March 4, 1969 H. A. TAGGART 3,430,711

CASING PERFORATING AND SCREEN PLUG SETTING DEVICE

Filed Dec. 11, 1967

Fig. 1

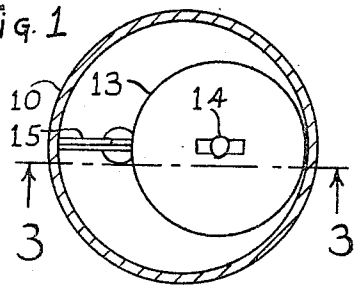


Fig. 2

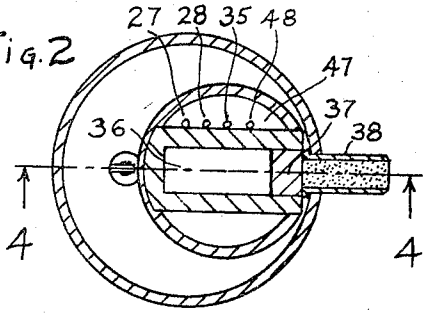


Fig. 3

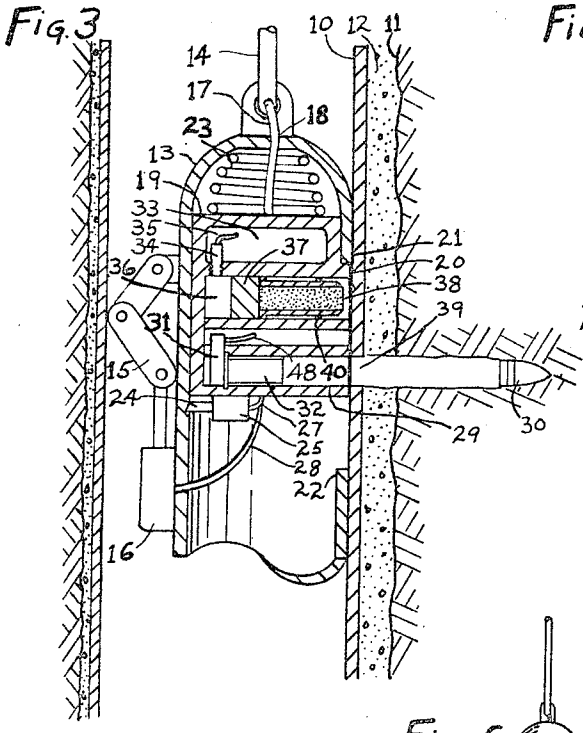


Fig. 4

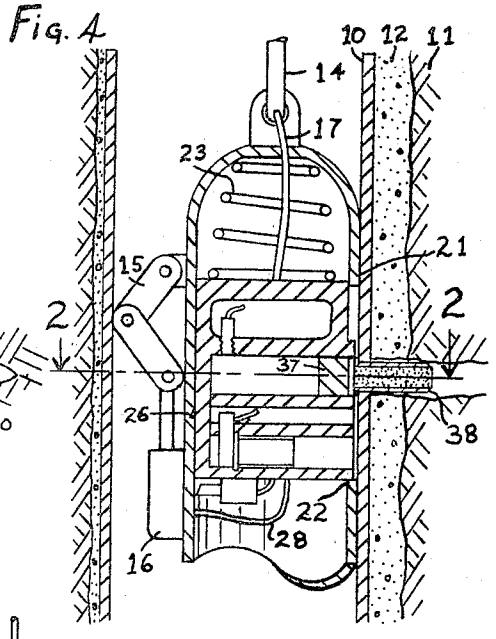


Fig. 5

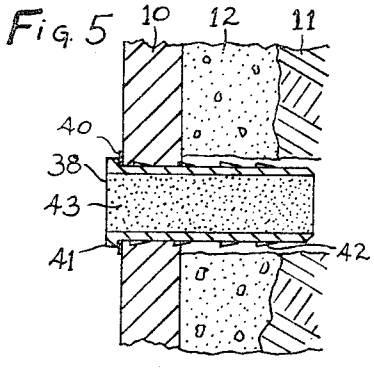
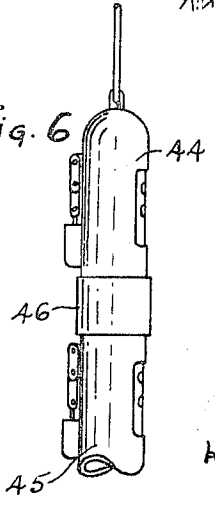


Fig. 6



INVENTOR

Harriet A. Taggart

United States Patent Office 3,430,711
Patented Mar. 4, 1969

3,430,711

CASING PERFORATING AND SCREEN PLUG SETTING DEVICE

Harriet A. Taggart, 17130 Horace St.,
Granada Hills, Calif. 91344

Filed Dec. 11, 1967, Ser. No. 689,468
U.S. Cl. 175—4.52 5 Claims
Int. Cl. E21b *43/116, 33/12*

ABSTRACT OF THE DISCLOSURE

The invention relates to wells drilled in the earth, and more particularly to completing and producing fluids from such wells. The device involves an element for perforating a well casing in combination with an element for inserting a screen or filter plug into the perforation.

An object of the invention is to provide a device wherein the casing of a well may be perforated and at the same time a screen plug set in the casing to prevent sand or other unconsolidated material from entering the well bore along with the fluid being produced.

Another object is to provide a perforating and screen plug setting device which may be lowered into the well and perform the above mentioned functions after the casing has been lowered and cemented into place.

Another object of the invention is to provide a device which will permit standard well completion and water shut off practices, and at the same time eliminate the need of setting screens, gravel packs and so forth. The screen setting process will instead be combined with the usual casing perforating procedure, and thus creating a savings in time and money.

Still another object of the invention is to create a casing perforating and screen plug setting device which may be suspended in the well on a line from the surface and at any selected point, be locked in position in the casing by electric means from the surface. Also upon command from the surface the casing may be perforated and the screen plug set in the perforation. Subsequent to this the device may be freed from its position in the casing and retrieved from well.

A further object is to offer an oil well casing perforating and screen plug setting device which contains multiple units as described above and which will perform the perforating and screen plug setting operation at selected points in the casing a number of times without necessitating the removal of the device from the well bore.

Yet another object of this invention is to provide a casing perforating and screen plug setting device with the versatility mentioned and yet relatively simple in design, free from operating failure and inexpensive to fabricate.

These and other objects will become apparent in the following detailed specification and drawing in which:

FIGURE 1 is a top view showing the casing with the perforating and screen plug setting device positioned within.

FIGURE 2 is a top section view of line 2—2 of FIG. 4 showing the device after the screen plug has been set in the perforation.

FIGURE 3 is a longitudinal section of the invention along line 3—3 of FIG. 1, showing the device disposed in the well casing after the perforation has been made.

FIGURE 4 is a longitudinal section of the device positioned in the well casing subsequent to the insertion of the screen plug.

FIGURE 5 is a detailed section of the screen plug after having been set in the casing.

FIGURE 6 is a side view of the perforating and screen plug setting device shown in multiple unit construction.

In current well completion practice, the casing is lowered into the hole and cemented into place. The cement is forced down the casing and up between the casing and the bore hole. In doing this the formation is completely shut off from the casing, and in order to produce the fluids from the formation, the casing and cement must be perforated. The usual practice is to set the casing in cement as described above and then selectively perforate the casing and cement opposite oil or gas sands. This prevents the production of water, since the water sands are left shut off behind the cement.

Many times the producing sands are unconsolidated and flow into the well with the fluids being produced and cause damage to the equipment, and "sanding up" in the well. When this occurs the production equipment must be pulled and the well cleaned out. Many different approaches have been taken to solve the problem of sand production. The approach taken here is to plug the perforation with a fluid permeable filter plug, and thus prevent the sand from entering the well bore. The procedure of selectively perforating cemented casing precludes the possibility of placing filters or screen plugs in the casing before the casing is set in the well, because the cement must also be perforated after it has set up in the hole.

The procedure described here is to provide a device which will selectively perforate a well casing, and at the same time insert a filter plug in the perforation which will hold fast, and prevent sand and other unconsolidated materials from entering the casing.

Referring now to the drawing in FIG. 3 there is illustrated a well casing **10** which has been set in the earth formation **11**. The cement **12** has been pumped down the casing and up between the casing **10** and the earth formation **11** and allowed to set up. The main housing **13** is suspended on the cable **14** and is locked in position in the casing **10** by the clutch **15**. The clutch is activated by the power motor **16**. A multi-strand electrical conducting cable **17** is integral with the cable **14** and extends from the surface to the device and enters the device at point **18**. A moveable member **19** is disposed within the main housing **13**, and is moveable in a longitudinal direction relative to the main housing **13**. The moveable member **19** is limited in its upward movement when the abutment **20** comes in contact with the main housing wall at **21**. The movement of the moveable member in the opposite direction stops when the moveable member **19** comes in contact with the main housing wall at **22** as in FIG. 4. A spring **23** urges the moveable member **19** down toward the position shown in FIG. 4. The catch **24** holds the moveable member **19** in position against the tension of the spring **23** until the solenoid **25** releases it from its seat **26** in the main housing. The wire **27** which activates the solenoid **25**, leads into the multi-strand conducting cable **17**. The wire **28** activates the clutch motor **16** and also leads into the multi-strand cable **17**.

The moveable member **19** is equipped with a projectile passage **29**, through which the perforating projectile **30** is fired. The solenoid **31** and wire **48** detonate the cartridge **32** which fires the perforating projectile **30**. The chamber **33** is completely enclosed and is filled with compressed gas. The solenoid valve **34** is activated by the wire **35** which leads to the multi-strand cable **17**. When the solenoid valve **34** is activated the compressed gas flows into the chamber **36** and drives the packing **37** out of the chamber **36**, and thus driving the screen plug **38** out of the chamber **36** and into the perforation **39** in the casing **10**, as is shown in FIG. 4. The gasket **40**

serves to center the screen plug in the chamber **36** as well as seal the screen plug in the casing as in FIG. **5**.

Referring now to FIG. 5, the screen plug **38** has been set in the casing **10**. The gasket **40** has been forced against the flange **41** on the screen plug and serves as a seal for the screen plug. It can be seen here that the casing **10**, the cement **12** and the earth formation **11**, have been perforated by the perforating projectile **30**. The screen plug **38** is equipped with projections **42** for the purpose of holding it fast in the perforation. The projections **42** are barb shaped and are made of hardened steel so as not to be damaged when the screen plug is forced into the perforation. The filtering material **43** is of a type which can be securely bonded to the inside of the plug, and can be adapted to filter out various size sands. The filter may be made of any of the common types of plastic or fiber filters.

Referring now to FIG. 6. This view shows the device in its multi-unit construction. The upper unit **44** is connected to a like unit **45** by the sleeve **46**. The unit **45** may be connected to a multiplicity of similar units in the same fashion.

FIG. 2 is a section view taken along line **2—2** in FIG. 4. This view shows the open space **47** between the moveable member **19** and the main housing **13**. The wires **27**, **28**, **35** and **48**, which activate the clutch mechanism, the firing mechanism, the catch release and the solenoid valve **34**, are shown in section view. Also shown in this view is the chamber **36**, the packing **37** and the filter plug **38**.

FIG. 1 shows a top view of the main housing **13** in the casing **10**. Also shown is the clutch mechanism **15**, and the cable **14**.

In operation the casing perforating and screen plug setting device would be used in place of a conventional casing perforating device, and when the casing has been cemented in place and prepared for selective perforating. The device would be lowered in the casing on the cable **14** to a point selected to be perforated. At this time the clutch **15** would be employed to hold the device rigid in the casing. The detonator **31** is activated electrically from the surface and fires the projectile **30** through the casing. The catch **24** is then released and the moveable member **19** moves due to compression in the spring **23** to a predetermined point as shown in FIG. 4 which aligns the filter plug with the perforation. The solenoid operated valve **34** is then opened and the high pressure gas drives the packing **37** and the filter plug **38** through the passage and into the casing perforation. The packing remains at the end of the passage and is removed with the device. The clutch **15** is then released and the device moved to another selected point or removed from the well.

Although a specific embodiment of the invention has been illustrated and described, it should be understood that many substitutions and modifications may be made without departing from the spirit of the invention. Shaped charges can easily be substitued for the gun type perforating. The filter plug can be driven by a powder charge or by hydraulic means. The various operations described in the foregoing specification can be triggered individually from the surface or may be activated in an automatic succession with the use of electrical relays.

What I claim is:

1. An oil well casing perforating and screen plug inserting device of the type described consisting of: a tubular housing, an electrically operated clutch mechanism attached to the outside of said housing, said clutch made up of a power motor adapted to activate a hinged arm and cause said hinged arm to expand and contact relative to said tubular housing; a moveable member within said housing and adapted to move in a longitudinal manner relative to said tubular housing; within said moveable member a casing perforating device, consisting of a projectile and electrical means for firing said projectile through a well casing, also within said moveable member a high pressure gas chamber separated from a filter plug by a solenoid operated valve, said filter plug consisting of a tubular member with filtering material bonded within said tubular member, around one end of said tubular member an external lip and gasket; said tubular member having external projections; a spring disposed between said tubular housing and said moveable member for the purpose of creating relative movement between said members; a solenoid operated releasable catch disposed between said tubular housing and said moveable member for the purpose of preventing relative movement between said members; said tubular housing being suspended on a multi-strand electrical conducting cable, said cable entering said housing; said component parts being so arranged that said clutch may be activated from the surface to expand and hold the device stationary in the well casing; at which time the perforating projectile may be fired through the casing and the catch released; said spring will then push the moveable member to a point aligning the filter plug with the perforation; the filter plug may then be inserted in the perforation by means of the high pressure gas; upon command from the surface the clutch may be released and the device removed from the well.

2. A casing perforating and screen plug inserting device for oil wells and the like consisting of: a cylindrical housing for lowering into a well casing; an electrically operated power grip on said housing to hold it stationary at any selected point in the casing; within said housing a slidable member which is movable relative to said housing; within said slidable member a gun casing perforator which may be fired from the surface at a selected point in the casing; said slidable member being held in spring loaded position by a releasable catch; also within said slidable member a cylindrical screen plug with means for forcing said screen plug into a perforation in the casing; said component parts being so arranged that the gun perforator may be fired into the casing at a selected point after the housing is fixed in place by said power grip; said catch may then be released and the slidable member moved relative to the housing to a point aligning the screen plug with the casing perforation; said screen plug may then be driven into said casing perforation.

3. An oil well casing perforating and filter plug setting device comprising: a tubular housing suspended in a well casing on a line from the surface, integral with said housing a power grip which can be expanded upon command from the surface to hold said housing rigid within said casing; a movable member within said housing adapted to move relative to said housing; spring means urging said movable member to move relative to said housing, a releasable latch between said movable member and said housing to prevent relative movement; within said movable member a casing perforating device adapted to perforate the casing subsequent to the activation of said power grip; adjacent to the perforating device and within said movable member a filter plug, with means for forcible insertion into a casing perforation; said moveable member adapted to move, subsequent to the perforation of the casing and upon release of said latch, a predetermined distance necessary to align the filter plug with said casing perforation.

4. The casing perforating and screen plug setting device of claim **3** combined in a series with a multiplicity of like units.

5. A casing perforating and screen plug inserting device for oil wells and the like consisting of: a housing suitable for lowering into a well bore, said housing provided with clutches for holding said housing in a fixed position at a selected point in the well bore; within said housing a moveable member, said moveable member containing casing perforating means and a screen plug, with means for inserting said screen plug into a casing perforation, said moveable member adapted to move a distance neces-

sary to bring said screen plug in alignment with said casing perforation.

References Cited

UNITED STATES PATENTS

2,482,913	9/1949	Jobe	166—55.1
2,540,123	2/1951	Kinley	166—55.1
2,544,601	3/1951	Kinley	166—55.1
2,559,687	7/1951	Thomas	166—55.1 X
2,708,000	5/1955	Zandmer	166—100

3,217,804	11/1965	Peter	175—4.52 X
3,301,337	1/1967	Vaughn et al.	166—55.3
3,348,621	10/1967	Schuster	175—4.52

DAVID H. BROWN, *Primary Examiner.*

U.S. Cl. X.R.

175—4.53; 166—55.1, 100