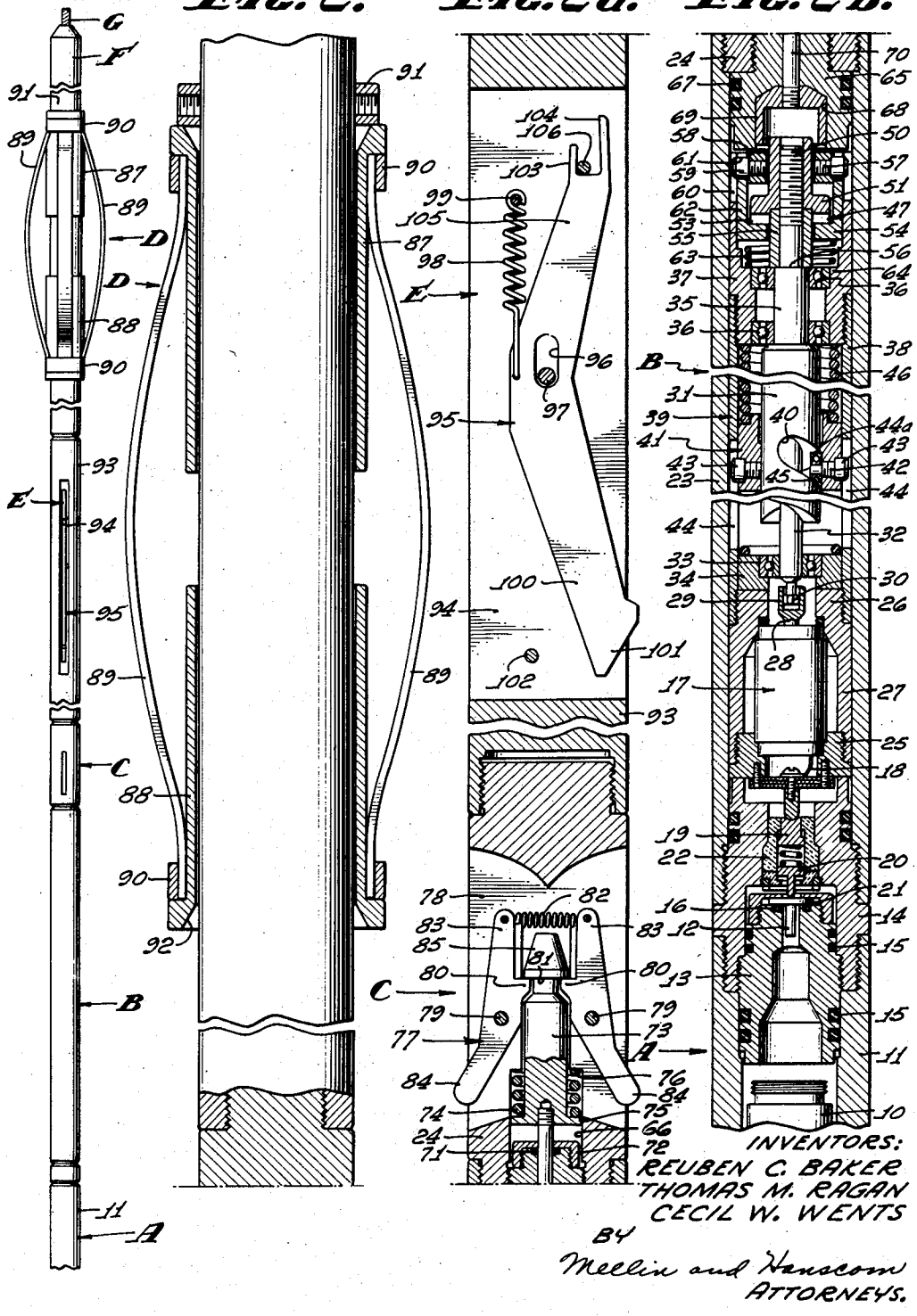
July 12, 1960 R. C. BAKER ET AL 2,944,603

SUBSURFACE ELECTRIC CURRENT GENERATING APPARATUS

Filed Jan. 30, 1956 3 Sheets-Sheet 1

FIG. 1. FIG. 2. FIG. 2a. FIG. 2b.



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Filed Jan. 30, 1956 3 Sheets-Sheet 2

FIG. 3.

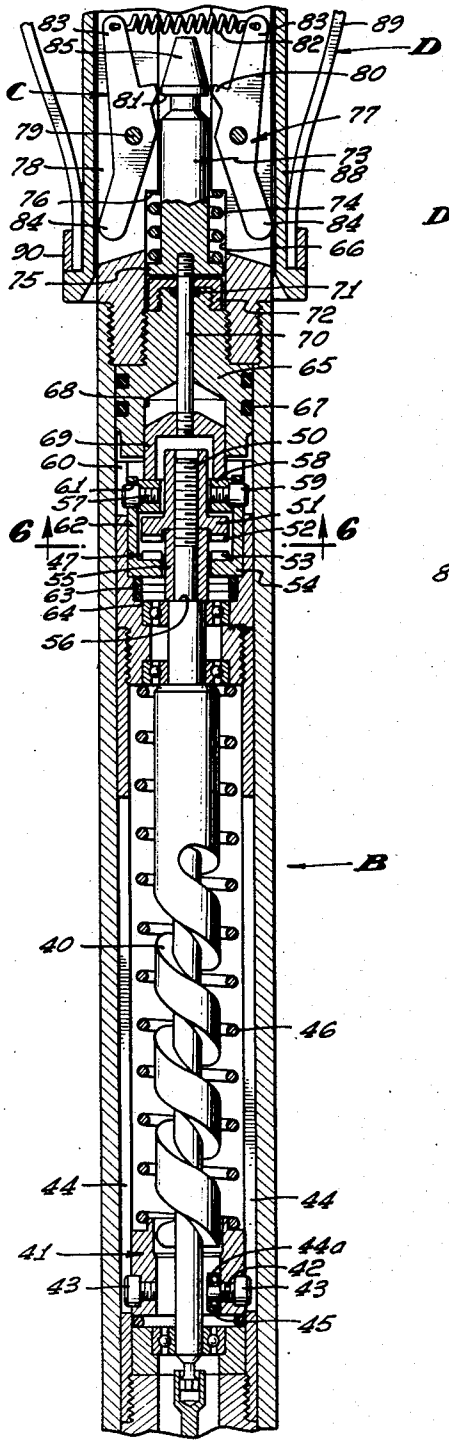
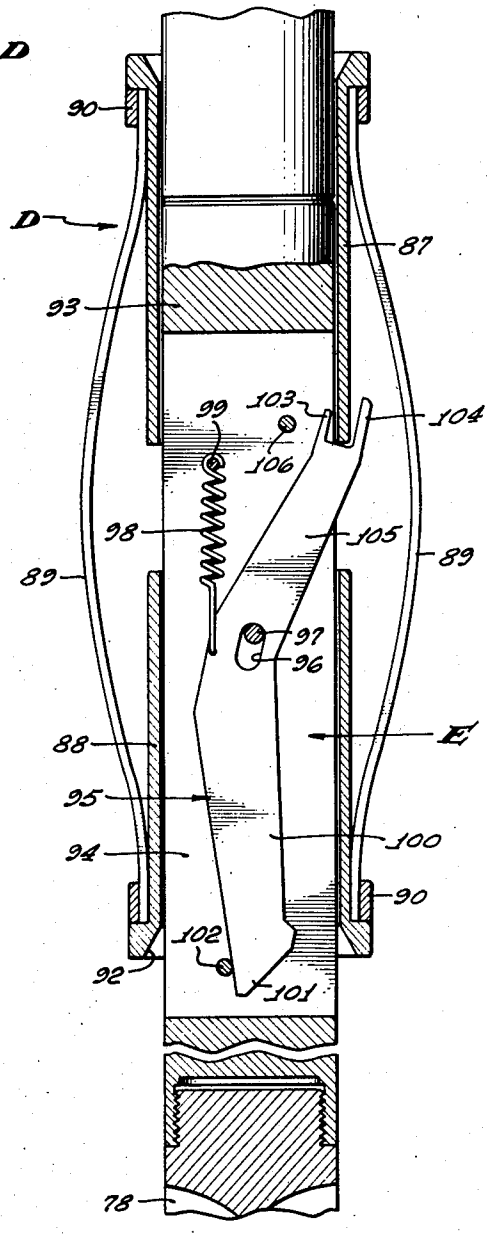


FIG. 5.



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Filed Jan. 30, 1956 3 Sheets-Sheet 3

FIG. 4.

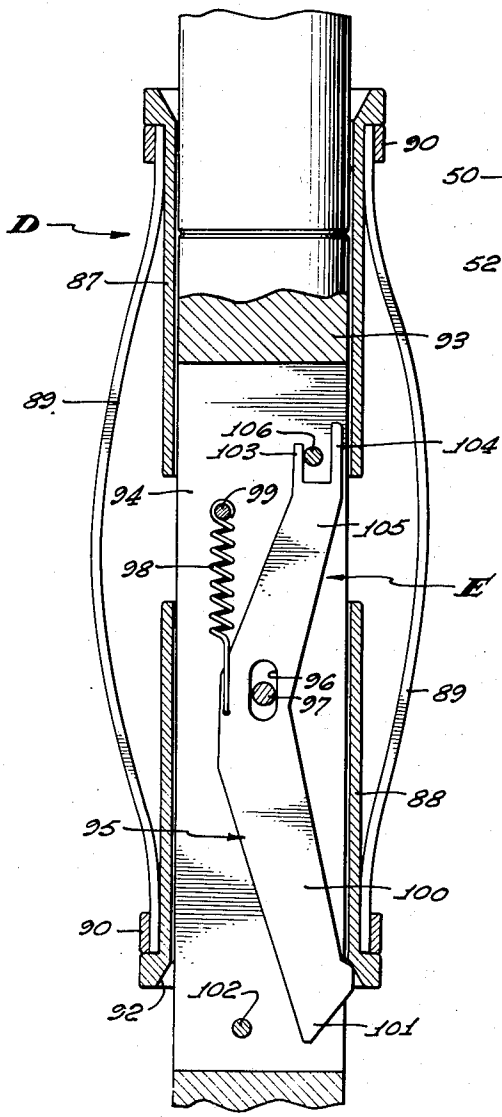


FIG. 6.

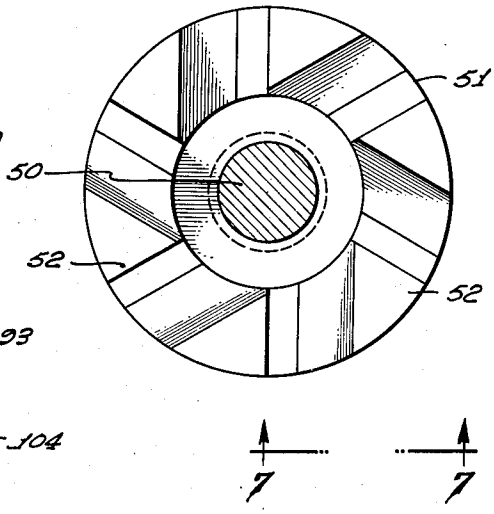
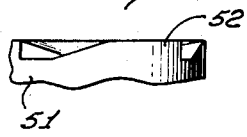


FIG. 7.



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2,944,603

SUBSURFACE ELECTRIC CURRENT GENERATING APPARATUS

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19 Claims. (Cl. 166—65)

The present invention relates to well apparatus, and more particularly to subsurface apparatus useful in the performance of different operations in oil, gas, water, and similar well bores.

An object of the present invention is to provide an improved subsurface electric current generating apparatus, generation of the current being under the control of the operator at the top of the well bore.

Another object of the invention is to provide electric current generating apparatus adapted to be lowered in a well bore on a running-in string, such as a wire line, operation of the apparatus being instituted at any desired time by manipulation of the running-in string.

A further object of the invention is to provide a subsurface electric current generating apparatus adapted to be lowered in a well bore on a running-in string, in which institution of electric current generation is responsive to manipulation of the running-in string, and in which operation of the apparatus can be prevented by suitable manipulation of the running-in string.

An additional object of the invention is to provide an improved spring motor device for rapidly rotating an electric generator disposed in a well bore.

Yet another object of the invention is to provide an improved spring motor adapted to be disposed in a well bore for rotating other equipment in the well bore, the spring motor being sturdily built and comparatively simple in construction and operation, while being capable of storing and transmitting a large amount of energy.

Still a further object of the invention is to provide a spring motor having an improved releasable latch mechanism for preventing operation of the motor until desired.

Another object of the invention is to provide a spring motor apparatus adapted to be lowered in a well bore on a running-in string, operation of the apparatus being instituted in response to manipulation of the running-in string. More specifically, the apparatus includes a friction drag device adapted to frictionally engage the wall of the well casing disposed in the well bore, the device effecting release of the spring motor in response to upward movement of the running-in string.

Yet a further object of the invention is to provide a spring motor apparatus adapted to be lowered in a well bore on a running-in string, and in which operation of the motor can be initiated by a friction drag device, manipulation of the running-in string causing the friction drag device to be secured in an ineffective position, if it is desired to avoid operation of the spring motor, once it has been lowered in the well bore.

Still another object of the invention is to provide apparatus to be lowered in a well bore on a running-in string, and embodying a friction drag device for initiating operation of the apparatus in response to manipulation of the running-in string, in which the running-in string can be manipluated to prevent the friction drag device from moving longitudinally of the running-in string and thereby forestall the friction drag device from initiating operation of the apparatus.

This invention possesses many other advantages, and has other objects which may be made more clearly apparent from a consideration of a form in which it may be embodied. This form is shown in the drawings accompanying and forming part of the present specification. It will now be described in detail, for the purpose of illustrating the general principles of the invention; but it is to be understood that such detailed description is not to be taken in a limiting sense, since the scope of the invention is best defined by the appended claims.

Referring to the drawings:

Figure 1 is a side elevational view on a reduced scale, of apparatus embodying the invention and adapted to be lowered in a well bore;

Figs. 2, 2*a* and 2*b* together constiute a side elevational and longitudinal sectional view, on a large scale, of the apparatus disclosed in Fig. 1, with the parts disposed in the position for lowering the apparatus in a well bore, Fig. 2*a* constituting a lower continuation of Fig. 2 and Fig. 2*b* constituting a lower continuation of Fig. 2*a*;

Fig. 3 is a longitudinal section through the spring motor, disclosing the parts in the position they occupy following release of the spring motor;

Fig. 4 is a view of the friction drag device and its control mechanism, with the parts in another operative position;

Fig. 5 is a view similar to Fig. 4, disclosing the friction drag device and its control device in the position in which the control device prevents operation of the friction drag device;

Fig. 6 is an enlarged cross-section taken along the line 6—6 on Fig. 3;

Fig. 7 is a fragmentary side elevation taken along the line 7—7 on Fig. 6.

In the specific apparatus disclosed in the drawings, it is desired to generate an electric current for initiating operation of a fluid pressure operating device A, such as disclosed in United States Patent 2,618,343. The electric current is supplied by a motor generator device B secured to the upper end of the fluid pressure operating device. The motor portion of the motor generator device is of the spring type, being initially prevented from operating by a latch device C secured to the upper end of the motor generator device.

The latch device C is releasable when a friction drag device D is permitted to engage it. Whether such engagement can occur is dependent upon a drag control device E secured to the upper end of the latch device C the upper end of the drag control device, in turn, being secured to sinker bars F, the upper end of which may be attached to a suitable running-in string G, such as a wire line extending to the top of the well bore. Initially, the friction drag device D, which is slidable along the sinker bars F, drag control device E and latch device C is disposed in an upper position on the sinker bars.

Only the upper portion of the fluid pressure operating device A, described in the above-identified patent, is shown in the drawings. Such device will generate a fluid pressure for the purpose of performing another operation in a well bore, such as to set a well packer (not shown) therewithin. The fluid pressure necessary for setting the well packer is derived through the combustion of a power charge **10** disposed in a cylinder **11** forming the upper part of the fluid pressure operating device. The initiation of the combustion of the power charge is secured by firing a cartridge **12** mounted in a gun barrel **13** threadedly attached to a cylinder head **14** that is threadedly secured to the upper end of the cylinder. Leakage of fluid between the gun barrel **13**, on the one hand, and the cylinder **11** and its head **14**, on the other hand, is prevented by suitable side seals **15**, there also being a gasket **16** under the head of the

cartridge 12 to prevent leakage by the latter into and out of the cylinder.

The cartridge 12 has a suitable supply of gunpowder therein, which is detonated in response to the passage of electric current through a filament (not shown) in the cartridge. In the present case, the electric current is supplied by an electric generator 17 of any suitable type, current from the generator passing through a suitable lead 18 to a series of suitable electric conducting elements 19, and to a spring pressed contact 20 that engages a suitable contact point 21 at the upper end of the cartridge connected to one end of the cartridge filament. The other line from the generator is grounded, as well as the connection running to the other end of the filament. The conductive elements 18, 19, 20 running from the generator to the filament are surrounded by suitable insulators 22 to prevent short circuiting of the current from the generator, all in a known manner.

The cylinder head is threadedly secured to the lower end of a motor-generator casing 23, the upper end of which is threadedly attached onto the lower end of a latch body 24 forming part of the latch device C for controlling the operation of the motor-generator set B. The generator 17 is clamped between an end plate 25 resting upon the upper end of the cylinder head 14 and the upper flange portion 26 of a clamp sleeve 27 threadedly secured to the end plate. An armature shaft 28 extends upwardly from the generator casing, this shaft terminating in a non-circular socket 29 receiving a companion non-circular end 30 of a screw drive shaft 31 that extends upwardly in the housing 23 to a substantial extent.

The lower end 32 of the shaft 31 is rotatably mounted in an anti-friction bearing 33 carried in a bearing support 34 resting upon the upper end of the clamp sleeve 27. The upper portion 35 of the screw drive shaft 31 is rotatably mounted in a pair of anti-friction bearings 36 carried in a suitable upper bearing support 37, the lower end of which is threadedly secured within the upper end of an elongate spline sleeve 38 within the casing 23 extending downwardly along the entire length of the motor shaft 31, the lower end of the spline sleeve being threadedly attached to the upper end of the clamp sleeve 27.

The drive shaft 31 forms the rotating part of a spring motor 39 which is adapted to rotate the armature shaft 28 at a rapid rate, which is more than sufficient to generate adequate current for heating the filament in the cartridge 12 to the extent necessary for detonating the latter, and causing ignition of the power charge 10 in the pressure cylinder 11. To secure rotation of the drive shaft 31 it is provided with a helical groove 40 of relatively steep pitch, the groove being located in an intermediate large diameter portion of the drive shaft, beginning near the upper end of the large diameter portion and terminating at the lowermost end of the large diameter portion. In fact, the groove 40 actually runs out of the large diameter portion at its lower end, the shaft portion 32 below such lower end being of a substantially reduced diameter and being rotatable in the lower bearing 33, as above described.

Cooperating with the shaft 31 is a nut device 41, which surrounds it. This nut device contains oppositely directed screws or keys 42 secured radially therewithin, the heads 43 of these keys being received within keyways or lengthwise slots 44 provided in the spline sleeve 38, these slots extending almost the complete length of the spline sleeve. Mounted on the inner end of one of the screws or keys 42 is a roller 44*a* extending into the helical groove 40 of the drive shaft. The roller diameter is substantially the same as the width of the groove 40, to minimize lost motion between the roller and the drive shaft 31. Preferably, the roller 44*a* is mounted on the radial screw 42 through the agency of anti-friction bearing elements 45.

The nut 41 is urged in a downward direction by a strong helical compression spring 46 encircling the drive shaft, the lower end of the spring bearing against the nut 41, and its upper end against the upper bearing support 37. The spring 46 is retained initially in its upper, highly compressed condition by a releasable latch mechanism 47 that is adapted to prevent rotation of the shaft 31. However, when the latch mechanism is released, the spring 46 is free to drive the nut 41 downwardly very rapidly, the nut being prevented from rotating by the reception of its keys 42 in the keyways or slots 44 in the spline sleeve 38. As a result of the reception of the driving roller 44*a* in the helical drive shaft groove 40, the straight-line downward motion of the nut 41 causes rotation of the drive shaft 31, the spring shifting the nut downwardly to its fullest extent, as shown in Fig. 3, in which the roller 44*a* rides out of the groove 40, thereby effecting a disconnection between the nut 41 and the drive shaft 31, the latter being free to continue rotating because of its own inertia. During the downward movement of the nut 41, the rotation of the drive shaft 31, of course, effects a corresponding rotation of the generator armature, such rotation continuing after the nut rides down off the helical shaft, until all of the energy of the rotating parts has been absorbed. The electric current generated as a result of the above rotary motion is sufficient to heat the cartridge filament and detonate the cartridge 12.

The spring 46 is prevented from expanding initially through retention of the nut 41 in its uppermost position as a result of preventing rotation of the drive shaft 31. The drive shaft has an upper threaded extension 50 integral therewith and threadedly receiving an upper brake member 51 having downwardly directed axial teeth 52 engageable with upwardly directed companion teeth 53 on a stationary brake member 54 surrounding a spacer sleeve 55 that engages an upwardly facing shoulder 56 on the drive shaft and the upper rotatable brake member 51. The stationary brake member 54 is prevented from rotating by a pair of radial screws 57 threaded into a release ring 58 freely encompassing the rotatable brake member 51, the heads 59 of the screws extending into longitudinal grooves, slots or keyways 60 in the upper portion of the upper bearing supporting member 37. The heads 59 of such screws also pass through holes 61 in the upwardly extending sleeve portion 62 of the stationary brake member 54. It is evident that the screws 57 effectively couple the stationary brake member 54 to the upper bearing supporting member 37, which thereby prevents rotary movement of the stationary brake member 54.

The stationary brake member 54 is slidable longitudinally along the upper portion of the upper bearing support member 37. Such stationary brake member 54, as well as the release ring 58 coupled thereto through the agency of the screws 57, are urged in an upward direction, to maintain the stationary brake teeth 53 in engagement with the rotatable brake teeth 52, by a helical compression spring 63 bearing upon the lower end of the stationary brake member 54, and also upon a shoulder 64 provided in the bearing support 37. The spring 63 normally retains the brake teeth 52, 53 coengaged and prevents the drive shaft 31 from rotating, which will prevent the spring 46 from shifting the nut 41 downwardly along the drive shaft 31.

The brake is releasable by a latch device carried within the latch body 24, the lower end of which is secured to the motor-generator casing 23. A lower head 65 is threaded into a central bore 66 in the latch body 24, this head being received within the upper end of the casing 23. Leakage of fluid between the head and the casing is prevented by suitable seal rings 67. The lower end of the head 65 has a cavity 68 containing a cup-shaped brake release member 69 which is secured to the lower end of an operating rod 70 slidable coaxially of the lower

head and extending upwardly into the bore 66 thereabove. Leakage of fluid along the rod 70 is prevented by a suitable rod seal ring 71 clamped against the head 65 by a cup-shaped member 72 threaded onto the upper end of the lower head.

The upper end of the rod 70 is threadedly secured to the lower end of a release head 73, which is urged in a downward direction by a helical compression spring 74 surrounding it, the lower end of the compression spring engaging a release head flange 75, and its upper end engaging a shoulder 76 of the latch body bore 66. The compression spring 74 tends to shift the release head 73, rod 70 and brake release member 69 in a downward direction to release the brake, as hereinafter described. However, it is prevented from shifting downwardly by a pair of diametrically opposed latches 77 located in a transverse slot 78 in the latch body and pivotally mounted on fulcrum pins 79 extending across the slot. The latch members 77 have inwardly directed latch fingers 80 above their fulcrum pins adapted to fit under a downwardly directed shoulder 81 of the release head 73, the fingers being maintained in a latching position by a tension spring 82 connected to and located between the upper ends of upwardly extending latch arm 83, from which the fingers 80 project inwardly. The lower parts of the latch members 77 are constituted as release legs 84 extending in a downward and outward direction from the fulcrum pins 79, the ends of these legs projecting beyond the periphery of the latch body 24 when the latch fingers 80 are disposed under their release shoulder 81. The upper end 85 of the release head 73 is tapered to facilitate upward shifting of the release head past the latch fingers 80 to the latched position disclosed in Fig. 2*a*. When the latch fingers are in the position disclosed in Fig. 2*a*, the release head 73, rod 70 and cup-shaped release member 69 are held in their upward positions, the release member 69 being disposed just a slight distance above the release ring 58.

When the release legs 84 are shifted inwardly, the latch members swing about their fulcrums 79 to shift their fingers 80 and out of engagement with the release head shoulder 81. Accordingly, the helical spring 74 can expand and shift the release head 73, release rod 70 and release member 69 downwardly, the latter engaging the release ring 58 and acting through the pins 57 to shift the stationary brake member 54 downwardly against the force of the helical spring 63, freeing the stationary brake teeth 53 from the rotatable brake teeth 52. Releasing the restraint on the drive shaft 31 allows the spring 46 to shift the nut 41 downwardly to its lowermost position disclosed in Fig. 3, during which time the shaft 31 is given a rapid rotation, by virtue of the radial movement of the nut roller 44*a* in the helical groove 40 of the shaft.

To release the latches 77 by swinging their legs 84 inwardly in the manner just described, a friction drag device D is provided that includes an upper collar 87 and a lower collar 88 spaced below the upper collar, there being outwardly disposed, circumferentially spaced drag springs 89 secured to both collars, as through use of the upper and lower securing rings 90, which can be attached to the collars in any suitable manner, as by welding. As the apparatus is lowered in a well casing (not shown) the outwardly bowed springs 89 frictionally drag along the wall of the well casing, resisting downward movement of the drag device D. However, a stop ring 91 is secured to one of the sinker bars F near the upper end of the latter, which engages the upper collar 87 and pushes the drag device D down the casing with the remainder of the apparatus, the drag springs 89 frictionally sliding along the wall of the casing.

When it is desired to trip the latches 77 to effect operation of the spring motor-generator set B, it is merely necessary to elevate the wire line G, or other running-in string, to lift the entire apparatus in the well casing, with exception of the drag device D, which will remain stationary. The entire apparatus is elevated until release legs 84 engage the lower downwardly diverting inner surface 92 on the lower collar 88, which will force the release legs inwardly and thereby trip the release head 73, which, in turn, will affect disengagement of the positive tooth brake and permit the spring motor to operate. Accordingly, the spring motor is placed in operation as a result of upward manipulation of the running-in string G.

After the apparatus has been lowered in the well casing, conditions may be encountered that warrant the removal of the apparatus from the well casing without operating the motor-generator B. Since upward movement of the friction drag device D is resisted by the well casing, upward movement of the running-in string and the remainder of the apparatus would effect a tripping of the latch mechanism and an operation of the spring motor. The present invention incorporates a control device E that is responsive to manipulation of the running-in string to prevent the drag device D from engaging the latch legs 84, in the event it is desired to remove the apparatus from the well casing without operating it.

The control device E includes an elongate control body 93 threadedly attached to the upper end of the latch body 24. The upper end of the control body is threadedly secured to the lower end of the string of sinker bars F on which the drag device D is originally disposed against the upper stop ring 91. The control body has an elongate longitudinal slot 94 therein containing a latch lever 95 having a central elongate slot 96 receiving a fulcrum pin 97 secured to the control body 93 and extending across its slot 94. The latch lever is urged in a clockwise direction, as seen in Figs. 2*a*, 4 and 5, by a tension spring 98, the lower end of which is attached to the latch lever 95 to the left of the fulcrum pin 97, and the upper end of which is attached to a suitable anchor pin 99 fixed to the control body. The action of the spring 98 tends to shift the lower leg portion 100 of the latch lever to the left, which movement is limited by engagement of the lower foot 101 of the latch with a stop pin 102 secured to the control body 93. The spring 98 also tends to elevate the latch member 95 within the body 93 to the extent determined by engagement of the fulcrum pin 97 with the lower end of the slot 96. Such elevating movement also tends to hold a pair of spaced fingers 103, 104, projecting upwardly from the arm 105 of the latch lever, on opposite sides of a holding pin 106 secured to the body 93 and extending across its slot 94.

Initially, the parts of the drag control device E occupy the position disclosed in Fig. 2*a*, in which the spring 98 holds the arm 105 of the latch lever 95 inwardly of the control body 93, with its spaced fingers 103, 104 disposed on opposite sides of the holding pin 106. The holding pin engages the left finger 103 and prevents the spring 98 from shifting the latch leg 100 inwardly of the slot 94 into engagement with its stop pin 102. Instead, when the holding pin 106 is engaging the left finger 103 of the latch, its foot portion 101 extends out of the slot 94 to a certain extent, as clearly disclosed in Fig. 2*a*.

When the drag control device E is conditioned as shown in Fig. 2*a*, the friction drag spring device D is located thereabove. When the latches 77 are to be tripped to allow operation of the spring motor, the running-in string G is elevated, which will elevate the sinker bars F and all of the mechanism therebelow, the drag device D being held stationary by frictional engagement of its leaf springs 89 against the wall of the well casing. As the control device E is pulled upwardly through the drag device D, the lower collar 88 of the drag device will engage the outwardly projecting foot portion 101 of the latch member and shift the latch 95 downwardly against the force of the tension spring 98 (as illustrated in Fig. 4), until the latch device slides down along the

fulcrum pin 97 and the holding pin 106 to the extent at which the left finger 103 is disposed below the holding pin. When this occurs, the spring 98 is effective to turn the latch lever 95 in a clockwise direction sufficiently to bring the foot portion 101 inwardly and to shift the arm portion 105 and fingers 103, 104 in an outward direction, the inner finger 103 then being disposed under the holding pin 106, which will prevent the latch lever 95 from moving back to its initial position shown in Fig. 2*a*. At the time the left finger 103 can release from the holding pin 106, the upper collar 87 is already sliding relatively down along the control body slot 94 and is disposed opposite the right finger 104, which will prevent any outward movement of the arm 105 with respect to the slot 94. The running-in string G, and all the other mechanism attached thereto, with the exception of the drag device D, can continue to move upwardly until the lower collar 88 of the drag device engages the latch legs 84 and releases the latches 77 from the release head 73, allowing the brake to be released from the drive shaft 31, in the manner described above. The drive shaft will rotate the generator 17, the latter feeding current to the cartridge 12, firing the latter and causing the power charge 10 to function and operate or anchor the bridge plug or other mechanism described in the above-identified patent in the well casing, after which the fluid pressure operated device A is automatically released from the bridge plug. The entire apparatus disclosed can now be elevated in the well casing and withdrawn to the top of the well bore.

If, however, it is not desired to operate the spring motor, the friction drag device D can be rendered ineffective. With the parts in their initial position, such as disclosed in Figs. 1, 2, 2*a* and 2*b*, the running-in string G is elevated to pull all the apparatus upwardly with respect to the drag device D. However, elevation only occurs to the extent at which the drag device D engages the latch lever foot 101 and shifts the latch lever 95 downwardly to release its right finger 103 from the holding pin 106. In any event, the drag device D is not permitted to move relatively down along the apparatus to the extent sufficient to engage the release legs 84. After the left finger 103 has been released from the holding pin 106, the apparatus is again lowered in the well casing, the friction drag device being prevented from lowering by its frictional engagement against the wall of the well casing. In other words, the friction drag device D will shift upwardly along the control body 93, and when its upper collar 87 moves above the right finger 104, the spring 98 is effective to rock the latch lever 95 in a clockwise direction and engage the foot 101 with the stop pin 102, which will locate the right finger 104 outwardly of the control body 93. The running-in string G and all of the apparatus, with the exception of the drag device D, are now elevated. The latch lever arm 105 will then engage the lower end of the upper collar 87 of the drag device, which is disposed between the fingers 103, 104, the lever 95 being shifted downwardly until the upper end of the slot 96 engages the fulcrum pin 97. When such engagement occurs, further downward movement of the latch lever 95 along the control body 93 cannot occur, so that elevation of the running-in string G will act through the latch lever 95 to elevate the drag device D in the well bore along with all of the other mechanisms secured to the running-in string. The entire apparatus can be elevated in the well casing and removed to the top of the hole, the drag device D being prevented from moving relatively downwardly along the control device E into engagement with the latch device C to shift the latch legs 84 inwardly and release the brake mechanism.

It is, accordingly, apparent that an apparatus has been provided in which a simple and exceedingly powerful and sturdy spring motor is provided for rapidly rotating the generator to supply sufficient current for operating another device in a well bore, such as to fire the cartridge 12. The spring motor is prevented from operating until desired. When its operation is to occur, it is merely necessary to elevate the running-in string G a predetermined amount, which will cause the friction drag device D to effect a release of the spring motor brake or latch mechanism. If, however, the spring motor is not to be operated and the apparatus withdrawn from the well bore, the friction drag device D can be rendered ineffective merely through appropriate manipulation of the running-in string.

The inventors claim:

1. In well apparatus adapted to be disposed in a well bore: a device to be operated in the well bore; a generator disposable in the well bore with its axis longitudinally of the well bore and electrically connected to said device for supplying current to said device; a spring motor, said motor including a drive shaft member substantially coaxial of said generator connected to said generator to rotate the same and a nut member surrounding said drive shaft member, means mounting said nut member for longitudinal slidable movement and against substantial rotation with said shaft member, one of said members having a helical thread thereon and the other of said members having means thereon engaging said thread, a spring for shifting said nut along said shaft to rotate said shaft, means connected to said spring for retaining said spring in a stressed condition and for preventing operation of said spring, said retaining means including releasable brake means, and means for releasing said brake means to permit said spring to shift said nut along said shaft.

2. In well apparatus adapted to be disposed in a well bore: a device to be operated in the well bore; a generator disposable in the well bore with its axis longitudinally of the well bore and electrically connected to said device for supplying current to said device; a spring motor, said motor including a drive shaft substantially coaxial of said generator connected to said generator to rotate the same and having a helical thread thereon and a nut surrounding said shaft and engaging said thread, means mounting said nut for longitudinal slidable movement and against substantial rotation with said shaft, a spring for propelling said nut along said shaft to rotate said shaft, said thread permitting said nut to be disengaged from said shaft, means connected to said spring for retaining said spring in a stressed condition and for preventing operation of said spring, said retaining means including releasable brake means, and means for releasing said brake means to permit said spring to shift said nut along said shaft.

3. In well apparatus adapted to be disposed in a well bore: a device to be operated in the well bore; a generator disposable in the well bore with its axis longitudinally of the well bore and electrically connected to said device for supplying current to said device; a spring motor, said motor including a drive shaft substantially coaxial of said generator connected to said generator to rotate the same and having a helical thread thereon and a nut surrounding said shaft and engaging said thread, means mounting said nut for longitudinal slidable movement and against substantial rotation with said shaft, a spring for propelling said nut along said shaft to rotate said shaft, said threads permitting said nut to be disengaged from said shaft, means connected to said spring for retaining said spring in a stressed condition and for preventing operation of said spring, said retaining means including releasable brake means, and means for releasing said brake means to permit said spring to shift said nut along said shaft.

4. In well apparatus adapted to be disposed in a well bore on a running-in string: a device to be operated in the well bore; a generator disposable in the well bore and electrically connected to said device for supplying current to said device; a spring motor, said motor including a drive shaft member connected to said generator to rotate the

same and a nut member surrounding said drive shaft member, means mounting said nut member for longitudinal slidable movement and against substantial rotation with said shaft member, one of said members having a helical thread thereon and the other of said members having means thereon engaging said thread, a spring for shifting said nut along said shaft to rotate said shaft, means connected to said spring for retaining said spring in a stressed condition and for preventing operation of said spring, said retaining means including releasable brake means; and means responsive to manipulation of said running-in string for releasing said brake means to permit said spring to shift said nut along said shaft.

5. In well apparatus adapted to be disposed in a well bore on a running-in string: a device to be operated in the well bore; a generator disposable in the well bore and electrically connected to said device for supplying current to said device; a spring motor, said motor including a drive shaft member connected to said generator to rotate the same and a nut member surrounding said drive shaft member, means mounting said nut member for longitudinal slidable movement and against substantial rotation with said shaft member, one of said members having a helical thread thereon and the other of said members having means thereon engaging said thread, a spring for shifting said nut along said shaft to rotate said shaft, means connected to said spring for retaining said spring in a stressed condition and for preventing operation of said spring, said retaining means including releasable brake means; means responsive to manipulation of said running-in string for releasing said brake means to permit said spring to shift said nut along said shaft; and means responsive to manipulation of said running-in string for preventing operation of said releasing means.

6. In well apparatus adapted to be disposed in a well bore: a device to be operated in the well bore; a generator disposable in the well bore and electrically connected to said device for supplying current to said device; a spring motor, said motor including a drive shaft having a helical thread thereon and connected to said generator to rotate the same and a nut surrounding said shaft and engaging said thread, means mounting said nut for longitudinal slidable movement and against substantial rotation with said shaft, a compressed helical spring above said nut for shifting said nut downwardly along said shaft to rotate said shaft, said thread permitting said nut to be disengaged from said shaft; releasable brake means engaging said shaft to prevent its rotation with said nut disposed in an upper position on said shaft and said spring in a compressed condition; and means for releasing said brake means.

7. In well apparatus adapted to be disposed in a well bore on a running-in string: a device to be operated in the well bore; a generator disposable in the well bore and electrically connected to said device for supplying current to said device; a spring motor, said motor including a drive shaft having a helical thread thereon and connected to said generator to rotate the same and a nut surrounding said shaft and engaging said thread, means mounting said nut for longitudinal slidable movement and against substantial rotation with said shaft, a compressed helical spring above said nut for shifting said nut downwardly along said shaft to rotate said shaft, said thread permitting said nut to be disengaged from said shaft; releasable brake means engaging said shaft to prevent its rotation with said nut disposed in an upper position on said shaft and said spring in a compressed condition; and means for releasing said brake means, comprising a friction drag device frictionally engageable with the wall of a well casing containing the apparatus, said releasing means being operable to release said brake means in response to upward movement of the running-in string in the well casing.

8. In well apparatus adapted to be disposed in a well bore on a running-in string: a device to be operated in the well bore; a generator disposable in the well bore and electrically connected to said device for supplying current to said device; a spring motor, said motor including a drive shaft having a helical thread thereon and connected to said generator to rotate the same and a nut surrounding said shaft and engaging said thread, means mounting said nut for longitudinal slidable movement and against substantial rotation with said shaft, a compressed helical spring above said nut for shifting said nut downwardly along said shaft to rotate said shaft, said thread permitting said nut to be disengaged from said shaft; releasable brake means engaging said shaft to prevent its rotation with said nut disposed in an upper position on said shaft and said spring in a compressed condition; means for releasing said brake means, comprising a friction drag device frictionally engageable with the wall of a well casing containing the apparatus, said releasing means being operable to release said brake means in response to upward movement of the running-in string in the well casing; and means responsive to manipulation of said running-in string for preventing movement of said releasing means and its friction drag device to a brake releasing position.

9. In well apparatus adapted to be disposed in a well bore on a running-in string: a device to be operated in the well bore; a generator disposable in the well bore and electrically connected to said device for supplying current to said device; a spring motor, said motor including a drive shaft having a helical thread thereon and connected to said generator to rotate the same and a nut surrounding said shaft and engaging said thread, means mounting said nut for longitudinal slidable movement and against substantial rotation with said shaft, a compressed helical spring above said nut for shifting said nut downwardly along said shaft to rotate said shaft, said thread permitting said nut to be disengaged from said shaft; a releasable brake means engaging said shaft to prevent its rotation with said nut disposed in an upper position on said shaft and said spring in a compressed condition; means for releasing said brake means, comprising a friction drag device frictionally engageable with the wall of a well casing containing the apparatus, said releasing means being operable to release said brake means in response to upward movement of the running-in string in the well casing; and a latch device located initially below said friction drag device with a portion of said latch device in an inward ineffective position allowing relative downward movement of said friction drag device therealong to a brake means releasing position; said friction drag device engaging said latch device when moving downwardly therealong to place said portion of said latch device in an outward effective position for coupling to said friction drag device in the event said friction drag device is moved upward relatively along said latch device and then relatively downward therealong.

10. In well apparatus adapted to be disposed in a well bore: a device to be operated in the well bore; a generator disposable in the well bore and electrically connected to said device for supplying current to said device; a spring motor, said motor including a drive shaft having a helical thread thereon and connected to said generator to rotate the same and a nut surrounding said shaft and engaging said thread, means mounting said nut for longitudinal slidable movement and against substantial rotation with said shaft, a compressed helical spring above said nut for shifting said nut downwardly along said shaft to rotate said shaft, said thread permitting said nut to be disengaged from said shaft; releasable brake means engaging said shaft to prevent its rotation with said nut disposed in an upper position on said shaft and said spring in a compressed condition; means movable downwardly to release said brake means; releasable latch means initially preventing downward movement of said

brake releasing means; and friction drag means movable in a downward direction with respect to said latch means to release said latch means.

11. In well apparatus adapted to be disposed in a well bore: a device to be operated in the well bore; a generator disposable in the well bore and electrically connected to said device for supplying current to said device; a spring motor, said motor including a drive shaft having a helical thread thereon and connected to said generator to rotate the same and a nut surrounding said shaft and engaging said thread, means mounting said nut for longitudinal slidable movement and against substantial rotation with said shaft, a compressed helical spring above said nut for shifting said nut downwardly along said shaft to rotate said shaft, said thread permitting said nut to be disengaged from said shaft; releasable brake means engaging said shaft to prevent its rotation with said nut disposed in an upper position on said shaft and said spring in a compressed condition; means movable downwardly to release said brake means; releasable latch means initially preventing downward movement of said brake releasing means; friction drag means movable in a downward direction with respect to said latch means to release said latch means; a latch device above said latch means and located initially below said friction drag device with a portion of said latch device in an inward ineffective position allowing relative downward movement of said friction drag device into engagement with said latch means; said friction drag device engaging said latch device when moving downwardly therealong to place said portion of said latch device in an outward effective position for coupling to said friction drag device in the event said friction drag device is moved upward relatively along said latch device and then relatively downward therealong.

12. In well apparatus to be disposed in a well bore on a running-in string: a drive shaft having a helical thread thereon and a nut surrounding said shaft and engaging said thread; means mounting said nut for longitudinal slidable movement and against substantial rotation with said shaft; a spring for propelling said nut along said shaft to rotate said shaft, said thread permitting said nut to be disengaged from said shaft to permit said shaft to continue rotating; means connected to said spring for retaining said spring in a stressed condition and for preventing operation of said spring, said retaining means including releasable brake means, and means for releasing said brake means to permit said spring to shift said nut along said shaft.

13. In well apparatus adapted to be disposed in a well bore on a running-in string: a drive shaft having a helical thread thereon and a nut surrounding said shaft and engaging said thread; means mounting said nut for longitudinal slidable movement and against substantial rotation with said shaft; a spring for propelling said nut along said shaft to rotate said shaft, said thread permitting said nut to be disengaged from said shaft to permit said shaft to continue rotating in a stressed condition.

14. In well apparatus adapted to be disposed in a well bore on a running-in string: a drive shaft having a helical thread thereon and a nut surrounding said shaft and engaging said thread; means mounting said nut for longitudinal slidable movement and against substantial rotation with said shaft; a compressed helical spring above said nut for shifting said nut downward along said shaft to rotate said shaft, said thread permitting said nut to be disengaged from said shaft to permit said shaft to continue rotating; releasable brake means engaging said shaft to prevent its rotation with said nut disposed in an upper position on said shaft and said spring in a compressed condition; and means for releasing said brake means.

15. In well apparatus adapted to be disposed in a well bore on a running-in string: a drive shaft having a helical thread thereon and a nut surrounding said shaft and engaging said thread; means mounting said nut for longitudinal slidable movement and against substantial rotation with said shaft; a compressed helical spring above said nut for shifting said nut downward along said shaft to rotate said shaft, said thread permitting said nut to be disengaged from said shaft; releasable brake means engaging said shaft to prevent its rotation with said nut disposed in an upper position on said shaft and said spring in a compressed condition; means for releasing said brake means comprising a friction drag device frictionally engageable with the wall of a well casing containing the apparatus, said releasing means being operable to release said brake means in response to upward movement of the running-in string in the well casing; and means responsive to manipulation of said running-in string for preventing movement of said releasing means and its friction drag device to a brake means releasing position.

16. In well apparatus adapted to be disposed in a well bore on a running-in string: a drive shaft having a helical thread thereon and a nut surrounding said shaft and engaging said thread; means mounting said nut for longitudinal slidable movement and against substantial rotation with said shaft; a compressed helical spring above said nut for shifting said nut downwardly along said shaft to rotate said shaft, said thread permitting said nut to be disengaged from said shaft; releasable brake means engaging said shaft to prevent its rotation with said nut disposed in an upper position on said shaft and said spring in a compressed condition; means movable downwardly to release said brake means; releasable latch means initially prevent downward movement of said brake releasing means; and friction drag means movable in a downward direction with respect to said latch means to release said latch means.

17. In well apparatus adapted to be disposed in a well bore on a running-in string: a drive shaft having a helical thread thereon and a nut surrounding said shaft and engaging said thread; means mounting said nut for longitudinal slidable movement and against substantial rotation with said shaft; a compressed helical spring above said nut for shifting said nut downwardly along said shaft to rotate said shaft, said thread permitting said nut to be disengaged from said shaft; releasable brake means engaging said shaft to prevent its rotation with said nut disposed in an upper position on said shaft and said spring in a compressed condition; means movable downwardly to release said brake means; releasable latch means initially preventing downward movement of said brake releasing means; friction drag means movable in a downward direction with respect to said latch means to release said latch means; a latch device above said latch means located initially below said friction drag device with a portion of said latch device in an inward ineffective position allowing relative downward movement of said friction drag device into engagement with said latch means; said friction drag device engaging said latch device when moving downwardly therealong to place said portion of said latch device in an outward effective position for coupling to said friction drag device in the event said friction drag device is moved upward relatively along said latch device and then relatively downward therealong.

18. In well apparatus adapted to be disposed in a well bore on a running-in string: supporting means connectible to the running-in string; a friction drag device movable longitudinally with respect to said supporting means; a latch device on said supporting means located initially below said friction drag device with a portion of said latch device in an inward ineffective position allowing relative downward movement of said friction drag device therealong; means on said friction drag device engaging said latch device when said friction drag device moves in said relative downward direction to place said portion of said latch device in an outward effective position for coupling to said friction drag device in the event said friction drag device is moved upwardly along said latch device and then relatively downward therealong.

19. In well apparatus adapted to be disposed in a well bore on a running-in string: supporting means connectible to the running-in string; a friction drag device movable longitudinally with respect to said supporting means; a latch lever on said supporting means located initially below said friction drag device; means on said supporting means engaging said lever to hold a coupling portion of said lever in an inward position on said supporting means to allow relative downward movement of said friction drag device along said lever; means on said lever engaged by said friction drag device when said friction drag device moves in said relative downward direction to release said lever from said holding means and allow said coupling portion to project outwardly of said supporting means; said outwardly projecting coupling portion becoming coupled to said friction drag device in the event said friction drag device is moved relatively upward along said lever and then relatively downward therealong.

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