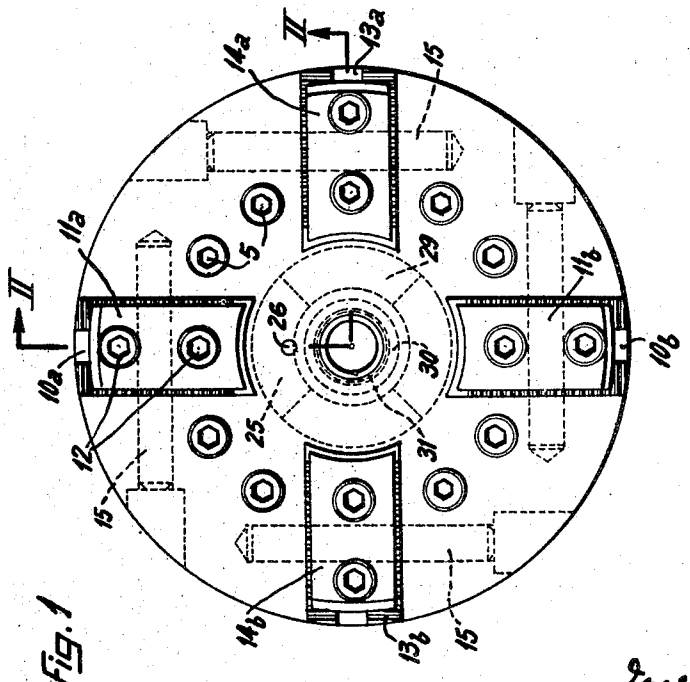


Fig. 1

Inventor
Louis J.-M. Gamet
by Stevens, Davis, Miller & Mosher
his attorneys

March 31, 1959 L. J-M GAMET 2,880,009

LEVER ACTUATED MACHINE-TOOL CHUCK

Filed June 4, 1956 2 Sheets-Sheet 2

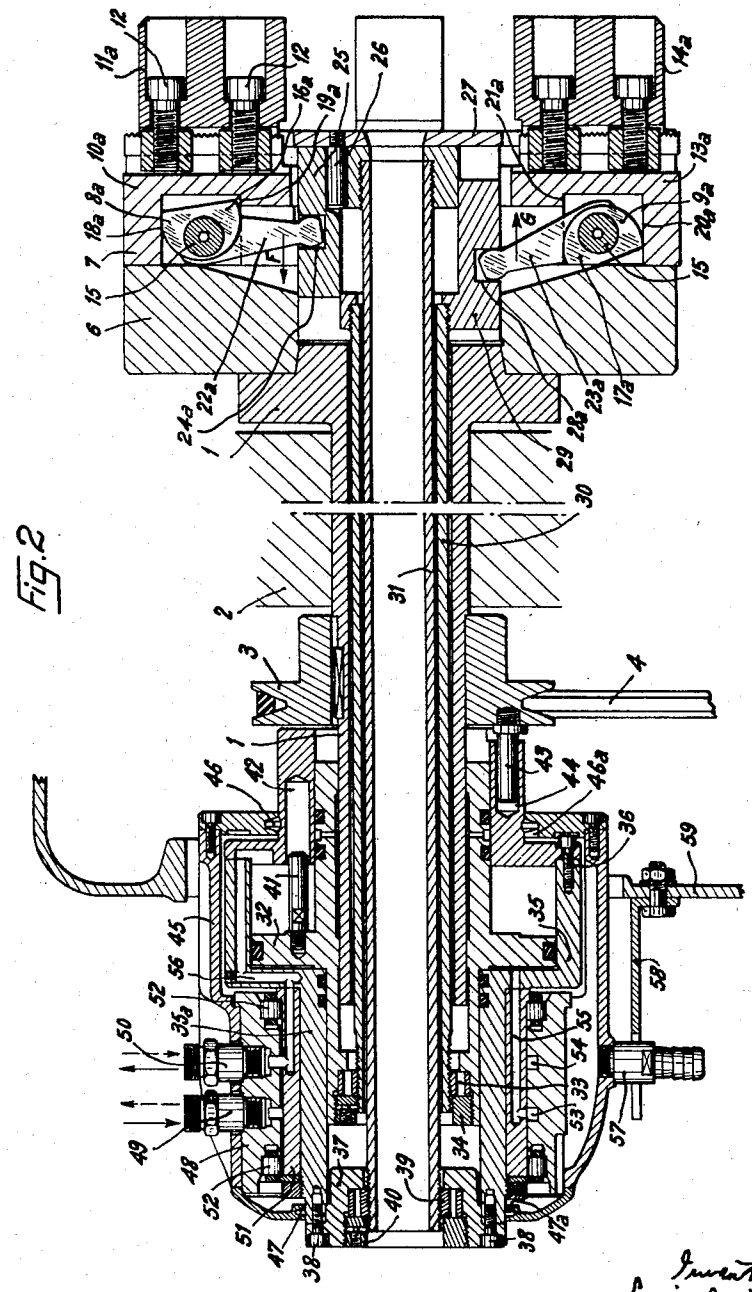


Fig. 2

Inventor
Louis J.-M. Gamet
by Stevens, Davis, Miller & Mosher
his attorneys

United States Patent Office 2,880,009 Patented Mar. 31, 1959

2,880,009

LEVER ACTUATED MACHINE-TOOL CHUCK

Louis J-M Gamet, Bougival, France, assignor to La Precision Industrielle (Société Anonyme), Rueil-Malmaison, France, a French company

Application June 4, 1956, Serial No. 589,160

Claims priority, application France June 7, 1955

5 Claims. (Cl. 279—119)

Chucks for machine-tools are already known which can be operated while running by means of jacks; these chucks have generally three jaws. Thus, a single operating member actuated by the jack and acting on these three jaws simultaneously can provide a balanced grip on a work-piece to be machined in the chuck.

In certain cases however, the form of the work-pieces to be machined is such that it is necessary to grip them with four jaws arranged in opposite pairs (in the case of four-sided work-pieces or members with opposite flats).

If the four jaws are actuated by the same operating member, a balanced grip of the work-piece cannot be obtained, since a clamping system of this kind is hyperstatic.

The present invention has for its object a chuck with four jaws and its operating mechanism, which enables a practically-balanced clamping action to be obtained by the four jaws on the work-piece to be held.

In accordance with the invention, the four jaws arranged in opposite pairs are displaced radially in the chuck by four equal levers two by two, the levers corresponding to one pair of opposite jaws being directed in the opposite sense to the levers corresponding to the other pair, and two members coaxial to the chuck act on the two pairs of levers, the said members being connected, one to the cylinder and the other to the piston of a fluid jack which is free to move along the axis of the said chuck.

Thus when the jack is put under pressure, the piston and the cylinder of the jack move in opposite direction which gives rise to radial displacements of the four jaws in the same direction, by reason of the reverse arrangement of the two pairs of levers. In addition, as soon as one of the pair of jaws has made contact with the work-piece to be held, the other continues to move radially until the four jaws have all made contact with the work-piece and clamp this latter.

The four jaws are preferably arranged at the same radial distance from the axis of the work-piece to be clamped, and the four levers are equal. In this case, by reason of the equality of the oppositely-directed forces which are produced in the jack, and the equality of the levers, the four jaws are finally equally tightened. In fact, for each pair of jaws, the forces on each of them are equal and directly opposed, whilst the forces are balanced on the two pairs of jaws by virtue of the equality of action and reaction in the forces developed into the jack.

In a construction of this kind, the two opposite pairs of jaws may be arranged at right angles in the jack; they may also be arranged at any other desired angle. The operating jack is preferably of the rotary type supplied by a rotating distributor which accompanies the axial movement of translation of the jack.

The description which follows below with reference to the attached drawings (which are given by way of example only and not in any sense by way of limitation) will make it quite clear how the invention may be carried into effect.

Fig. 1 shows a front view of a chuck with four jaws.

Fig. 2 is a developed cross-section along the line II—II of Fig. 1 of the chuck and its operating mechanism.

Fig. 3 is a detail view in perspective of the actuating member of the levers of the chuck.

The chuck shown in Figs. 1 and 2 is carried on the nose of a spindle **1** which rotates in a head-stock **2** of a machine-tool driven by means of a pulley **3** and a trapezoidal belt **4**. The chuck is centered on this spindle by a conical mounting to which it is fixed in the usual manner, for example by means of screws. The chuck is constituted by two parts **6** and **7** assembled together, in which hollowed-out portions facing each other form the emplacement of the levers **8***a* and **9***a*.

The lever **8***a* corresponds to a jaw-carrier **10***a* which slides radially in the chuck and which carries a jaw **11***a* in known manner, fixed by means of blocks and screws **12**. At a position diametrically opposite to the jaw-carrier **10***a* and to the jaw **11***a*, is arranged a further jaw carrier **10***b* carrying a jaw **11***b*. The jaw-carrier **10***b* is operated by a lever **8***b* (not shown) which is identical with the lever **8***a* but diametrically opposite thereto.

The lever **9***a* corresponds to a jaw-carrier **13***a* which carries a jaw **14***a*. Opposite to the jaw-carrier **13***a* and the jaw **14***a* is arranged the jaw-carrier **13***b* and the jaw **14***b* which are operated by the lever **9***b* (not shown) diametrically opposite to the lever **9***a* and which is arranged in the same way as this latter lever.

The levers **8***a*, **8***b*, **9***a*, **9***b* are adapted to pivot about pins **15** located in the same plane perpendicular to the axis of the chuck and at the same distance from said axis. In addition, these levers are each constituted by an eccentric portion **16***a*, **17***a* (and **16***b*, **17***b*, not shown) which is in contact with the opposite faces **18***a*, **19***a*, **20***a*, **21***a* of cavities formed in the present case in the jaw-carriers **10***a* and **13***a*. Each of these eccentrics is rigidly secured with an arm **22***a*, **23***a* for the levers **8***a* and **9***a*.

As can be seen from Fig. 2, the two levers **8***a* and **9***a* and in consequence the two levers **8***b* and **9***b* (not shown) are oppositely directed, that is to say, in order to obtain for example a movement of the jaw-carrier **10***a* towards the axis, it is necessary to act on the arm **22***a* in the direction of the arrow F, whilst in order to obtain a movement towards the axis of the jaw-carrier **13***a*, action must be taken in the opposite direction (arrow G) on the arm **23***a* of the lever **9***a*.

The two extremities of the arms **22***a* and **22***b* (the latter not being shown) of the levers **8***a* and **8***b* are respectively engaged in the grooved portions **24***a* and **24***b* of a member **25** which is movable in an axial direction. This member **25** is constituted, as shown in Fig. 3, by two diametrically-opposite segments of a cylinder coupled together by a circular central portion. In a similar manner, the extremities of the two arms **23***a* and **23***b* are respectively engaged in the grooved portions **28***a* and **28***b* of a second member **29** similar in shape to the member **25**, that is to say comprising two diametrically-opposite cylindrical segments which engage with the corresponding portions of the member **25**, in such manner that the periphery of the two engaged members forms practically a complete cylinder.

The two members **25** and **29** can slide in the central portion of the chuck, but they are prevented from rotating with respect to the chuck by means of a finger **26** fixed in the plate **27** (provided with openings for the passage of the jaws) which form the front face of the chuck, the said finger passing into a hole drilled in the member **25**.

In the member **29**, a tube **30** is fixed, for example by

screwing, and a concentric tube **31** is also fixed in the member **25**. It will be noted that the tube **31** forms, over the whole length of the device, a longitudinal channel which enables the machining in the chuck of bars of indefinite length and also permits of the introduction of cooling fluid into the centre or again an exploratory control ensuring the automatic closure of the chuck when the work-piece to be machined is introduced into the jaws.

On the opposite side of the chuck with respect to the head-stock **2**, the actuating jack of the said chuck is able to slide on the extremity of the spindle **1**. This jack comprises an annular piston **32** which is rigidly fixed to the tube **30** by means of a nut **33** and a lock-nut **34**. This piston is contained in the cylinder **35** which is in two parts assembled together by means of screws **36**, which cylinder can slide longitudinally with respect to the piston and which is fixed to the tube **31** through the intermediary of the cup-shaped member **37**. This cup is fixed to the cylinder **35** by the screws **38** and to the tube **31** by the nut and the lock-nut **39** and **40** respectively.

The cylinder and the piston are secured for rotation by a finger **41** which, during the movement of the piston with respect to the cylinder, engages in the hole **42** drilled in the body of the cylinder. The piston and the cylinder are rotatably driven together at the same speed as the spindle, for example by means of a finger **43** which, in the example shown, is fixed on the pulley **3** and engages in a hole **44** bored in the body of the cylinder **35**. The whole assembly is enclosed in a casing **45** which forms a collector of leakage from the distributor of the jack, as will be described later. Frictionless fluid-tight grooves **46** and **47**, provided with oil return slots **46***a* and **47***a* prevent all leakage of oil to the exterior. Inside the casing **45** is fixed the distributor **48** which provides for the alternate supply of fluid to the two compartments of the jack. This distributor comprises the couplings **49** and **50** to flexible conduits for the supply of oil under pressure and the return circuit of the oil.

The rotating extension **35***a* of the cylinder **35** carries a ring **51** which is centered in the fixed distributor **48** without making contact therewith. This centering without contact is obtained by means of roller bearings **52**. The conduits **49** and **50** deliver into peripheral grooves **53** and **54** respectively of the distributor **48**, and the ring **51** together with the body of the cylinder **35** are provided with channels **55** and **56** respectively which provide a communication between the conduits **49** and **50** and the compartments of the jack.

When oil under pressure is applied to one of the conduits **49** or **50**, this oil is directed through the groove and the channel corresponding into one of the compartments of the jack and there is produced a slight leakage of oil at a limited and controlled rate, between the distributor **48** and the ring **51**, this leakage being provided to lubricate the bearings **52** which are thereby cooled at the same time. The oil which has thus escaped is collected in the bottom of the casing **45** and is evacuated through the collector nozzle **57** which returns this oil to the supply tank. This nozzle **57** is also coupled to the said tank by a flexible conduit and, in the present case, this nozzle is employed in conjunction with a lug **58** fixed to the general framework **59** of the machine in order to prevent rotation of the casing **45** of the jack whilst at the same time permitting a free sliding longitudinal movement of the assembly of the jack and its casing.

It will be assumed that with the device shown in Fig. 2 it is desired to ensure the clamping of the exterior of a work-piece located between the jaws **11***a*, **11***b*, **14***a*, **14***b*. In the position shown in Fig. 2, oil under pressure is sent into the conduit **49** and is delivered into the left-hand compartment of the jack. This oil under pressure applies a thrust towards the right on the piston **32** and, at the same time, the same thrust towards the left is applied to the cylinder **35***a*. By virtue of the coupling of these two members respectively by the tubes **30** and **31** with the members **29** and **25**, the two levers **9***a* and **9***b* are pushed in the direction G and the two levers **8***a* and **8***b* are pulled in the direction F. One of the opposite pairs of jaws then comes into contact with the member to be gripped and, as the jack continues to extend, the other pair of jaws comes in its turn into contact with the said member. As the surfaces on which the oil under pressure acts are the same for the piston and for the jack, the tractive force in the direction F is the same as the thrust force in the direction G and, since the levers **8** are equal to the levers **9**, the gripping force is equally divided between the four jaws.

If the gripping diameters of the opposite pairs of jaws are different, the lengths of the levers **8** and **9** may be adapted in this case to these differences in gripping diameters and in order to obtain a balanced clamping action, it is necessary that the pair of jaws which acts on the greater of the two clamping diameters should be actuated by a pair of levers which are shorter than those which act on the smaller clamping diameter.

The release of the chuck and also the clamping action on the exterior, as the case may be, are obtained by changing over the intake and return oil circuits, that is to say by sending the oil under pressure through the nozzle **50**, the oil return being effected through the nozzle **49** (arrows in dotted lines).

As is well known, the diameter of the eccentrics and their degree of eccentricity may be such that once the gripping action has been applied, this grip is retained without it being necessary to apply the oil pressure continuously in the jack. Premature releases of the work-pieces are thus avoided in the event of leakages in the conduit system or of breakages of these latter.

It will of course be understood that modifications may be made to the forms of embodiment which have just been described above in particular by the substitution of equivalent technical means, without thereby departing from the spirit or from the scope of the present invention.

What I claim is:

1. A clamping device for work-pieces on a machine-tool spindle comprising a chuck secured to said spindle and having two pairs of radially displaceable opposite jaws; a first pair of equal leverage means for radially reciprocating one pair of jaws; a second pair of equal leverage means oppositely directed with respect to the said first pair for radially reciprocating the other pair of jaws; two elongated, coaxially arranged members concentric with said chuck and spindle and respectively connected with each pair of said leverage means, and a fluid operated jack comprising a piston reciprocating in a cylinder coaxial with said spindle and adapted to move freely with respect thereto, said piston being connected to one of said elongated members and said cylinder to the other and means for introducing an actuating fluid into said jack to operate the latter.

2. A clamping device for work-pieces on a machine-tool spindle comprising a chuck secured to said spindle and having two pairs of radially displaceable opposite jaws; a first pair of levers having equal radial arms directed with respect to said chuck for radially reciprocating one pair of jaws; a second pair of levers oppositely directed with respect to said first pair of levers and having equal radial arms internally directed with respect to said chuck for radially reciprocating the second pair of jaws; a first member formed by two diametrically-opposite segmental portions of a cylinder coaxial to said chuck and having a peripheral groove engaging the internal ends of said first arms; a second member formed by two diametrically-opposite segmental portions of a cylinder coaxial to said chuck and having a peripheral groove engaging the internal ends of said second arms, said second member being fitted into the first one; two coaxial tubular members concentric with said spindle,

and respectively connected with each of said members; an annular jack piston sliding on said spindle and connected to the end of the outer of said tubular members; and a jack cylinder enclosing said piston and longitudinally movable with respect to said spindle and connected to the end of the inner of said tubular members and means for introducing an actuating fluid into said cylinder.

3. A device according to claim 2 further comprising a casing enclosing said piston and cylinder and stationary slide means for preventing rotation of said casing and permitting displacement of said casing in the longitudinal direction of said spindle.

4. A clamping device for work-pieces according to claim 2 wherein said piston and said cylinder are fast with said tubular members and further comprising axially directed finger means fast with said spindle and slidingly engaged into said cylinder and further axially directed finger means fast with said piston and slidingly engaged into said cylinder, whereby said cylinder and piston are driven by said spindle.

5. A machine-tool chuck comprising a cylindrical, axially apertured body, having a front part formed with four rectangular slide channels and four bores, in the same cross-section of said body and at the same distance of the axis thereof, each bore crossing perpendicularly one of the said channels; two pairs of opposite jaws, each jaw sliding in one channel and having towards the rear part of said body, a first transverse recess with two

faces in parallel relationship with the corresponding bore and with the axis of said body, and a second radial recess extending from said first recess to the inner end of said jaw; an axle disposed in each of said bores; a lever pivoted about each of said axles and comprising a cylindrical portion tangentially contacting said both faces of said first recess and eccentrically carried with respect to the said axles, and a radial arm extending in said second recess, the pair of levers corresponding to one pair of jaws being oppositely directed with respect to the other pair of levers; a first member formed by two diametrically-opposite segmental portions of a cylinder, coaxially housed in the axial aperture of said body and have a peripheral groove engaging the internal ends of one pair of said lever arms; and a second member formed by two diametrically opposite segmental portions of a cylinder, fitted into said first member and having a peripheral groove engaging the internal ends of the other pair of lever arms.

References Cited in the file of this patent

UNITED STATES PATENTS

534,812	Carlinet	Feb. 26, 1895
1,968,700	Milotta	July 31, 1934
1,999,031	Burger	Apr. 23, 1935
2,568,092	Sloan et al.	Sept. 18, 1951

FOREIGN PATENTS

761,157	Great Britain	Nov. 14, 1956