Oct. 10, 1950 M. HAINAULT 2,525,669

AUTOMATIC TREPANS

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Fig.1.

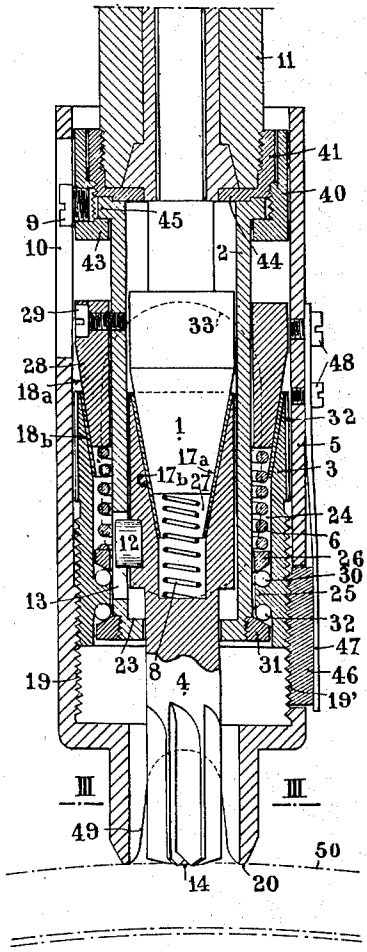


Fig.2.

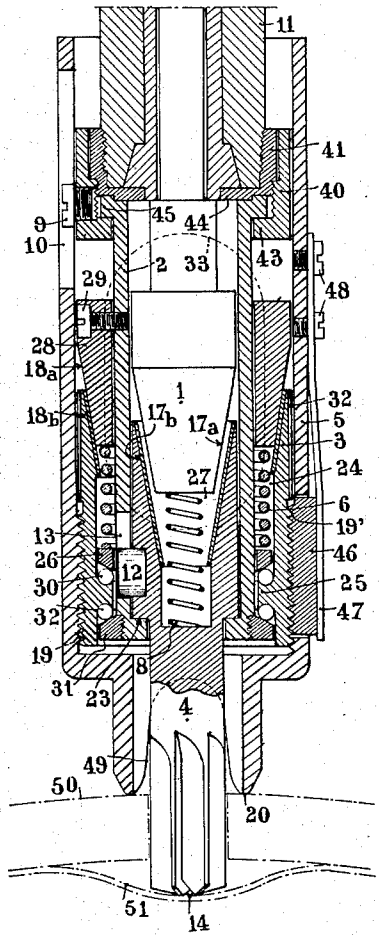
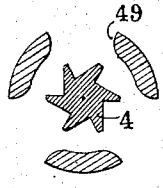


Fig.3.



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AUTOMATIC TREPANS

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3 Claims. (Cl. 128—310)

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This invention is concerned with improvements in automatic trepans for use in perforating the brain-pan and which comprise an automatic stop which prevents the cutter from suddenly piercing the skull.

Trepans known heretofore comprise on one hand a cutter which performs the perforating operation and a claw or like clutch adapted, as the cutter is pressed against the skull, to throw the cutter into gear and to impart the rotational movement of a motor to said cutter, the latter being thrown out of gear automatically at the end of the perforating operation as the apex of the cutter is deprived of its rest, and on the other hand a stop consisting of a point which takes its rest on the outside of the skull adjacent to the hole drilled by the cutter, said stop being raised in proportion as the cutter sinks by the action of a telescopic device whose rotary portion derives its movement from the rotational movement of the cutter through the medium of a gear set and a claw or like clutch by which the said rotary portion of the telescopic device is only geared with the driving portion of said clutch when the tip of the stop member finds a rest on the outside of the skull.

Thus, at the completion of the perforating operation, the cutter is disengaged automatically from the motor and comes to a standstill while the tip of the stop member which is still in engagement with the outside of the skull prevents the cutter from getting deeper into the skull.

However, in this known arrangement, the claw or like clutches suffer from the inconveniences that the cutter is abruptly thrown into or out of engagement with or from the rotary portion of the stop telescopic device, with the result that vibration of the cutter takes place. Such vibration is made still worse by the small play that exists between the teeth of the gear set that transmits the rotational movement of the cutter to the driving portion of the clutch which enables to gear in the rotary portion of the stop telescopic device.

For the purpose of doing away with such vibration one object of this invention is to equip the cutter and/or the rotary portion of the stop telescopic device with friction gearings.

A further object of the invention is to provide the trepan with a stop constituted by the lower end of a sleeve in which the cutter and the rotary portion of the telescopic device of said stop are housed, said lower end coming into engagement with the skull at points located around the hole drilled by the cutter.

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According to a further feature of the invention the driving portion of the telescopic device clutch is coaxial with and driven directly by the cutter instead of being driven through a gear set as in the aforementioned known arrangement, and the stop-raising telescopic device is composed of a pair of parts coaxial with the cutter.

A further feature of the invention resides in the provision in the sleeve and more particularly in that end of the same which performs the function of a stop of notches enabling to see the end and more particularly the apex of the cutter, the lower end of the sleeve thus engaging the outside of the skull at two or more places of its periphery rather than all around the cutter.

Due to the stop engaging the skull at several places around the cutter the latter can be set in position much more easily than where one single rest is provided.

A preferred embodiment of the subject-matter of the invention will now be described by way of example, reference being had to the appended drawing in which:

Figure 1 is a vertical sectional view of the trepan according to the invention with the cutter tip engaging the skull and ready to begin the perforating operation.

Figure 2 is a similar sectional view of the trepan in the position assumed by the same once the skull is perforated throughout and no resistance is opposed any longer to the penetration of the cutter.

Figure 3 is a sectional view taken on line III—III in Fig. 1.

A rotary axial member 1 is rotated at its upper end by known means, for instance a motor and a flexible shaft which may be rigidly coupled with member 1 by means of a chuck or a strap.

The member 1 has a tapered lower end 17*a* on which a bore 27 provided in the upper portion of the cutter 4 is adapted to fit with its tapered surface 17*b*. The pair of surfaces 17*a*, 17*b* provide a friction clutch. A conical sleeve made of graphite may be interposed between the surfaces of the pair.

The upper portion of the cutter 4 is slidably received in the tubular part 2 between an upper end portion in which the cutter 4 is operatively connected with the rotary member 1 through the friction clutch 17*a*, 17*b* and a lower end position in which the surfaces 17*a*, 17*b* are disengaged from each other. A spring 8 urges the said surfaces away from each other; said spring is housed in the bore 27 and is pressed between the lower end face of part 1 and the bottom of the bore 27,

that is, the cutter 4 itself. The cutter 4 is coupled with the rotary part 1 whenever the point 14 of the cutter 4 is laid upon such a bearing point at the outside of a skull and the spring 8 is compressed.

The cutter 4 is rotationally connected with the tubular part 2 by a key 12 slidably received in a longitudinal slot 13 in the tubular member 2. Said key 12 moves up and down in said slot 13 as the cutter 4 is reciprocated between its top and its bottom end position in the tubular part 2.

The downward motion of the cutter 4 in part 2 is limited by a shoulder 23 in part 2.

In the coupled condition of the rotary member 1 and the cutter 4 the former and the tubular part 2 partake of the same rotary motion. When the rotary member 1 and the cutter 4 are loose from each other the former revolves freely within the tubular member 2.

Secured by means of a screw 29 on the outside of the tubular member 2 is a collar 28 formed with a taper skirt portion 18*a*.

Surrounding the lower end of the tubular member 2 are an additional tubular member 3 and a sleeve 5 whose lower end 20 acts as a stop.

The tubular member 3 is formed with an internal taper surface 18*b* adapted to fit on the taper surface 18*a*. The pair of taper surfaces 18*a*, 18*b* provide a friction clutch.

The lower portion of the part 3 is provided with an outer thread 19 by means of which said part can be screwed in the sleeve 5.

An annular space 24 is left free between the tubular parts 2 and 3 which are centered with respect to each other by means of an inwardly projecting ring portion 25 formed in part 3 and in which part 2 is slidably fitted.

A spring 6 housed in the annular space 24 urges the surfaces 18*a*, 18*b* of the friction clutch away from each other. With this end in view said spring 6 rests with one end thereof on the lower end face of the collar 28 and with its other end through the medium of a ring 26 and balls 30 on the ring portion 25 in part 3. The advantage with said ring 26 and balls 30 that transmit the thrust from spring 6 to the annular projection on part 3 is that the rotational movement of part 28 cannot be transmitted to part 3 through the spring 6 itself in the disengaged condition of the surfaces 18*a*, 18*b*.

The longitudinal displacement of part 3 with respect to part 2 is limited by a ring 31 acting as a stop for the annular projection 25 through the medium of balls 32 interposed between said ring 31 and said projection 25. The purpose of said balls 32 is to prevent the rotational movement of part 2 and ring 31 from being transmitted frictionally to part 3.

The part 3 and the sleeve 5 provide a telescopic device. The part 3 is able to rotate while the sleeve 5 is retained against rotation by a screw 9 whose head is slidably received in a slot 10 in said sleeve 5, said screw being inserted in a non-rotary ring 40 which is screwed on a further ring 41 which in turn is screwed on a non-rotary member 11 which is or can be made rigid with a handle.

The rings 40 and 41 are provided with flanges 43, 44 that straddle a flange 45 on part 2; in this manner said member 2 is retained against longitudinal displacement with respect to part 11 and to the rotary part 1.

The upper portion 32 of the outer surface of part 3 is knurled and apertures 33 are cut in the wall of the sleeve 5. By acting on the knurled portion through said apertures 33 the part 3 can be rotated with respect to the sleeve 5 and thereby screwed on said sleeve 5 owing to the provision of the thread 19; it is thus possible to adjust the position of the part 3 with respect to the sleeve 5.

A block 46 is cut in the sleeve 5 and is resiliently pressed against the part 3 by a spring leaf 47 secured on the sleeve 5 by means of a screw 48. Said block 46 is formed with a portion 19' of the thread 19 and is adapted to sprag the rotation of the part 3. The advantage with such spragging action is that the part 3 is stopped immediately as soon as the surfaces 17*a*, 17*b* or 18*a*, 18*b* are disengaged from each other.

Notches 49 are cut in the lower portion of the sleeve 5. They enable an observer to ascertain the place on the skull at which the point 14 is applied.

The operation is as follows:

First of all the position of part 3 with respect to the sleeve 5 is so adjusted that the point 14 is flush with the stop 20 in the expanded condition of the spring 8. Thereafter the point 14 is applied on the desired place on the skull 50; the spring is stressed, the cutter 4 is coupled with the rotary member 1 by means of the friction clutch 17*a*, 17*b*; the cutter is thus driven into rotation.

As point 14 of the cutter 4 sinks into the skull 50, the point 20 comes into contact in its turn with the skull 50. By pushing upwardly the element 3 ascends and the element 3 screwed on the threads 19 brings about the contact of the portions 18*b* and 18*a* of the clutch with compression of the spring 6. The element 28 being always in rotation it results that the element 3 rotates in turn. Since said part 3 is screwed at the thread 19 in the fixed sleeve 5 the rotary motion imparted thereto causes said sleeve 5 to move upwards. Said ascending motion cannot exceed the downward motion of the cutter 4 since otherwise the stop 20 would come out of engagement with the skull and the part 3 would be disconnected from tube 2 due to the action of spring 6 which urges the surfaces of the friction clutch 18*a*, 18*b* away from each other.

As soon as at the completion of the perforating operation no resistance is opposed any longer to the penetration of the cutter tip the spring 8 is released and only part 1 goes on rotating. The stop 20 remains in engagement with the outside of the skull, so that the tip 14 of the cutter will not sink farther into the skull while rotating.

Consequently, at the completion of the perforating operation, the cutter urged downward by the spring 8 is limited in its travel by the stop 23, its longitudinal displacement being attended with no rotary motion, so that the cutter tip 14 will slightly loosen the cartilages and the membrane 51 from the skull 50 without perforating them.

It is to be understood that the above-described improvements in automatic trepans are applicable to all perforating apparatus in which a cutter, a drill or a bit is used in combination with an automatic stop constituted by the lower end of a sleeve having said cutter, drill or bit arranged inside thereof as well as to all perforating apparatus in which a rotary cutter, drill or bit is used in combination with a telescopic automatic stop in the form of a sleeve or the like (and particularly in the known form of a point in non-coaxial relation to the cutter) characterized thereby that said members are driven through frictional devices.

What I claim is:

1. An automatic trepan with a telescopic stop comprising a cutter, a non-rotary sleeve whose lower portion provides a stop adapted to rest on the skull round the hole drilled by the cutter, having a cylindric inner wall, being coaxial with the cutter and provided with a thread, a first tubular member rotationally rigid with said cutter and in which the upper portion of said cutter is slidably received, an axial rotary member whose lower portion is located within said first tubular member, a first friction clutch adapted to transmit the rotational movement of said axial rotary member to said cutter, a spring urging the friction surfaces of the first clutch away from each other whenever the tip of said cutter finds no rest, a collar rotationally rigid with said first tubular member, a second tubular member coaxial with said cutter provided with a thread on its outer wall, said second tubular member being adapted to screw itself in said sleeve, a second friction clutch adapted to transmit the rotational motion of said collar to said second tubular member, an annular projection on the inner wall of said second tubular member, the inner edge of said annular projection coming into engagement with the outer wall of said first tubular member, a ring above said annular projection, balls between said annular projection and said ring, a spring compressed between said collar and said ring tending to throw said second

clutch out of engagement, a ring screwed on the lower end of said first tubular member and balls between said ring and said annular projection.

2. An automatic trepan with a telescopic stop as claimed in claim 1 wherein the sleeve is provided with notches through which said second tubular member can be rotated manually for the purpose of screwing said second tubular member in said sleeve and thereby to adjust the position of the same with respect to said sleeve.

3. An automatic trepan with a telescopic stop as claimed in claim 1 comprising a block cut in said sleeve and formed with a portion of the thread of said sleeve on its inner wall, and a spring leaf having one end secured to said sleeve and its other end pressing said block into engagement with the outer wall of said second tubular member.

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