Oct. 8, 1957 K. M. LAWRENCE ET AL 2,809,014

SHOT-HOLE DRILLING APPARATUS

Filed Sept. 17, 1954 3 Sheets-Sheet 1

Fig. 1.

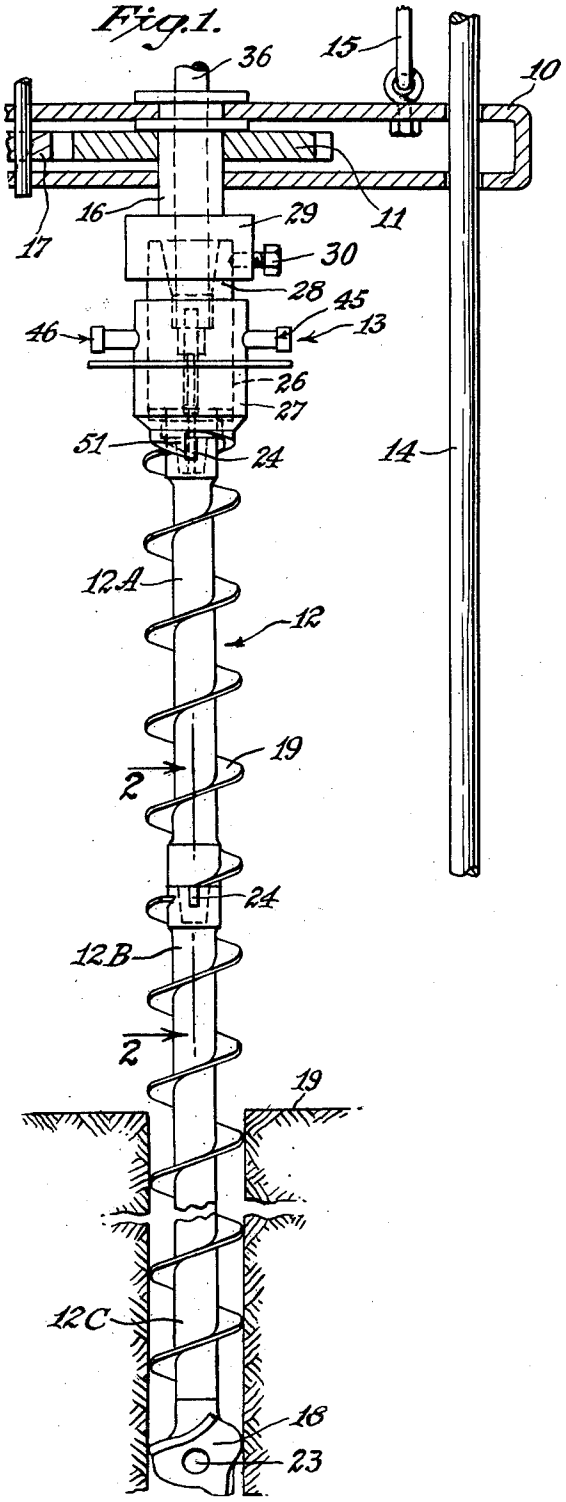
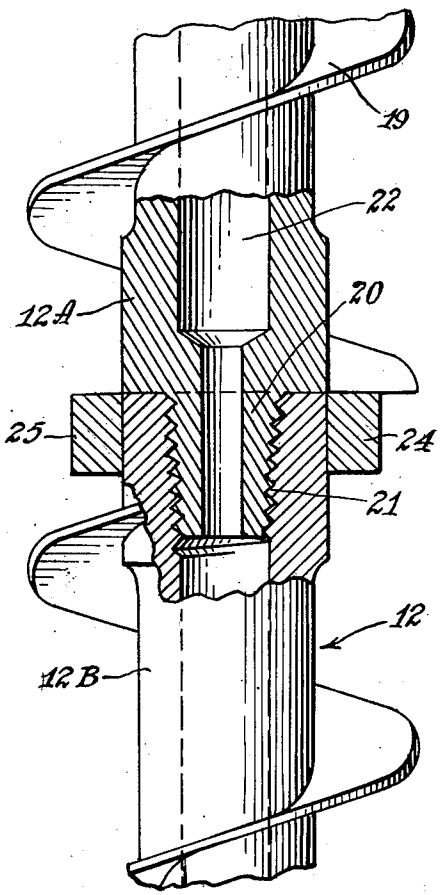


Fig. 2.



KENNETH M. LAWRENCE
WESLEY K. RICKEL
INVENTORS.

BY Kenyon & Kenyon
ATTORNEYS.

Oct. 8, 1957 K. M. LAWRENCE ET AL 2,809,014

SHOT-HOLE DRILLING APPARATUS

Filed Sept. 17, 1954 3 Sheets-Sheet 2

Fig. 3.

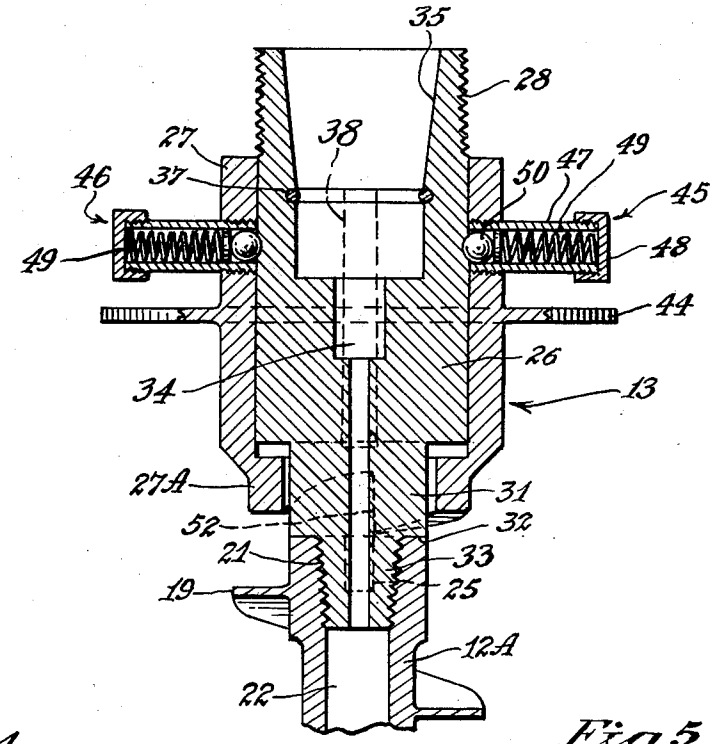


Fig. 4.

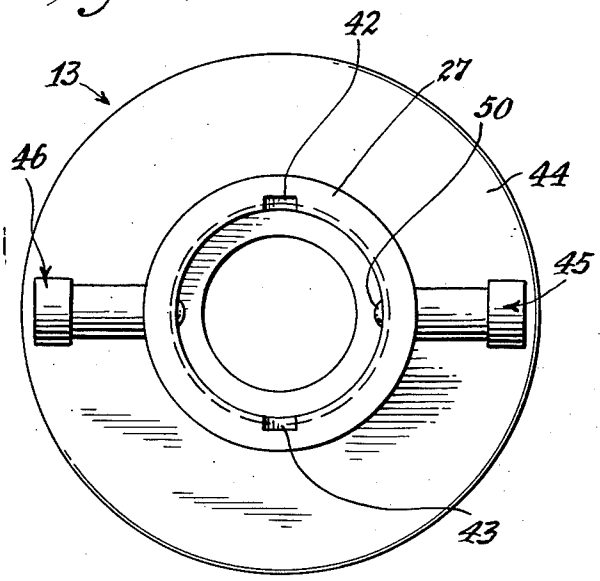
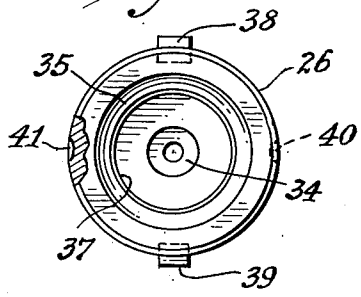


Fig. 5.



KENNETH M. LAWRENCE
WESLEY K. RICKEL
INVENTORS.

BY Kenyon & Kenyon
ATTORNEYS.

Oct. 8, 1957 K. M. LAWRENCE ET AL 2,809,014

SHOT-HOLE DRILLING APPARATUS

Filed Sept. 17, 1954 3 Sheets-Sheet 3

Fig. 7.

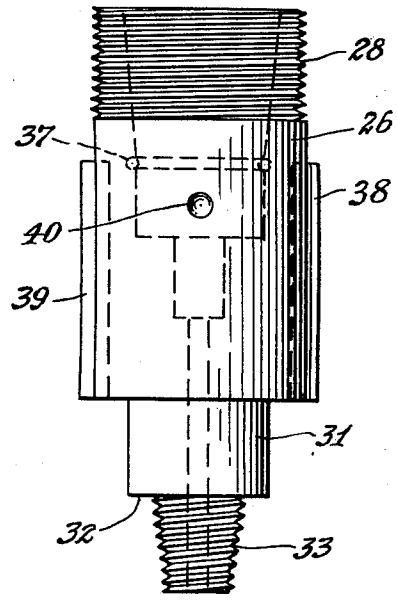
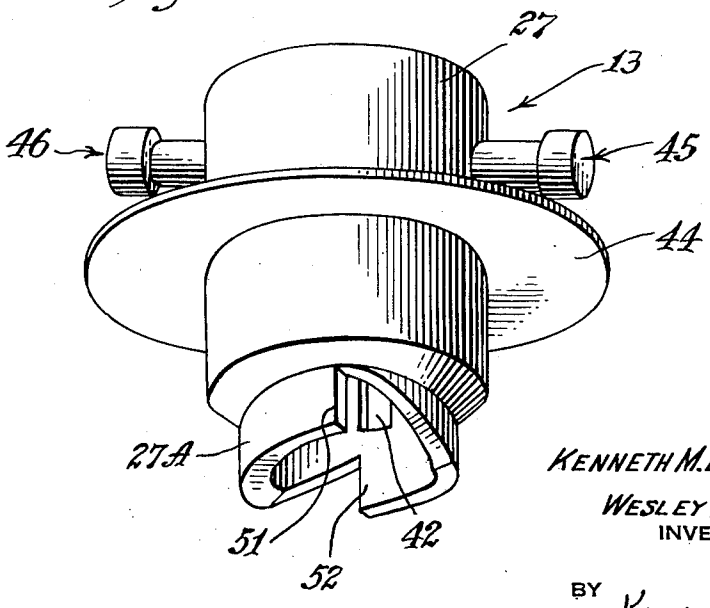


Fig. 6.



KENNETH M. LAWRENCE
WESLEY K. RICKEL
INVENTORS.

BY Kenyon & Kenyon
ATTORNEYS.

United States Patent Office

2,809,014

Patented Oct. 8, 1957

2,809,014

SHOT-HOLE DRILLING APPARATUS

Kenneth M. Lawrence, Tulsa, Okla., and Wesley K. Rickel, Calgary, Alberta, Canada., assignors to Geophysical Research Corporation, New York, N. Y., a corporation of New Jersey

Application September 17, 1954, Serial No. 456,808

5 Claims. (Cl. 255—35)

The present invention relates to shot-hole drilling apparatus constituted by a powered rotary turntable coupled to an auger stem formed by a string of interconnected sections, and more particularly to an attachment adapted to facilitate the decoupling and removal of said stem sections upon completion of a boring operation.

In geological explorations for oil, it is conventional to detonate a charge of powder, thereby causing waves to travel down into the earth. If these waves impinge upon a rock structure, such as a dome or other fault in which the normal position of the rocks is disturbed, the waves will be reflected back to the surface. By measuring the distance the waves have travelled by means of a seismometer, the geologist can locate certain structures, thereby obtaining clues as to where he may find oil. To create the explosion, it is the practice to drill a so-called shot-hole in which a charge of powder is placed.

In the conventional shot-drilling rig, holes of different depths may be drilled by means of a multi-section drill stem, the number of sections used depending on the desired depth of the hole. A bit is secured to the lowermost section of the stem, and the stem is operated by means of a vertically-movable, powered rotary turntable. The relatively short stem sections are each provided at one end with an externally-threaded pin or plug and at the other end with an internally-threaded socket. Sections are joined together in end-to-end relation by inserting the plug of one section into the socket of the other. When boring a hole into the earth's surface, as each section penetrates into the hole an additional section is coupled to the stem by first reversing the turntable to unscrew the associated stem section therefrom and then adding a further section which is coupled into engagement with the rig by operating the turntable in the drilling direction.

The difficulty experienced with drilling rigs of the above-described type arises when the hole is fully bored and it is desired to withdraw the stem therefrom and to dismantle the various sections. Heretofore, this dismantling operation could not be accomplished under power, for in reversing the turntable direction, the stem section directly coupled to the turntable became uncoupled therefrom. Hence, to separate an upper stem section from a lower stem section joined thereto, it was necessary to clamp the lower section to keep it from turning and then by manual means to unscrew the upper section to break the joint. As a consequence, the dismantling operation had to be performed manually and without the assistance of turntable power. With a string formed by a relatively large plurality of stem sections, such dismantling operations entailed a considerable amount of time and effort.

Accordingly, it is the principal object of the present invention to provide a shot-hole drilling apparatus wherein decoupling as well as coupling of the stem sections is accomplished quickly and under power.

More particularly, it is an object of the invention to

provide an attachment adapted to facilitate the decoupling of the stem sections, said attachment including dog elements engaging lugs formed on one end of each stem section.

Still another object of the invention is to provide an attachment of the above-described type having an inner coupling head for engaging a drill stem section and an outer break-out sleeve axially slidable on said head, whereby said sleeve may be lowered to engage the lugs on the drill section coupled to the head.

Yet another object of the invention is to provide an attachment of the above-described type and including an inner head and an outer sleeve wherein the sleeve is axially slidable on the head and wherein rotary movement of the sleeve relative to the head is prevented.

It is also an object of the invention to provide an improved drilling rig of sturdy and efficient design.

For a better understanding of the invention as well as other and further objects thereof, reference is made to the following detailed description to be read in conjunction with the accompanying drawing wherein like components are identified by like reference numerals.

In the drawing:

Fig. 1 is an elevational view of a shot-hole drilling apparatus in accordance with the invention.

Fig. 2 is an enlarged view, partially in section, taken between the planes 2—2 in Fig. 1 and illustrating the joint between adjacent sections of the drill stem.

Fig. 3 is a longitudinal sectional view of the attachment for coupling the turntable to the drill stem, the attachment comprising an inner coupling head and an outer break-out sleeve.

Fig. 4 is a top plan view solely of the break-out sleeve shown in Fig. 3.

Fig. 5 is a top plan view solely of the coupling head shown in Fig. 3.

Fig. 6 is a perspective view of the break-out sleeve.

Fig. 7 is an elevational view of the coupling head.

Referring now to the drawings and more particularly to Fig. 1, the shot-hole drilling rig in accordance with the invention comprises a vertically-movable crosshead or frame **10**, a turntable **11** rotatably supported in a horizontal plane within said frame, a multi-section drill stem **12** and an attachment **13** for operatively coupling said turntable to said drill stem.

Frame **10** includes a pair of parallel plates and is movable in the vertical direction along a pair of spaced columns **14**, only one of which is shown in Fig. 1. A cable **15** is linked to the frame to raise or lower the positions thereof, as required. Turntable **11** is mounted on a hollow shaft **16** whose lower end projects below the frame. The turntable is driven in either direction by a pinion **17** intermeshing with the turntable and coupled to a suitable power source such as an electrical motor. Drill stem **12** is constituted by a string of interconnected screw auger sections, three sections **12A**, **12B** and **12C** being shown by way of example. Secured to the extremity of the lowermost section **12C** is a suitable bit **18** having cutting edges for boring a shot-hole in the earth's surface **19**.

As best seen in Fig. 2, each of the screw auger sections is provided with a spiral flight **19**, which extends the full length of the section, a tapered and externally-threaded plug **20** which projects from the lower extremity of the section and a correspondingly tapered and internally-threaded socket **21** formed in the upper extremity of the section. In assembly, the plug **20** of one section is threadably received within the socket **21** of the next section. Thus, in Fig. 2, section **12A** is joined to section **12B** in end-to-end relation. The course of the thread is such that in rotating section **12A** in the clockwise or drilling

direction the plug 20 of this section turns into engagement with the socket 21 in section 12B. Consequently, in the drilling direction, the coupling between sections tends to tighten. In order to unscrew adjacent sections, one of the sections must be clamped against rotation, while the other section is turned in the counterclockwise or counter-drilling direction.

Extending longitudinally through each of the sections is a water passage 22, the passages being interconnected when the sections are joined together. Bit 18 is provided with a nozzle opening 23 which communicates with the water passage in the related stem section.

At the upper end of each section and extending laterally therefrom at diametrically-opposed positions are a pair of lugs 24 and 25 having a rectangular configuration. These lugs in conjunction with the attachment 13 serve to facilitate the separation of the stem sections.

Attachment 13, as best seen in Figs. 3–7, is comprised of an inner coupling head 26 and an outer break-out sleeve 27 concentric with said head and axially slideable thereon. The construction of the attachment is such that rotational movement of the sleeve relative to the head is prevented. Head 26 is formed by a cylindrical block whose upper end 28 is externally-threaded. As shown in Fig. 1, the upper end 28 of the head is received within a collar 29 secured to the free end of the turntable shaft 16, the end 28 of the head being fixedly held in the collar by means of a set screw 30.

The lower end 31 of head 26 is constricted in diameter to form a shoulder 32, and projecting from the lower end 31 is an externally-threaded coupling pin 33. Extending centrally through head 26 is a water passage 34, the upper portion 35 of said passage being enlarged to accommodate the end of a water pipe passing through the hollow shaft 16 of the turntable (Fig. 1). An O ring 37 is provided in the upper portion 35 to effect a water-tight seal between pipe 36 and coupling head 26. Thus, water entering the attachment through pipe 36 flows through successive passages in the stem sections and is ejected from nozzle 23 in bit 18 attached to the lowermost section 12C.

Pin 33 of head 26 is threadably received within socket 21 in the upper stem section 12A, whereby rotation of the turntable 11 in the boring direction effects rotation of auger stem 12. Inserted in longitudinal grooves formed in coupling head 26 on diametrically-opposed sides thereof are rectangular bars 38 and 39, co-acting as keys for the break-out sleeve. On diametrically-opposed sides of the head at positions displaced 90° from keys 38 and 39 are concave recesses 40 and 41 adapted to accommodate friction catches.

Break-out sleeve 27 is constituted by a hollow cylinder having a constricted portion 27A whose inner diameter is slightly greater than that of the outer diameter of head end portion 31, whereby the head telescopes within the sleeve. Formed in the sleeve 27 on diametrically-opposed sides thereof are longitudinal grooves 42 and 43 functioning as key-ways for the keys in the head, thereby permitting axial movement of the sleeve relative to the head but precluding rotational movement therebetween. Extending laterally from sleeve 27 is a circumferential flange 44 providing a safety surface and an operating handle.

A pair of releasable, frictional catches 45 and 46 are provided, each catch including a nipple 47 enclosed by a cap 48 and containing a spring 49 which urges a steel ball 50 into the associated recess into the coupling head. The lower end of the sleeve is triangularly notched at opposing sides of the sleeve to define a pair of dogs 51 and 52. When the break-out sleeve is urged downwardly by pressure applied to flange 44, the friction catches are released and the dogs 51 and 52 are brought into engagement with lugs 24 and 25 on the stem section joined to the coupling head. By rotating the turntable in the counter-drilling direction whereby the lugs on the upper

section are engaged by the dogs on the attachment and clamping the adjacent section joined to the upper section against rotation, the upper stem section may be unscrewed from the lower section.

Referring now to Fig. 1 wherein the drill stem is constituted by sections 12A, 12B and 12C, the procedure will now be described by which the several sections are dismantled in coming out of the shot-hole. As will be seen in this figure, the upper section 12A is well above the earth's surface, whereas the section 12B joined thereto is only partially withdrawn from the hole. The first step in the procedure is to hold section 12B with a wrench or a similar tool to keep it from turning and also from falling into the hole. Then, the break-out sleeve 27 on the attachment 13 is lowered to engage the dogs on section 12A. The direction of rotation of turntable 11 is reversed, thereby breaking the joint between sections 12A and 12B. After the joint is broken, the break-out sleeve on the attachment is raised. At this juncture, the wrench is applied to the lower end of section 12A to clamp same against rotation. The turntable is again operated in the reverse direction, thus breaking the joint between the coupling head 26 of the attachment and section 12A, and permitting the removal of section 12A from the stem. Now, by means of cable 15 the turntable is lowered to engage section 12B, and the turntable is rotated in the drilling direction so that the pin 33 on the coupling head 26 screws into the socket 21 in section 12B. The turntable is now elevated so that section 12B is lifted a few feet above the earth's surface while section 12C remains partially in the hole. Thereupon, the above-described steps are repeated, to permit the removal of section 12B. It will be seen from the foregoing that the several sections forming the drill stem may be removed under power, and the manual procedure heretofore entailed for this purpose is no longer necessary. It is to be understood that while the invention has been described in connection with shot-hole drilling apparatus, it is equally applicable to well-drilling and other forms of drilling rigs.

While there has been shown what is at present considered to be a preferred embodiment of the invention, it is manifest that various changes and modifications may be made therein without departing from the essential spirit of the invention. It is intended, therefore, in the annexed claims to cover all such changes and modifications as fall within the true scope of the invention.

We claim:

1. A shot-hole drilling apparatus comprising a vertically movable frame, a turntable rotatably mounted in said frame, power means coupled to said turntable selectively to effect rotation thereof in a drilling direction and in a counter-drilling direction, a drill stem constituted by a string of sections threadably joined in end-to-end relation, each section having one lug at its upper end and an attachment for coupling said stem to said turntable, said attachment comprising a coupling head having a pin for threadably engaging the uppermost section of said stem, and a break-out sleeve slidably mounted on said head and having a dog element for engaging said lug on said uppermost section, said sleeve including means to prevent rotation thereof relative to said head.

2. An attachment for coupling a powered turntable, rotatably mounted on a shaft terminating in a coupling collar, to a multi-section drill stem, said turntable being selectively rotatable in a drilling direction and in a counter-drilling direction, each section of which is provided at one end with an internally-threaded socket and a pair of oppositely-disposed lugs, said attachment comprising a cylindrical coupling head one end of which is externally-threaded for insertion in said collar, said head having a threaded pin projecting from the other end thereof for insertion in the socket of the uppermost section of said drill stem, a break-out sleeve slideably mounted on said head and having a pair of dogs formed therein for engaging said lugs on said drill section when said

sleeve is axially lowered relative to said head, means to prevent rotation of said sleeve relative to said head, and releasable catch means normally to hold said sleeve on said head at a raised position thereon out of engagement with said lugs.

3. An attachment for coupling a powered turntable, rotatably mounted on a shaft terminating in a coupling collar, to a multi-section drill stem, each section of which is provided at one end with an internally-threaded socket and a pair of oppositely-disposed lugs, said turntable being selectively rotatable in a drilling direction and in a counter-drilling direction, said attachment comprising a cylindrical coupling head one end of which is externally threaded for insertion in said collar, said head having a threaded pin projecting from the other end thereof for insertion in the socket of the uppermost section of said drill stem, a break-out sleeve slideably mounted on said head and having a pair of dogs formed thereon for engaging said uppermost lugs on said drill section when said sleeve is axially lowered relative to said head, and releasable catch means normally to hold said sleeve on said head at a raised position thereon out of engagement with said lugs, said head further including a pair of diametrically-opposed keys operating within correspondingly positioned keyways formed in said sleeve whereby rotational movement of said sleeve relative to said head is prevented.

4. An attachment, as set forth in claim 3, further including an outwardly-extending flange formed circumferentially on said sleeve to provide a safety surface and operating handle.

5. A shot-hole drilling apparatus comprising a vertically reciprocable frame, a turntable rotatably mounted in said frame on a shaft terminating below said frame in a coupling collar, a pinion rotatably supported in said frame to drive said turntable selectively in a drilling direction and in a counter-drlling directon, a drill stem constituted by a string of sections threadably joined in end-to-end relation, each section having at one end thereof a socket and a pair of oppositely-directed lugs and at the other end a threaded plug for insertion in the socket of another section, and an attachment for coupling said collar to said stem and including a cylindrical coupling head one end of which is externally threaded for insertion in said collar, said head having a threaded pin projecting from the other end thereof for insertion in the socket of the uppermost section of said drill stem, a break-out sleeve slideably mounted on said head and having a pair of dogs formed thereon for engaging said lugs on the uppermost drill section when said sleeve is axially lowered relative to said head, means to prevent rotation of said sleeve relative to said head, and releasable catch means normally to hold said sleeve on said head at a raised position thereon out of engagement with said lugs.

References Cited in the file of this patent

UNITED STATES PATENTS

1,544,847	Mason	July 7, 1925
1,714,818	Reed	May 28, 1929
1,846,177	Bascom et al.	Feb. 23, 1932
2,181,641	Hicks	Nov. 28, 1939