

Quickly movable screw jack

The present utility model relates to a lifling implement, i.e. a screw jack with the function of quickly moving up-and-down, which is especially suitable to be used as car's maintaining tool for a sedan. The nucleus of its invention - "automatic opening and closing semi-nuts set" except for the screw jack, can be used on bench vice, machine vice, sliding table of machine tool, architectural scaffold and other means that require using screw and nut as kinematic pair of drive but in need of quickly passing over an idle stroke.

Fig. 1-I is a schematic drawing showing the structural principle of a screw jack used for replacing type of a car which is commonly used in car maintenance at present. The screw jack comprises bottom seat 10.5, top support 10.6, four links with sector gears 10.1-10.4, screw 4, left pivot axle O_2 , right pivot axle O_1 , plane bearing 10.8, safeguard pin 10.10, rope 10.11 and pivot axle nut "k" which is integral with the right pivot axle O_1 . The left end of the screw 4 is connected to the pivot axle O_2 , whereas the threaded part at the right end is fitted into the nut "k" which is integral with the pivot axle O_2 . When operating, the screw 4 is rotated, by means of the nut "k", the distance between the left and right two axles O_2 and O_1 is shortened or enlarged, and the top support 10.6 lifts a car W up or down through the link mechanism. As the nut "k" is an integral nut, it cannot quickly pass over an idle stroke, as the

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device has its drawback of low working efficiency.

The object of the present utility model is to overcome the above-mentioned drawback and provide a screw jack with the function of quickly moving up-and-down.

The technical scheme of the present utility model is to replace the integral nut "k" disposed on the right pivot axle O_1 as shown in fig.1-I by a "quickly movable automatic and synchronous opening and closing semi-nuts set" (brief as "F nut" in the following) as shown in fig.1-II and 1-III, others remain the same. It is characterized in that, the "F nut" can be disposed on one pivot axle such as the right pivot axle O_1 in fig. 1-II, so that the threads of the screw 4 at the outer periphery of its right portion can be engaged with the corresponding semi-nuts in the "F nut", and the left end of the screw 4 passing through the central hole of the left pivot axle O_2 is connected to the transmission means (such as joint of a handle, transmission gear box, electric motor etc.) and receives the rotating torque therefrom; or the "F nuts" can be disposed on both pivot axles O_1 and O_2 of the screw jack respectively, as shown in fig. 1-III. However, as to the two "F nuts" and the left and right portion of the screw 4 correspondingly fitted therewith, their threads must be opposite in spiral direction, for example, if the "F nut" disposed on the left pivot axle O_2 and the left portion of the screw fitted therewith have left handed threads (or right handed threads), then the "F nut" disposed on the right pivot axle O_1 and the right portion



of the screw fitted therewith must have right handed threads (or left handed threads). Further, the transmission means to rotate the screw 4 can be disposed at one end of the screw. The "F nut" comprises: (1) supporting seat, (2) one or more semi-nuts, (3) automatic and synchronous opening and closing mechanism for the semi-nuts. The screw with threads on it passes through the supporting hole of supporting seat in the "F nut" to be fitted with the corresponding semi-nuts and its automatic opening and closing mechanism. The features of these three components are: (1) supporting seat: provided on which are the portion (such as pivot axle) connected with the applied carrier (such as screw jack), the portion connected with the screw (such as supporting hole), the portions fitted with the semi-nuts, besides, there are provided position limiting device, safeguard device, quick and slow speeds changing device; (2) semi-nuts: one or more in number, with internal threads less than a half of the periphery, on the semi-nuts are provided up-and-down sliding guideways, outer peripheral face and actuating member (such as cam profile, guide pin of face cam), sometimes it has further the structural member (such as pivot axle, supporting and positioning surface) connected to the practically applied carrier. (3) "semi nuts automatic and synchronous opening and closing mechanism" comprises: automatic and synchronous overload separating device, relatively opening and closing actuating device" including that of elastically engaging and rigidly self-locking type (all these will be briefed as "opening and closing actuating device" in the following) which makes the screw and the semi-nuts relatively open and closed,



self-locking device to retain the engagement of the semi-nuts and position limiting device to limit the opening and closing stroke, safeguard device to prevent the semi-nuts from suddenly separating out when the screw jack is lifted, and the speed changing control device which makes the screw jack a quick or slow drop.

The advantages of the invention lie in that, owing to the use of "F nut", the screw jack can quickly pass over an idle stroke, thereby the working efficiency is improved. Although the impact is greater with quick drop, but the sedan is designed to have a perfect antishock system of spring and tyre, so its potential can be fully utilized. Furthermore, if an electric motor is equipped and it is desired to drop the lifted car, this can be achieved simply by reversing the rotating of the motor, once it is reversed, the car will quickly drop under gravity, thus electrical energy is saved on dropping.

The following is a brief description of the attached drawings:

Fig.1-I is a schematic drawing showing the structural principle of a screw jack of the prior art which uses integral nut "k" on the right pivot axle O_1 .

Fig.1-II is an electrically operated screw jack with the function of quick and slow moving up-and-down which uses the "F nut" of the present invention and a speed reducing transmission means for



the motor.

Fig 1-III is a schematic drawing showing the jack, in which "F nut" are provided on the left and right pivot axle O_1 and O_2 respectively.

Fig. 2-I is a main view of the embodiment of an "opening and closing actuating device" when it is composed of an internal curved cam pair and a plate spring. In the figure, the screw 4 rotates in "M" direction, and the internal and external threads are in engaging state.

Fig.2-II is one of the A-A sectional view of fig 2-I, showing that the screw 4 rotates in "M" direction, the internal threads of the two semi-nuts are going to engage with the external threads of the screw.

Fig.2-III is the another A-A sectional view of fig.2-I, showing that the screw 4 rotates reversely in "N" direction, the internal and the external threads are separated from each other.

Fig. 3-I is a perspective view of the supporting seat of Fig.2-I.

Fig.3-II is a perspective view of the upper and lower two semi-nuts 2A, 2A'.

Fig 3-III is a perspective view of up-and-down sleeve 3A in fig



2.

Fig.3-IV is a perspective view of the expandable spring 14.

Fig.4-I is a main view of the embodiment of an "opening and closing actuating device" when it is composed of an internal curved cam and an end face cam groove. On the figure, the screw 4 rotates in "M" direction, the internal and external threads are in engaging state.

Fig.4-II is one of G-G sectional view of fig.4-I, the screw 4 rotates in "M" direction, the internal and external threads are in engaging state.

Fig.4-III is another G-G sectional view of fig.4-I, the screw rotates reversely in "N" direction, the internal and external threads are in separating state.

Fig.4-IV is a perspective view of the upper and lower semi-nuts 2B, 2B' of fig.4-I.

Fig. 5-I is a main view of the embodiment of "opening and closing actuating device" when the kidney-like end face cam grooves are disposed on the semi-nuts. In the figure, the screw 4 rotates in "M" direction, the internal and external threads are in engaging state.



Fig.5-II is one of F-F sectional view of fig.5-I. In the figure, the internal and external threads are in engaging state.

Fig. 5-III is the another F-f sectional view of fig.5-I. In the figure, the internal and external threads are in separating state.

Fig.6-I is a main view of the embodiment of "opening and closing actuating device" when the kidney-like end face cam grooves are disposed on the up-and-down sleeve and the cam guide pins are disposed on the semi-nuts. In the figure, the internal and external threads are in separating state.

Fig.6-II is one of G-G sectional view of fig.6-I.

Fig.6-III is a H-H sectional view of fig.6-I.

Fig.6-IV is the another G-G sectional view of fig.6-I, compression spring 32 is used to replace the "drop portion of cam profile" 3.D.22, and the internal and external threads are in separating state.

Fig.7 is a main view of the embodiment of "opening and closing actuating device" when the cam profile is disposed on the cylinder 3E.1 of the up-and-down sleeve, and the cam guide pin is disposed on the end of the semi-nuts. The screw 4 rotates reversely



in "N" direction, the internal and external threads are in separating state.

Fig.8 is a view of the embodiment of "opening and closing actuating device which is of the link type of "crank-sliding block mechanism". This figure is the third of F-F sectional view of fig.5-I, in which the screw 4 rotates reversely in "N" direction, the internal and external threads are in separating state.

Fig. 9-I is a main view of the embodiment of "opening and closing actuating device" which is a cam pair composed of an outer peripheral radial cam and cam up-and-down plate, and the pivot axles O_1 are disposed on the semi-nut.

Fig.9-II is a perspective view of the semi-nut 2F.

Fig.10-I is a main view of the embodiment of "opening and closing actuating device". It is the same as fig.9-I except the pivot axles O_1 are disposed on a supporting seat 1G.

Fig.10-II is a perspective view of the supporting seat 1G.

Fig.11 is a main view of the embodiment of "opening and closing actuating device". It is the same as Fig.9-I except the supporting frame 1F is eliminated.

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Fig.12-I is a view of the embodiment which is the same as fig.11 except an anti-shift frame is added.

Fig.12-II is a perspective view of the frame.

Fig.13 is a main view of the embodiment of "opening and closing actuating device". It is a cam pair composed of an eccentric cam sleeve 3H conjugating with a frame-like opening.

Fig.14-I is a main view of the embodiment of "opening and closing actuating device" which is the same as fig.13 except that the semi-nut is also disposed in the eccentric cam sleeve.

Fig.14-II is one of A-A sectional view of fig.14-I.

Fig.14-III is the another A-A sectional view of fig.14-I.

Fig.15-I is a partial main view of overload separating device of the semi-nuts opening and closing mechanism wherein the device is of an end face friction cone type.

Fig.15-II is an A-A sectional view of Fig.15-I.

Fig.16-I is a partial main view of overload separating device of the semi-nuts opening and closing mechanism wherein the device is of outward expandable friction ring type.



Fig.16-II is one of the B-B sectional view of Fig.16-I, showing the structure of an outward expandable friction ring.

Fig.16-III is the another B-B sectional view of Fig.16-I, showing structure of an inward expandable friction ring.

Fig.17-I is a partial main view of overload seperating device of the semi-nuts opening and closing mechanism wherein the device is of axial guiding pillar (or ball) type.

Fig.17-II is a partial main view of overload separating device of the semi-nuts opening and closing mechanism wherein the device is of radial ball (or pillar) type.

Fig.18-I is a main view of "quick and slow speeds control device" of the semi-nuts opening and closing mechanism wherein the device is a locking device of the pawl and inserting pin type.

Fig.18-II is one of the A-A sectional view of fig.18-I.

Fig.18-III is the another of A-A sectional view of fig.18-II.

Fig.19-I is an alternative of fig.18-I, wherein the device is composed of a spring hoop and a fork type eccentric handle.



Fig.19-II is a k-k sectional view of fig.19-I.

Fig.20 is a main view of the "F nut" of the invention when it is used on the practical carrier of a bench vice.

Fig.21-I is a main view of the embodiment of the screw jack of the invention, wherein its rocking handle is made into foldable type.

Fig.21-II is a main view of the embodiment of the invention, wherein its rocking handle is made into foldable and retractable type.

Fig.2-I is the first embodiment of the invention. It is characterized in that, one or more semi-nuts are used. The screw is supported by the supporting seat. One or more semi-nuts are evenly distributed around the cross-section of the screw. The semi-nuts are disposed between the supporting seat and the up-and-down sleeve. The semi-nuts are provided with opening and closing means which can automatically rise or drop. The up-and-down sleeve is provided with anti-shift means to prevent the shift along the axial direction of the screw. The supporting seat comprises: supporting arms (one or two), supporting hole (one or two correspondingly), supporting body (including means connecting to the carrier such as pivot axle O_1 etc.), the up-and-down guiding member which is fitted with the semi-nuts up-and-down sliding guideway, and the position limiting member. The screw passes through the supporting hole with



movable fit and is fitted with the screw and the up-and-down means (such as the up-and-down sleeve, including the anti-shift means to prevent the axial shift). For two or more semi-nuts, they should be symmetrically arranged about the center of the screw. The semi-nuts have internal threads which extend less than a half of the periphery, sliding guideways for guiding the up-and-down movement, as well as actuating member to transmit the up-and-down force; the "semi-nuts automatic opening and closing mechanism" which is used to control the automatic and synchronous opening and closing motion of the semi-nuts comprises opening and closing actuating device (such as up-and-down sleeve and cam profile), overload separating device (such as pawl, spring hoop etc.) and upward stroke limiting device, safeguard device, self-locking device, and speed changing device which makes the screw to have the function of being capable to advance or retract with either quick or slow speed.

Fig.2-I is a main view of the embodiment of the "F nut" of the invention, wherein two semi-nuts are used, and the opening and closing actuating device for the semi-nuts is composed of inner curved cam and an expandable plate spring.

This embodiment comprises supporting seat 1A, the upper and lower two semi-nuts 2A and 2A', expandable plate spring 14, up-and-down sleeve 3A, pawl 7, spring hoop 6, limiting stop pin 15, clamp plate 17, locking device 5 and the screw 4. As the practical carrier of "F nut" is a screw jack, so the supporting seat is to be



connected to the pivot axle 1A.1 (as fig.3-I). The screw 4 passes through supporting hole 1A.2 and the inner hole 3A.1 of the up-and-down sleeve, and cooperates with the semi-nuts and their opening and closing actuating device. The outer side faces 2A.2 and 2A.3 etc. of the two seminuts 2A and 2A' at its left side with about half of its volume are in movable fit with the inner side guideway faces 1A.3 and 1A.4 of the supporting seat; while the other half at the right end is mounted in a large hole at the left end of the up-and-down sleeve 3A, that hole really is an inner-curved cam, its cam profile is composed of two symmetric segments of rise portions 3A.2, 3A.3 and two segments of inner arcs 3A.4 with minimum radius as R_{min} (this is also the self-locking cam profile of the self-locking device to prevent the separation of the closed semi-nuts), as well as other two segments of inner arcs 3A.5 with maximum radius as R_{max} . The expandable plate spring 14 is mounted in the grooves 2A.4 and 2A'.4 (fig.3-II) of the upper and lower two semi-nuts, alternatively, instead of the expandable plate spring, each of the semi-nut may use its own individual spring, thereby urging the upper and lower seminuts to separate outward, so as the highest points 2A.5 and 2A'.5 of the outer arcs of the semi-nuts can always firmly press against the inner-curved cam face of the up-and-down sleeve, this inner-curved cam profile really is the "opening and closing actuating device" of "F nut", its working principle is easy to understand. Suppose the up-and-down sleeve 3A rotates in "M" direction (clockwise), the inner-curved cam profile which contacts with the highest points 2A.5, 2A'.5 of the outer arc of the semi-nuts



will move from the place of maximum radius 3A.5, through the rise portion of cam profile 3A.2, and to the place of minimum radius 3A.4, thus forcing the two semi-nuts 2A and 2A' to close with each other in the direction toward the center of the screw (brief as centripetal movement in the following), until the internal and external threads are completely engaged and self-locked (fig.2-II). At that time, the position limiting stop pin 15 just touches with the stopper 17. On the contrary, for the same reason, if the up-and-down sleeve rotates in "N" direction (counterclockwise), then the semi-nuts 2A and 2A' will make centrifugal movement, so that the internal and external threads will be separated from each other, as shown in fig.2-III.

The torque to rotate the above up-and-down sleeve 3A either in "M" or in "N" direction comes from the screw 4, it is transmitted to the up-and-down sleeve through an "automatic synchronous overload separating device" mounted on the up-and-down sleeve. The "overload separating device" shown in fig.2-I comprises a pawl 7 which is mounted in a radial hole 3A.7 of the up-and-down sleeve (in sliding fit), a spring hoop 6 and a keyway 4.1 on the screw 4. At the lower end of the pawl there are two ramps 7.1 whose end part could be pushed by the resilience of the spring hoop 6 to press against the outer periphery of the screw 4 or fall into the keyway 4.1 of the screw 4, when the screw 4 rotates in "M" direction, the side edges 4.1.1 of the keyway 4.1 of the screw touch with the ramps 7.1 of pawl, push the pawl 7 and up-and-down 3A and rotate with the



up-and-down sleeve in "M" direction, then the "opening and closing actuating device" on the up-and-down sleeve 3A forces the semi-nuts 2A, 2A' to make "centripedal engaging movement" until the limiting stopper 17 on the up-and-down sleeve touches with the stop pin 15 on the supporting seat 1A and the rotation is stopped. Meanwhile the screw 4 still rotates in "M" direction so as the force exerted by the side edge 4.1.1 of the keyway on the pawl ramp 7.1 is increased till the upward axial component of the force is greater than the downward pressure which is exerted by the spring hoop 6 on the pawl, the ramp 7.1 of the pawl would be squeezed out apart from the keyway 4.1, i.e. separating under overload, and the screw could still rotate in "M" direction to lift the car. On the contrary, when the screw rotates in "N" direction, the torque would be transmitted in the same way to the up-and-down sleeve 3A through the pawl 7, cause the up-and-down sleeve 3A rotate with the screw 4, and through "opening and closing actuating device" cause the semi-nuts make "centrifugal movement" to force the internal and external threads to be separated (see fig.2-III), then the quick drop of the screw jack is realized. If it is desired that the falling speed is to be slowed, a locking device 5 could be mounted on the supporting seat 1, this device comprises an inserting pin 5.1, a spring 5.2, a socket for inserting pin 5.3, a pin axle 5.4 and an eccentric handle 5.5, wherein the front end of the inserting pin 5.1 is an inserting pin tip 5.1.1, which is just aligned with the locking hole 3A.8 in the up-and-down sleeve 3A. The working principle of the locking device is as follows: when it is desired that the screw 4 should have the



functions of slow retract and slow advance (i.e. the screw jack can rise or drop in a slow way); at first, operate the handle, let the screw 4 rotate in "M" direction, which cause the internal and external threads to be in engagement, then let the arrow of the eccentric handle 5.5 be placed in vertical direction (as shown in fig.2-I), meanwhile the eccentric handle 5.5 is at a position of short axis (i.e. the bottom face 5.5.2 of the eccentric handle 5.5 is in contact with the front end face 5.3.1), the inserting pin 5.1 could be inserted in the locking hole 3A.8, and the up-and-down sleeve 3A is fixed to be incapable of rotation, thereby the internal threads of the semi-nuts 2 and the external threads of the screw could be kept in engagement, this is the same as conventional screw drive mechanism, and the original functions of slow advance and slow retract are completely retained. When it is desired that the screw should have the functions of quick advance and quick retract, the eccentric handle 5.5 could be placed with its arrow in horizontal position, whereby the eccentric handle 5.5 is at the position of long axis (i.e. the side face of the eccentric handle 5.5 is in contact with the front end face 5.3.1 of the spring seat 5.3), meanwhile the inserting pin tip 5.1.1 retracts from the locking hole 3A.8 of the up-and-down sleeve 3A and the up-and-down sleeve 3A could be brought by the screw and pawl to rotate in "N" direction, thus the internal threads of the semi-nuts 2A and 2A' could be separated from the external threads of the screw, thereby cause the screw 4 to have the function of speedily passing through an idle stroke. If the carrier to be applied is a screw jack, then the quick rise or drop of that screw jack can be realized.



Fig.4-I is an "opening and closing actuating device" of the "F nut" of the invention, it is divided into two sets of actuating devices, of which the actuating device responsible for automatic closing of the semi-nuts 2B and 2B' is the same as fig.2-I, i.e. the inner-curved cam profiles 3B.2, 3B.4, 3B.5 on the large hole at left end of the up-and-down sleeve 3B, whereas the actuating device responsible for automatic opening of the semi-nuts is undertaken by an end face cam pair which is composed of cam grooves and cam guide pins, the end face cam grooves 2B.2 and 2B'.2 of that cam pair are disposed on the right end face of the semi-nuts 2B and 2B', its up-and-down actuating cam profiles are 2B.3 and 2B'.3, see fig.4-II; and its cam guide pins 16 and 16' are disposed on the left end face 3B.2 of the up-and-down sleeve 3B; alternatively, according to the principle of relative motion, the cam grooves may be disposed on the up-and-down sleeve, while the guide pins may be correspondingly disposed on respective semi-nut. Its working procedure is as follows: when the screw 4 rotates in "M" direction, its torsion moment is transmitted to the up-and-down sleeve 3B through the pawl 7, and the up-and-down sleeve also rotates in "M" direction, as the radians of rise portion 3B.2 of inner-curved cam profile is changed from a large value to a smaller value, the semi-nuts 2B, 2B' are forced to make "centripetal engaging movement" until they are stopped by the limiting stopper 17, meanwhile the screw 4 continues to rotate in "M" direction and the screw jack is raised with a slow speed (see fig.4-II). On the contrary, when the screw 4 rotates in "N" direction



(as fig.4-III), the up-and-down sleeve 3B also rotates in "N" direction, the cam guide pins 16 and 16" mounted on the up-and-down sleeve 3B enter into the cam grooves 2B.2 and 2B'.2 and cooperate with the rise portions 2B.3 and 2B'.3 of cam profiles, causing the semi-nuts 2B and 2B' to make "centrifugal movement", thereby realizing the separation of the internal and external threads, thus permitting quickly moving to and fro between the screw and the nut. Others are the same as fig.2-I.

The "opening and closing actuating device" as shown in fig.5-I is characterized by its fully end face cam pairs. Its kidney-like end face cam grooves 2C.2 and 2C'.2 are disposed on the right end face of the semi-nuts 2C and 2C', and the actuating members for the cam grooves are composed of the rises portion of cam profile 2C.4 and the drop portion of cam profile 2C.3. The cam guide pins 16 and 16' are disposed on the left end face 3C.2 of the up-and-down sleeve 3C. As to the position limiting device for the movement range on opening and closing the semi-nuts and the self-locking device after opening and closing the semi-nuts, their actuating members are the arc type cam profiles 2C.7, 2C'.7, 2C.8, 2C'.8 at the two ends of the kidney-like cam grooves. Its working procedure is as follows: when the screw 4 rotates in "M" direction and brings the up-and-down sleeve 3C and the guide pins 16, 16' provided on it to rotate together in "M" direction, through the action of drop portion cam profile 2C.4 and 2C'.4 on the end face of the semi-nuts, the semi-nuts are forced to make "centripetal engaging movement" until the



guide pins 16 and 16' are stopped by the end 2C.7 of the kidney-like grooves, causing the internal and external threads to be fully engaged and self-locked (such as fig.5-II). On the contrary, when the screw 4 rotates in "N" direction, through the action of rise portions 2C.3 and 2C'.3 of cam profiles, the semi-nuts 2C and 2C' are forced to make centrifugal movement, causing the separation of the internal and external threads. Others are the same as fig.2-I.

Another structural form of the "opening and closing actuating device" as shown in fig.6-I is characterized in that, the kidney-like cam grooves 3D.2 and 3D'.2 are disposed on the cam disc 3D.1 of the up-and-down sleeve 3D, the actuating members of the cam grooves are composed of rise portion cam profile 3D.2.1 and drop portion cam profile 3D.2.2 as well as position limiting (and self-locking) cam profile 3D.2.4 and 3D.2.3; the cam guide pins 16 and 16' are disposed on the semi-nuts 2D and 2D', which are restrained to make up-and-down as well as opening and closing movement in a frame shape (or dovetail shape etc.) up-and-down guideway of the supporting seat 1D. As to the restraint of axial shift of the up-and-down sleeve 3D, it is accomplished by providing bosses 16.1 to the end face of cam guide pins 16, 16' for resisting against the right side face 3D.4 of the cam disc 3D.1. There are many equivalent schemes to restrain the axial shift of the up-and-down sleeve 3D. For example, instead of using the bosses 16.1 which are integral with the cam guide pins, the bosses may be directly mounted on a means connected with the supporting seat 1D. Since both the "opening and



closing actuating devices" of this fig.6-I and fig.5-1 are composed of kidney-like cam groove and cam guide pin (only difference is the relative mounting position of these two, one is on the up-and-down sleeve, and the another is on one of the semi-nuts), so the acting procedure and working principle of these two are completely the same, it needs not to be discussed further.

The "opening and closing actuating device" of fig.6-IV is derived on the basis of fig.6-II: at first, the drop portion cam profile 3D.2.2 of the kidney-like cam grooves 3D.2 and 3D'.2 in fig. 6-II is eliminated (for convenience to discuss, only take one of the cam grooves 3D.2 as example), only the rise portion cam profile 3D.2.1 and the actuating members for the position limiting device and self-locking device i.e. cam profiles 3D. 2.3 and 3D.2.4 are retained, next, it is provided in addition one set of elastically engaging and rigidly self-locking actuating means, which is composed of elastically engaging spring (including the integral retractable spring 32 or individual springs mounted separately on respective semi-nut) and self-locking device. One of the structures of the above self-locking device is to use a cam pair which is composed of cam profile 3D.2.4 and cam guide pin 16, other structures are the same as fig.6-I and fig.6-II. Thus, the "opening and closing actuating device" of fig 6-IV substantially contains two sets of actuating device: of which one set is the "separating actuating device" to accomplish the automatic separation of the semi-nuts 2D and 2D', one of its embodying scheme is realized by a cam pair which is



composed of rise portion cam profile 3D.2.1 on the cam disc 3D.1 and cam guide pin 16 on the semi-nut 2D, or is realized by a cam pair which is composed of guide pin 16 on the cam disc 3D.1 and rise portion 3D.2.1 of cam profile on the semi-nut 2D; the another set is an elastically engaging and rigidly self-locking “engaging actuating device”, one of its embodying scheme is to use the above-mentioned elastically engaging and rigidly self-locking actuating means to realize an engaging rate of 100%.

The “opening and closing actuating device” of fig.7 is achieved by making improvement on the basis of Fig.2-I, it is realized by a radial cam pair which is composed of cam profiles 3E.1.2 and 3E.1.1 on the inner and outer cylindrical body of the up-and-down sleeve 3E and the cam conjugating pins 18, 19, while the conjugating pins 18, 19 are mounted on the transmitting pins 16E and 16E' at the ends 2E.1 and 2E'1 of the semi-nuts, other structures are the same as fig.2-I.

The “opening and closing actuating device” of fig.8 is realized by a crank-slider mechanism. The crank 20 has two pivot axle holes O_2 and O_3 , pivot axle hole O_2 is connected with the semi-nut 2F, while O_3 is connected with the up-and-down sleeve 3F. Other structures are similar as fig 2-I. On operating, when the up-and-down sleeve 3F rotate in “N” direction, the pivot axle O_3 also rotates in “N” direction, then the inclination angle α of the crank becomes larger, so that the pivot axles O_2 and O_2' of the crank make



“centrifugal movement”, causing the semi-nuts 2F and 2F’ to be separated from each other, until the crank touch the position limiting face 2F.1. On the contrary, when the up-and-down sleeve 3F follows the screw 4 to rotate in “M” direction, the pivot axles O_2 and O_2' of the crank will bring the semi-nuts 2F and 2F’ to make “centripedal engaging movement”.

The “opening and closing actuating device” of fig 9-I and 9-II is realized by a cam pair which is composed of the cam profiles (including rise portion profile 2F.2 and drop portion profile 2F.3) on the outer periphery of the semi-nut 2F and the up-and-down plate 3F.1 on the up-and-down sleeve 3F. The semi-nut 2F has its internal threads 2F.6 less than a half of the periphery, a semi-plain-hole 2F.7 with diameter greater than that of the screw 4, two pivot axles 2F.7 at front and rear sides connected with the carrier (the screw jack), and a rise portion of cam profile 2F.2 and a drop portion of cam profile 2F.3 on its outer periphery. The screw 4 passes successively through left end hole 1F.1 of the supporting frame 1F, plain hole 2F.7 of the semi-nut, hole 3F.3 of the up-and-down sleeve, and right end hole 1F.2 of the supporting frame. When the up-and-down plate 3F.1 of the “actuating device” rotates to the upmost position, where it is inserted in a sliding fit between an upper top face 2F.9 on the outer periphery of the semi-nut 2F and an upper bottom face 1F.3 of the inner cavity of the supporting frame 1F. The above “actuating device” also can be made the following three simple equivalent transformation, such as:



(1) The pivot axles 2F.7 connected to the carrier (screw jack) and disposed initially at the front and rear sides on the outer periphery of the semi-nut 2F, can be modified as to be mounted on the front and rear side faces of the left side wall of the supporting frame 1F, thus the supporting frame 1F is changed into a supporting seat 1G with pivot axles, as shown in fig 10-I and fig.10-II, i.e. there mounted pivot axles 1G.7 and 1G'.7 on the front and rear side faces 1G.8, 1G.9 of the left side wall of the supporting seat 1G. The semi-nut after dropping off its pivot axles 2F.7 is changed into a semi-nut 2G without pivot axle. Others such as the up-and-down sleeve 3G are completely the same as 3F etc. including that pawl 7 is mounted on the up-and-down sleeve, locking device 5G is mounted on the supporting frame as 5F etc.

(2) In the fig.9-I, the original supporting frame 1F is eliminated, only the semi-nut 2F with pivot axle O_1 and the up-and-down sleeve 3F are retained, other main structures remain the same, thus it is transformed into another new "actuating device" (as shown in fig.11), i.e. with semi-nut 2G and up-and-down sleeve 3G. To prevent axial shift, a stop pin 12 is provided on the up-and-down plate 3G.1 of the up-and-down sleeve, correspondingly a deep groove 2G.10 is cut on the semi-nut 2G to cooperate with the stop pin 12.

(3) In the same manner, by eliminating the original supporting



frame 1F in fig.9-I (others remain the same), it is transformed into another new "actuating device", with semi-nut 2F and up-and-down sleeve 3F. To prevent axial shift, an anti-shift frame 33 is added, there are two lug holes 33.1 and 33.2 on the frame which can be put on the pivot axles 2F.7 on the front and rear side faces of the semi-nut 2F.

The working principle of the "opening and closing actuating device" in fig.9-I is as follows: When the screw 4 via the pawl 7 brings the up-and-down sleeve 3F and the up-and-down plate 3F.1 on it together to rotate in "M" direction, the up-and-down plate 3F.1 makes planetary rotation around the rise portion of the cam profile 2F.2 and the drop portion of cam profile 2F.3 on the outer periphery of the semi-nut 2F. Since the distance from these cam profiles to the center of the internal threads is variable, such as the distance from cam profile 2F.2 to the center of the internal threads 2F.6 is a maximum, whereas that from cam profile 2F.3 to the center is a minimum. So the distance from the center of the inner hole 3F.3 of the up-and-down sleeve and the screw 4 in sliding fit with which to the center of the internal threads 2F.6 of the semi-nut 23 will become smaller as the up-and-down plate 3F.1 makes planetary rotation in "M" direction, thus forcing the external threads 4.3 of the screw and the internal threads 2F. 6 of the semi-nut to engage with each other. On the contrary, when the screw 4 brings the up-and-down sleeve 3F to rotate in "N" direction, the internal and external threads will separate from each other. Besides, the width of the



supporting frame 1F from the front to the rear is just equal to the width between the front and rear side face 2F.11 and 2F.12 of the left portion of the semi-nut, the supporting frame 1F serves as up-and-down guideways to hold the semi-nuts between the link plate 10.1, 10.2 of the screw jack, so the screw 4 can only make the up-and-down motion between the link plates.

The "opening and closing actuating devices" as shown in fig.13 is realized by an eccentric cam kinematic pair which is composed of an eccentric cam sleeve 3H and the upper and lower two flat surface 1H.4 and 1H.3 of a frame-like rectangular opening of the semi-nut supporting seat 1H. The semi-nut supporting seat 1H has a shape of frame, in the center of the frame, there is a rectangular opening, the upper and lower plane 1H.4 and 1H.3 of that opening is in sliding fit with the eccentric outer circumferential surface 3H.2; internal threads 1H.6 and 1H.5 which are less than a half of the periphery and semi-plain-holes 1H.1 and 1H.2 with diameter greater than that of the screw 4 are provided separately in the left and right two side walls 1H.7 and 1H.8 of the frame. The screw 4 successively passes through the plain hole 1H.h1 of left wall, the inner hole 3H.1 of eccentric cam and the plain hole 1H.2 of right wall. Besides, at the front and rear sides of the left side-wall of the frame, pivot axles O_1 are provided to be connected with the screw jack body 10.1 and 10.2 of the practical carrier.

As to the wall thickness of the eccentric cam-sleeve 3H, it is



thick on one side and thin on another side due to eccentricity. When the eccentric cam sleeve 3H rotates in "M" direction after the screw 4, the thickest portion just rotates to the lowest position and contacts with the lower plane 1H.3 of the supporting seat, thereby the center of the screw 4 is raised, forcing the internal and external threads to engage with each other. On the contrary, when the screw 4 with the eccentric sleeve 3H rotate in "N" direction, the thickest portion of the eccentric sleeve 3H rotates to the upmost plane 1H.4 of supporting seat 1H, the internal and external threads separate from each other.

The "opening and closing actuating device" as shown in fig.14-I is realized by a cam kinematic pair which is composed of the eccentric cam profile 2J.1 on the outer periphery of the semi-nuts 2J and the upper and lower two planes 1J.1 and 1J. 2 of the frame-like rectangular opening in the supporting frame 1J.

The eccentric cam profile 2J.1 on the outer periphery of the semi-nuts 2J in fact is a cylindrical surface with O_3 as center, there are two eccentric holes in the body of semi-nut 2J, the centers of these holes are O_2 and O_4 , both their eccentric distances from the center O_3 are equal to e (e is slightly greater than the depth of a spiral thread), the eccentric hole with center O_4 is a semi-plain-hole 2J.3 with diameter greater than that of the screw 4, the eccentric hole with center O_2 has its internal threads 2J.4 less than a half of the periphery, on the semi-nut 2J are provided two up-stroke



limiting pins 35, 36 and a radial hole 2J.5, in which is fitted with a pawl 34, and a spring hoop 6 presses against the pawl 34, causing the cone body of pawl tip 34.1 to press against the outer periphery of the screw 4 or be inserted into the keyway 4.1.

The supporting seat has a shape of frame, in the opening of the frame, semi-nut 2J is seated. The screw successively passes through the left frame supporting hole 1J.3 of the supporting seat 1J, the semi-nut hole and the right frame supporting hole 1J.4. At the front and rear sides of the left frame part are mounted pivot axles 1J.5 (with O_1 as center), to be connected to the practical carrier (screw jack).

In order to improve the engaging property, besides the cylindrical body, the shape of cam profile 2J.1 on the outer periphery of the semi-nut 2J can be designed into other cam curves according to the requirement.

The principle of this mechanism is evident that, when the screw 4 bring the semi-nut 2J to rotate in "M" direction, the farthest point on the eccentric outer periphery 2J.1 apart from the center O_2 of internal threads rotates to the lower plane 1J.2 of the internal cavity of the supporting frame so as the center O_2 of internal threads coincides with the center O_3 of the screw 4, causing the internal and external threads coming into engagement, this is stopped by the position limiting pin 35 when it touches with the lower plane 1J.2,



as shown in fig.14-II. On the contrary, when the screw rotates in "N" direction, and brings the semi-nut 2J to rotate in the same direction, as shown in fig.14-III. When the nearest arc part on the eccentric outer periphery 2J.1 apart from the center O_2 of inner threads rotates to contact with the lower plane 1J.2, the center O_2 of internal threads O_2 goes apart from the center O_5 of the screw 4, realizing the separation of the internal and external threads, the rotation is stopped by the position limiting pin when it touches with the lower lane 1J.2.

Summarizing the above, for the "F nut" of the invention, many equivalent mechanisms can be used to replace these embodiments. For instance, the Archimede's spiral end face threads commonly used in the three-jaw automatically centering chuck of a lathe can be used to replace the end face cam mechanism in fig.4-I; again, the number of semi-nut can be one or two, or more than two. All these are within the scope of the invention, so it will not be listed one by one.

With respect to the "automatic and synchronous overload separating device" used in the invention, besides the overload separating device of fig.2-I which is composed of a pawl 7 and a spring hoop 6, there are a great many of other equivalent overload separating devices. As to the form, it may be of single direction or of double direction, as to the drive manner, it may be electro-magnetic, hydraulic or pneumatic, as to the overload separating element,



must be greater than the depth that the teeth would be inserted in.

Fig 16-I and 16-II is an overload separating device of an expandable ring with its outer circumference as friction surface. This embodiment uses an outer circumference friction expandable ring 25 in fig.16-I to replace the friction ring 21 and compression spring 22, the expandable ring 25 is still kept by a check ring 24, and there is an axial open slot 25.1 provided on the cylindrical body of the expandable ring 25. When the expandable ring is in the free state, its outside diameter 25.2 is greater than the inside diameter of inner hole 3A.11 of the up-and-down sleeve 3A. When assembling, the open slot 125.1 is forced to contract, it releases after the expandable ring is inserted into the inner hole 3A.11, thus by resilience the outer circumference 125.2 of the expandable ring 125 expands and sticks on the inner wall of the inner hole 3A.11 of the up-and-down sleeve 3A, and results a certain amount of frictional force. The inside diameter of the expandable ring is slightly greater than the outside diameter of the screw, and the former is connected to the latter through a guide key 23. Its operating process is the same as the type of friction ring in fig.9-I, the only difference is that the friction surface which can slide over at overload is transferred from the end face (or cone face) to the outer circumference of the expandable ring.

Fig.16-III is an overload separating device of the type of an expandable ring with its inner hole as friction surface. Its working



various elements such as pawl (of single or double direction), teeth, ball, guide pillar, friction cone (disc, plate, block, cushion) and various elastic elements (such as spring, elastically expandable loop or ring, expandable sleeve) can be used. In the following, some of the equivalent overload separating devices derived from fig.2-I are listed.

Fig.15-I, 15-II show a friction overload separating device using friction ring(or friction cone). Its working principle is as follows: A friction ring (cone) 21 is mounted in an up-and-down sleeve 3A, and slidably encloses the outer circumference of the screw 4. Friction face (cone) 21.1 tightly presses against the right friction face (cone) 3A.10 of the up-and-down sleeve 3A under the effect of the compression spring 22, friction ring (cone) 21 is connected to the screw 4 through a guide key 23. When the screw 4 rotates, its driving torque is transmitted through keyway 4.1, guide key 23, friction face of friction ring (cone) 21.1 to the up-and-down sleeve 3A which is brought to rotate together, until it stops when colliding with an upward stroke limiting means, but the screw will continue to rotate, meanwhile this friction pair is overloaded and slides over each other without hindering the rotation of the screw, and the screw can achieve its predetermined job. The above stated contact faces 21.1 and 3A.10 of the friction ring (cone) can be replaced by a pair of teeth which can slide over each other under the effect of a compression spring 22 when overload occurs. Of course the amount of compression deformation of the compression spring



principle is essentially the same as fig 16-II. Its expandable ring 26 has also an axial open slot 26.1. When in free state, the inside diameter of its inner hole 26.2 is slightly smaller than the outside diameter 4.9 of the screw 4. After the screw is inserted in the inner hole, by resilience the inner hole embraces around the outer periphery of the cylinder of the screw 4 and results a certain amount of frictional force (there is no keyway on the screw). The outside diameter of the inwardly expandable ring 26 is slightly smaller than the inside diameter of the inner hole of the up-and-down sleeve 3A, the driving torque of the screw is transmitted through a transmitting pin 127 to the up-and-down sleeve 3A. The operating process is the same as fig.16-II, but that the friction surface which can slide at overload is directly undertaken by the friction surface lying between the outer circumference of the screw 4 and the inner hole of the expandable ring.

Fig. 17-I is an overload separating device of the type of axially distributed guide pillar (or steel ball). Its working principle is as follows: On the left end face of a sliding sleeve 28 which encloses around the screw 4, there are radial small holes, small compression springs 29 and guide pillar 30 (or steel ball) are fitted into the small holes, and engage with the resistant small cone pits 3A.12 which are provided on the right end face of the up-and-down sleeve 3A. The operating process is essentially the same as fig.15-1, the only difference is that, the pure end face friction in fig.15-I is changed into small cone pit resisting with guide pillar (or steel ball) in



fig.17-I. The device shown in fig.17-II is the equivalent mechanism of that shown in fig 17-I, the axially arranged holes of guide pillar in fig. 17-I has been changed into radially arranged holes in fig. 17-II where 3A.13 represents an axially resistant groove. In a word, there can be still many kinds of overload separating devices composed by various overload elements but are the equivalent mechanisms of the overload separating device of the invention.

With respect to the structural form of the "quick and slow speed control device" used in the invention, besides the inserting pin locking device 5 of fig.2-I, fig.19-I is another kind of pawl type locking device 5'. Its structure is essentially the same as the inserting pin type locking device 5, except the cylindrical inserting pin 5.1 is replaced by the pawl 7 of fig.2-I, thus the inserting pin tip 5.1.1 of the original cylindrical inserting pin 5.1 is replaced by a pawl type inserting pin tip 5'.1.1 with double conical faces, or replaced by a pawl type inserting pin tip with single conical face, i.e. the pawl pin tip only with ramp on one side while the other side is a right angle, this inserting pin tip can be inserted into the keyway 4.1 of the screw 4 or retracted from it under the control of the eccentric handle 5',5, the socket 5'.2 for the inserting pin is fixed on the up-and-down sleeve 3A. For convenience of operation, the eccentric handle 5',5 with a plate of arrow shape can be replaced by an eccentric handle 36 with a fork of two branches which cooperate with the end tip of the pawl 30. For mounting spring 6, a groove 3A.10 is cut on the up-and-down sleeve 3A, and a groove 30.3 is cut



on the pawl 30 correspondingly.

The working principle of the pawl locking device is as follows: when the eccentric handle 5'.5 is placed in the vertical position, as shown in fig.18-II, the pawl can be inserted into the keyway 4.1 under the action of a compression spring 5'.2, the action is the same as the "locking device" 5 of fig 2-1. At this time, if the screw 4 rotates in "M" direction, it can via keyway 4.1 and conical face 5'.1.2 of the pawl bring the up-and-down sleeve to rotate in "M" direction, and via the opening and closing actuating device to cause the internal threads of semi-nuts 2A, 2A' to engage with the external threads of the screw 4. At this time, if the eccentric handle 5',5 is placed at its horizontal position, as shown in fig.18-III, then the end tip 5.1.1 of the pawl is lifted apart from the keyway 4.1 of the screw 4. In this manner, no matter how the screw 4 rotates either in "M" or in "N" direction, the up-and-down sleeve 3A cannot be brought to rotate with the screw 4, thereby the engaging and self-locking state between the internal and external threads of the semi-nuts and the screw is held, this is the same as conventional screw-and-nut drive mechanism, and the original functions of slow advance and slow retract is retained, if the carrier to be applied is a screw jack, then at this time, the slow rise or drop of that screw jack can be realized.

In the quickly movable screw jack as shown in fig. 1-II, the left end of the screw 4 passes through the central supporting hole of the left pivot axle O_2 and connects with the transmission means



which imports the driving torque. Among these transmission means, besides the "directly manual type" using a handle which manually and directly rotates the screw and the "manual speed reducing type" using a handle which manually rotates a transmission gear box then brings the screw to rotate, it is characterized in that, the electric source on the car itself may be used, it can use a electric motor 10.8 to drive the transmission gear box 10.9 then drive the screw 4, thus forming an "electrically driven type" or a "manual and electric dual use type" which can be operated either manually or electrically.

The handle 10.7 as shown in fig.-I is composed of a handle body 10.7.5 and rocking arms 10.8.1., 10.7.2. In order to reduce the volume so that the handle can be stored conveniently, it can be made foldable or retractable. The features of fig.21-I are: the rocking arms 10.7.1, 10.7.2 of the control handle 10.7. can be folded separately and quickly with pivot axles 10.7.3 and 10.7.4 as axis, using spring 10.7.6 and steel ball 10.7.7 to accomplish positioning. Fig.21-II shows the mechanism which can be retracted by placing the rocking arm 10.7 into the inner hole 10.7.8 of the hollow rocking arm 10.7.1, 10.7.9 is positioning coiled spring, the handle body 10.7.5 can be made foldable or retractable if necessary.

Summarizing the above, although the carrier related is screw jack which can quickly or slowly up or down, but the most essential nucleus of the invention is a "F nut". That mechanism has a wide variety of applied carrier. If the applied carrier is a screw jack, then



that screw jack is a "double speed screw jack". If the applied carrier is a bench vice, then the invention is a quickly or slowly, opening or closing bench vice. For instance, fig 20 is the embodiment which uses the "F nut" as shown in fig 2-I, but the carrier is changed from a screw jack to a bence vice. The method of retrofitting really is very simple, it needs only change the connecting part between the respective carrier and the "F nut". e.g. the pivot axle O_1 on the supporting seat 1A in fig 2-I is omitted, and the bottom plane 1A'1 and vertical plane 1A'2 on the supporting seat 1A' are utilized to directly contact with the corresponding positioning planes a_1 and a_2 on the fixed body "a" of the bench vice, and the screws "h" are used for fastening. While the screw 4 needs only to connect with the movable body "c" of the bench vice, others remain unchanged. As summary, for the applied field i.e. the applied carrier of the "F nut" of the invention, besides the screw jack, it can be used further in: bench vice, machine vice, pipe vice, sliding table of machine tool, tailstock of a lathe, architectural scaffold whose height can be adjusted and all others require using screw and nut pair as drive device and consistute new mechanism, all are within the scope of the invention. (It needs only using some common methods to change the connection with the above applied carriers.)





Claims

1. A quickly movable screw jack comprising: screw 4, bottom seat 10.5, top support 10.6, lifting link mechanism 10.1-4, left pivot axle O_1 , right pivot axle O_2 , is characterized in that:

(1) a quickly movable automatic and synchronous opening and closing semi-nuts set (brief as "F nut" in the following) is provided on the left and right pivot axles O_2 and O_1 ;

(2) the left end of the screw 4 passes through the central hole of the left pivot axle O_2 and connects with a manual or machinedriven transmission means which imports driving forque, and the threads of the screw 4 on the outer periphery of its right portion can be engaged with the correspondingly semi-nuts in the "F nut" when it is provided on the right pivot axle O_1 ;

(3) the "F nut" comprises: ①supporting seat, ②one or more semi-nuts, ③automatic and synchronous opening and closing mechanism for the semi-nuts; the screw with threads on it passes through the supporting hole of supporting seat in the "F nut" to be fitted with the semi-nuts and its automatic and synchronous opening and closing mechanism;

the features of these three components are: ①supporting seat: provided on which are the portion connected with the applied carrier,





the portion fitted with the screw for its relative rotation and axial movement, the portion fitted with the semi-nuts for its opening and closing movement; besides, there are provided position limiting device, safeguard device, quick and slow speeds changing device;

②semi-nuts: one or more in number, with internal threads less than a half of the periphery, on the semi-nuts are provided: guiding and sliding fitted face or member for realizing the opening and closing movement, actuating member fitted with position limiting device and self-locking device, outer peripheral face and actuating member including cam profile or cam guide pin or transmitting pin to produce and transmit the opening and closing (up-and-down) force;

③semi-nuts automatic and synchronous opening and closing mechanism, compressing the following components: automatic and synchronous overload separating device, actuating device for relatively opening and closing between the screw and the nuts including that of elastically engaging and rigidly self-locking type (all these will be briefed as "opening and closing actuating device" in the following), self-locking device to retain the engagement of the semi-nuts and position limiting device to limit the opening and closing stroke, safeguard device to prevent the semi-nuts from suddenly separating out when the screw jack is lifted, and the "speed changing device" for the quick and slow speeds makes the screw jack a quick or slow drop.

2. The quickly movable screw jack as claim 1, characterized in that, the structure of the "opening and closing actuating device"





in the "semi-nuts automatic opening and closing mechanism" of the "F nut" is: the screw 4 passes through the supporting hole 1A.2 of the supporting seat 1A and the inner hole 3A.1 of the up-and-down sleeve 3A, and cooperates with two semi-nuts 2A and 2A' which can make relative opening and closing (up and down) movement relative to the screw 4, the outer side faces 2A.2, 2A'.2 and 2A.3, 2A'.3 at its left side with about half of its volume are in movable fit with the sliding guideways 1A.3, 1A.4 of the supporting seat 1A, while the other half at the right end is mounted in a large hole at the left end of the upper-and-down sleeve 3A, its "opening and closing actuating device" is an inner-curved cam means on that large hole, the cam profile is composed of two symmetric segments of rise portions 3A.2, 3A.3 and two segments of inner arcs 3A.4 with minimum radius as R_{min} (this is also the self-locking cam profile of the self-locking device to prevent the separation of the closed semi-nuts), as well as other two segments of inner arcs 3A.5 with maximum radius as R_{max} ; the expandable spring 14 is mounted in the grooves 2A.4 and 2A'.4 of the upper and lower two semi-nuts, alternatively, instead of the expandable spring, each of the semi-nuts may use its own individual spring, thereby urging the upper and lower semi-nuts 2A', 2A to separate outward, so as the highest points 2A.5 and 2A'.5 of the outer arcs of the semi-nuts can always firmly press against the inner-curved cam face of the up-and-down sleeve, its clamp plate 17 and stop pin 15 compose the position limiting device for the opening and closing stroke of the semi-nuts.





3. The quickly movable screw jack as claim 1, characterized in that, the "opening and closing actuating device" in the "semi-nuts automatic opening and closing mechanism" of the "F nut" is achieved by making improvement on the "opening and closing actuating device" of the above claim 2, i.e. the actions of automatic opening and automatic closing for the semi-nuts are separately accomplished by two sets of "actuating device", others remain the same; of which the "actuating device" responsible for automatic closing and self-locking of the semi-nuts are still the inner-curved cam profiles 3B.2, 3B.4, 3B.5 on the large hole at left end of the up-and-down sleeve 3B, whereas the "actuating device" responsible for automatic opening of the semi-nuts is undertaken by an end face cam pair which is composed of cam grooves and cam guide pins, the end face cam grooves 2B.2 and 2B'.2 of that cam pair are disposed on the right end face of the semi-nuts 2B and 2B', the cam profiles for actuating the separating action are 2B.3 and 2B'.3, and its cam guide pins 16 and 16' are disposed on the left end face 3B.2 of the up-and-down sleeve 3B, or according to the principle of relative motion, the cam grooves may be disposed on the up-and-down sleeve, while the guide pins may be correspondingly disposed on respective semi-nut.

4. The quickly movable screw jack as claim 1, characterized in that, the "opening and closing actuating device" in the "semi-nuts automatic opening and closing mechanism of the "F nut" is a fully end face cam pair which is composed of kidney-like end face cam





grooves and cam guide pins, its kidney-like end face cam grooves 2C.2 and 2C'.2 are disposed separately on the right end face of the semi-nuts 2C and 2C', and the opening and closing actuating members for the kidney-like cam grooves are composed of the rise portion of cam profile 2C.4 and the drop portion of cam profile 2C.3, while the cam guide pins 16 and 16' are disposed on the left end face 3C.2 of the up-and-down sleeve 3C, as to the position limiting device for the movement range on opening and closing the semi-nuts and the self-locking device after opening and closing the semi-nuts, their actuating members are composed of the arc type cam profiles 2C.7, 2C'.7, 2C.8, 2C'.8 at the two ends of the kidney-like cam grooves.

5. The quickly movable screw jack as claim 1, characterized in that, the structure of the "opening and closing actuating device" in the "semi-nuts automatic opening and closing mechanism" in the "F nut" is that, the kidney-like cam grooves 3D.2 and 3D'.2 are disposed on the cam disc 3D.1 of the up-and-down sleeve 3D, the "actuating members" for the opening and closing movement of the semi-nuts are composed of rise portion cam profile 3D.2.1 and drop portion cam profile 3D.2.2, whereas the position limiting device for the movement range on opening and closing the semi-nuts and the self-locking device after opening and closing the semi-nuts, their actuating members are composed of the arc type cam profiles 3D.2.4, 3D.2.3, and its cam guide pins 16, 16' are disposed on the semi-nuts 2D and 2D', which are restrained to make opening and closing (up





and down) movement in a frame shape or dovetail shape guideway of the supporting seat 1D, as to the restraint of axial shift of the up-and-down sleeve 3D, it is accomplished by providing bosses 16.1 to the end face of cam guide pins 16, 16' for resisting against the right side face 3D.4 of the cam disc 3D.1, or the bosses 16.1 on the above cam guide pins may be eliminated, then the loss bodies may be directly mounted on a means connected with the supporting seat 1D.

6. The quickly movable screw jack as claim 1, characterized in that, the "opening and closing actuating device" in the "semi-nuts automatic opening and closing mechanism" of the "F nut" is that of the elastically engaging and rigidly self-locking type, its structural form is derived from the structure described in claim 5, by eliminating the drop portion of cam profile 3D.2.2 of the kidney-like cam grooves 3D.2 and 3D'.2 (for convenience to discuss, only take one of the cam grooves 3D.2 as example), retaining only the rise portion of cam profile 3D.2-1 and the actuating members for the position limiting and self-locking device, i.e. cam profiles 3D.2.3 and 3D.2.4, and providing in addition one set of elastically engaging and rigidly self-locking actuating means, which is composed of elastically engaging spring (including the integral retractable spring 32 or individual springs mounted separately on respective semi-nut) and self-locking device, one of the structures of the above self-locking device is to use a cam pair which is composed of cam profile 3D.2.4 and cam guide pin 16, other structures are the same as that of claim 5; thus, the "opening and closing actuating device"





substantially consists of two sets of actuating device: of which one set is the "separating actuating device" to accomplish the automatic separation of the semi-nuts 2D and 2D', one of its embodying scheme is realized by a cam pair which is composed of rise portion cam profile 3D.2.1 on the cam disc 3D.1 and cam guide pin 16 on the semi-nut 2D, or is realized by a cam pair which is composed of guide pin 16 on the cam disc 3D.1 and rise portion cam profile 3D.2.1 on the semi-nut 2D, the another set is an elastically engaging and rigidly self-locking "engaging actuating device", one of its embodying scheme is to use the above-mentioned elastically engaging and rigidly self-locking actuating means to realize an engaging rate of 100%.

7. The quickly movable screw jack as claim 1, characterized in that, the "opening and closing actuating device" in the "semi-nuts automatic opening and closing mechanism" of the "F nut" is achieved by making improvement on the basis of the "opening and closing actuating device" as described in claim 2, it is realized by a radial cam pair which is composed of cam profiles 3E.1.2 and 3E.1.1 provided on the inner and outer cylindrical body of the up-and-down sleeve 3E and the cam conjugating pins 18, 19 mounted on the transmitting pins 16E and 16E' at the ends 2E.1 and 2E'.1 of the semi-nuts, other structures remain the same.

8. The quickly movable screw jack as claim 1, characterized in that, the "opening and closing actuating device" in the "semi-nuts





automatic opening and closing mechanism" of the "F nut" is achieved by making improvement on the "opening and closing situating device" as described in claim 2, it is realized by a crankslider mechanism, the crank 20 has two pivot axle holes O_2 and O_3 , of which pivot axle hole O_2 is connected with the semi-nut 2F, while O_3 is connected with the up-and-down sleeve 3F, other structures remain the same.

9. The quickly movable screw jack as claim 1, characterized in that, the "opening and closing actuating device" in the "semi-nuts automatic opening and closing mechanism" of the "F nut" is realized by a cam pair which is composed of the profiles (including rise portion profile 2F.2 and drop portion profile 2F.3) on the outer periphery of the semi-nut 2F and the up-and-down plate 3F.1 on the up-and-down sleeve 3F, the semi-nut 2F has its internal threads 2F.6 less than a half of the periphery, a semi-plain-hole 2F.8 with diameter greater than that of the screw, two pivot axles 2F.7 at front rear sides connected with the carrier (screw jack), and a rise portion of cam profile 2F.2 and a drop portion of cam profile 2F.3 on its periphery; the screw 4 passes successively through left end hole 1F.1 of the supporting frame 1F, plain hole 2F.8 of the semi-nut, hole 3F.3 of the up-and-down sleeve, and right and hole 1F.2 of the supporting frame; when the up-and-down plate 3F.1 of the "actuating device" rotates to the upmost position where it is inserted in a sliding fit between an upper top face 2F.9 on the outer periphery of the semi-nut 2F and an upper bottom face 1F.3 of the inner cavity





of the supporting frame 1F; the above "actuating device" can be reformed, such as: (1) the pivot axles 2F.7 connected to the carrier (screw jack) and disposed initially at the front and rear sides on the outer periphery of the semi-nut 2F, can be modified as to be mounted on the front and rear side faces of the left side wall of the supporting frame 1F, thus the supporting frame 1F is changed into a supporting seat 1G with pivot axles, i.e. there mounted pivot axles 1G.7 and 1G'.7 on the front and rear side faces 1G.8, 1G.9 of the side wall of the supporting seat 1G; the semi-nut after dropping off its pivot axles 2F.7 is changed into a semi-nut 2G without pivot axle; others such as the up-and-down sleeve 3G are completely the same as the above up-and-down sleeve 3F; or (2) the original supporting frame 1F is eliminated, only the semi-nut 2F with pivot axle O_1 and the up-and-down sleeve 3F are retained, other main structures remain the same, i.e. with semi-nut 2F and up-and-down sleeve 3F; to prevent axial shift, a stop pin 12 is provided on the up-and-down plate 3F.1 of the up-and-down sleeve, correspondingly a deep groove 2F.10 is cut on the semi-nut 2F to cooperate with the stop pin 12; or (3) the original supporting frame 1F is eliminated, other main structures remain the same, with semi-nut 2F and up-and-down sleeve 3F; to prevent axial shift, an anti-shift frame 33 is added, there are two lug holes 33.1 and 33.2 on the frame which can be put on the pivot axles 2F.7 on the front and rear side faces of the semi-nut 2F.

10. The quickly movable screw jack as claim 1, characterized





in that, the structure of the "opening and closing actuating device" in the "semi-nuts automatic opening and closing mechanism" of the "F nut" is realized by an eccentric cam kinematic pair which is composed of an eccentric cam sleeve 3H and the upper and lower two planes 1H.4 and 1H.3 of a frame-like rectangular opening of the semi-nut supporting seat 1H; the semi-nut supporting seat 1H has a shape of frame, in the center of the frame, there is a rectangular opening, the upper and lower planes 1H.4 and 1H.3 of that opening is in sliding fit with the outer peripheral surface 3H.2 of the eccentric cam 3H, internal threads 1H.6 and 1H.5 which are less than a half of the periphery and semi-plain-holes 1H.1 and 1H.2 with diameter greater than that of the screw 4 are provided separately in the left and right two side walls 1H.7 and 1H.8 of the frame, the screw 4 successively passes through the plain hole 1H.1 of left wall, the inner hole 3H.1 of eccentric cam and the plain hole 1H.2 of right wall, besides, at the front and rear sides of the left side wall of the frame, pivot axles O_1 are provided to be connected with the screw jack body 10.1 and 10.2 of the practical carrier, furthermore, overload separating means 7 is provided on the eccentric cam 3H, speed changing mechanism 5 is provided on the frame 1H.

11. The quickly movable screw jack as claim 1, characterized in that, the "opening and closing actuating device" in the "semi-nuts automatic opening and closing mechanism" of the "F nut" is realized by a cam kinematic pair which is composed of the cam





profile 2J.1 on the outer periphery of the semi-nuts 2J and the upper and lower two planes 1J.1 and 1J.2 of the frame-like rectangular opening in the supporting frame 1J, the eccentric cam profile 2J.1 on the outer periphery of the semi-nuts 2J in fact is a cylindrical surface with O_3 as center, there are two eccentric holes in the body of semi-nut 2J, the centers of these holes are respectively O_2 and O_4 , both their eccentric distances from the center O_3 are equal to e (e is slightly greater than the depth of a spiral thread), the eccentric hole with center O_4 is a semi-plain-hole 2J.3 with diameter greater than that of the screw 4, the eccentric hole with center O_2 has its internal threads 2J.4 less than a half of the periphery, on the semi-nut 2J are further provided two up-stroke limiting pins 35, 36 and a radial hole 2J.5, in which is fitted with a pawl 34, and a spring hoop 6 presses against the pawl 34, causing the cone body of pawl tip 34.1 to press against the outer periphery of the screw 4 or be inserted into the keyway 4.1; the supporting seat 1J has a shape of frame, in the opening of the frame, semi-nut 2J is seated, the screw successively passes through the left frame supporting hole 1J.3 of the supporting seat 1J, the semi-nut hole and the right frame supporting hole 1J.4, at the front and rear sides of the left frame part 1J.6 are mounted pivot axles 1J.5 (with O_1 as center) to be connected to the practical carrier (screw jack);

in order to improve the engaging property, besides the cylindrical body, the shape of cam profile 2J.1 on the outer periphery of the semi-nut 2J can be designed into other cam curves





according to the requirement.

12. The quickly movable screw jack as any one of claims 1-11, characterized in that, the structure of the "automatic and synchronous overload separating device" in the "semi-nuts automatic opening and closing mechanism" of the "F nut" is:

on the up-and-down sleeve 3A, there is provided a radial pawl hole 3A.7, in which is mounted a pawl 7, a spring hoop 6 is fitted on the pawl 7, while on the screw 4, there is provided one or more axial keyway 4.1 so as to be fitted with the pawl 7, at the lower end of the pawl 7 there are two ramps 7.1, or only one ramp with other plane at right angle to consistute a pawl of single direction as required.

13. The quickly movable screw jack as any one of claims 1-11, characterized in that, the structural form of the "automatic and synchronous overload separating device" in the "semi-nuts automatic opening and closing mechanism" of the "F nut" comprises an up-and-down sleeve 3A, a friction ring (cone) 21, a guide key 23, a compression spring 23 and a check ring 24, the friction ring (cone) 21 is mounted in the up-and-down sleeve 3A, and is connected to the screw 4 through the guide key 23, while on the said screw 4, there is provided axial keyway 4.1 so as to be fitted with the guide key 23; or the contact faces 21.1 and 3A.10 of the friction ring (cone) can be replaced by a pair of teeth, meanwhile the amount of deformation of the compression spring 22 must be





increased so as to give a space for the left and right movement which is slightly greater than the depth that the teeth would be inserted in.

14. The quickly movable screw jack as any one of claims 1-11, characterized in that, the "automatic and synchronous overload separating device" in the "semi-nuts automatic opening and closing mechanism" of the "F nut" comprises an elastically expandable ring 26, a transmitting pin 27, an up-and-down sleeve 3A and a check ring 24, there is an open slot 26.1 provided on the elastically expandable ring 26 for producing sufficient frictional force, when the expandable ring is in the free state, its inside diameter is slightly smaller than the screw 4, the expandable ring 26 is mounted between the screw and the up-and-down sleeve and is connected with the up-and-down 3A sleeve through the transmitting pin 27.

15. The quickly movable screw jack as any one of claims 1-11, characterized in that, the "automatic and synchronous overload separating device" in the "semi-nuts automatic opening and closing mechanism" of the "F nut" comprises an elastically expandable ring 25 with an opening 25.1, a guide key 23 and a check ring 24, when in free state, the outside diameter 25.2 of the expandable ring 25 is slightly greater than the inside diameter of inner hole 3A.11 of the up-and-down sleeve, the expandable ring is mounted between the screw and the up-and-down sleeve, and is connected to the screw provided with axial keyway 4.1 through the guide key 23.





16. The quickly movable screw jack as any one of claims 1-11, characterized in that, the "automatic and synchronous overload separating device" in the "semi-nuts automatic opening the closing mechanism" of the "F nut" comprises a sliding sleeve 28, a guide key 23, many spaings 29, many guide pillars 30 and an up-and-down sleeve 3A, small compression springs 29 and guide pillar 30 are fitted into some axial small hole on left end face of sliding sleeve 28 and engage with the resistant small cone pits 3A.12 which are provided on the right end-face of the up-and-down sleeve 3A, the sliding sleeve 28 in connected with the screw 4 through the guide key 23, axial keyway 4.1 is provided on the screw 4 so as to fit with the guide key 23, guide pillar 30 can be replaced by steel ball.

17. The quickly movable screw jack as any one of claims 1-11, characterized in that, the "automatic and synchronous overload separating device" in the "semi-nuts automatic opening and closing mechanism" of the "F nut" comprises a sliding sleeve 28, a guide key 23, many springs 29, many steel balls 30, an up-and-down sleeve 3A and many resistant small slots 3A.13, steel balls 30 and springs 29 are mounted in radial small holes of the up-and-down sleeve 28, steel balls 30 are fitted with the resistant slots or pits 3A.13, the sliding sleeve 28 is connected with the screw through the guide key 23, axial keyway 4.1 is provided on the screw 4 to fit with the guide-key 23, steel ball 30 can be replaced by guide pillar.

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18. The quickly movable screw jack as any one of claims 1-11, characterized in that, the "quick and slow speeds control device" in the "semi-nuts automatic and synchronous opening and closing mechanism" of the "F nut" employs an inserting pin type locking device which is composed of an inserting pin 5.1, a socket for inserting pin 5.3, an axial pin 5.4 and an eccentric handle 5.5, the front end of the inserting pin 5.1 is a cylindrical inserting pin tip 5.1.1, it can be inserted into the locking hole 3A.8 on the up-and-down sleeve 3A, the inserting pin tip 5.11 can be inserted into the locking hole 3A.8 or be withdrawn from it if the arrow direction of the operating eccentric handled be controlled to be vertical (or horizontal), the socket 5 for the inserting pin is mounted on the supporting seat 1A.

19. The quickly movable screw jack as any one of claims 1-11, characterized in that, the "quick and slow speed control device" in the "semi-nuts automatic and synchronous opening and closing mechanism" of the "F nut" employs pawl type locking device 5', its structure is essentially the same as the inserting pin type locking device 5, except the cylindrical inserting pin 5.1 is replaced by the pawl 7, thus the inserting pin tip 5.1.1 of the original cylindrical inserting pin 5.1 is replaced by a pawl type inserting pin tip 5'.1.1 with double conical faces, or with single conical face, i.e. the pawl pin tip only with ramp on one side while the other side is a right angle, this inserting pin tip can be inserted into the keyway 4.1 of the screw 4 or retracted from it under the control of the eccentric





handle 5'.5, the socket 5'.2 for the inserting pin is fixed on the up-and-down sleeve 3A, for convenience of operation, the eccentric handle 5'.5 with a plate of arrow shape can be replaced by an eccentric handle 36 with a fork of two branches which cooperate with the end tip of the pawl 30, for mounting spring 6, a groove 3A.10 is cut on the up-and-down sleeve 3A, and a groove 30.3 is cut on the pawl 30 correspondingly, in the same manner, it needs only to operate the handle 36 to a correct direction, such as vertical or horizontal, the end tip 30.2 of the pawl can be retracted from the keyway 4.1 of the screw 4 or inserted into it.

20. The quickly movable screw jack as claim 1, characterized in that, left (or right) handed threads are provided on the outer periphery of the left portion of the screw 4 so as to be fitted with the corresponding semi-nuts in the "F nut" provided on the left pivot axle O_2 , whereas right (or left) handed threads are provided on the outer periphery of the right portion of the screw 4 so as to be fitted with the corresponding semi-nuts in the "F nut" provided on the right pivot axle O_1 , further, the transmission means to rotate the screw 4 may be disposed at any end of the screw.

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