

Sept. 2, 1930.

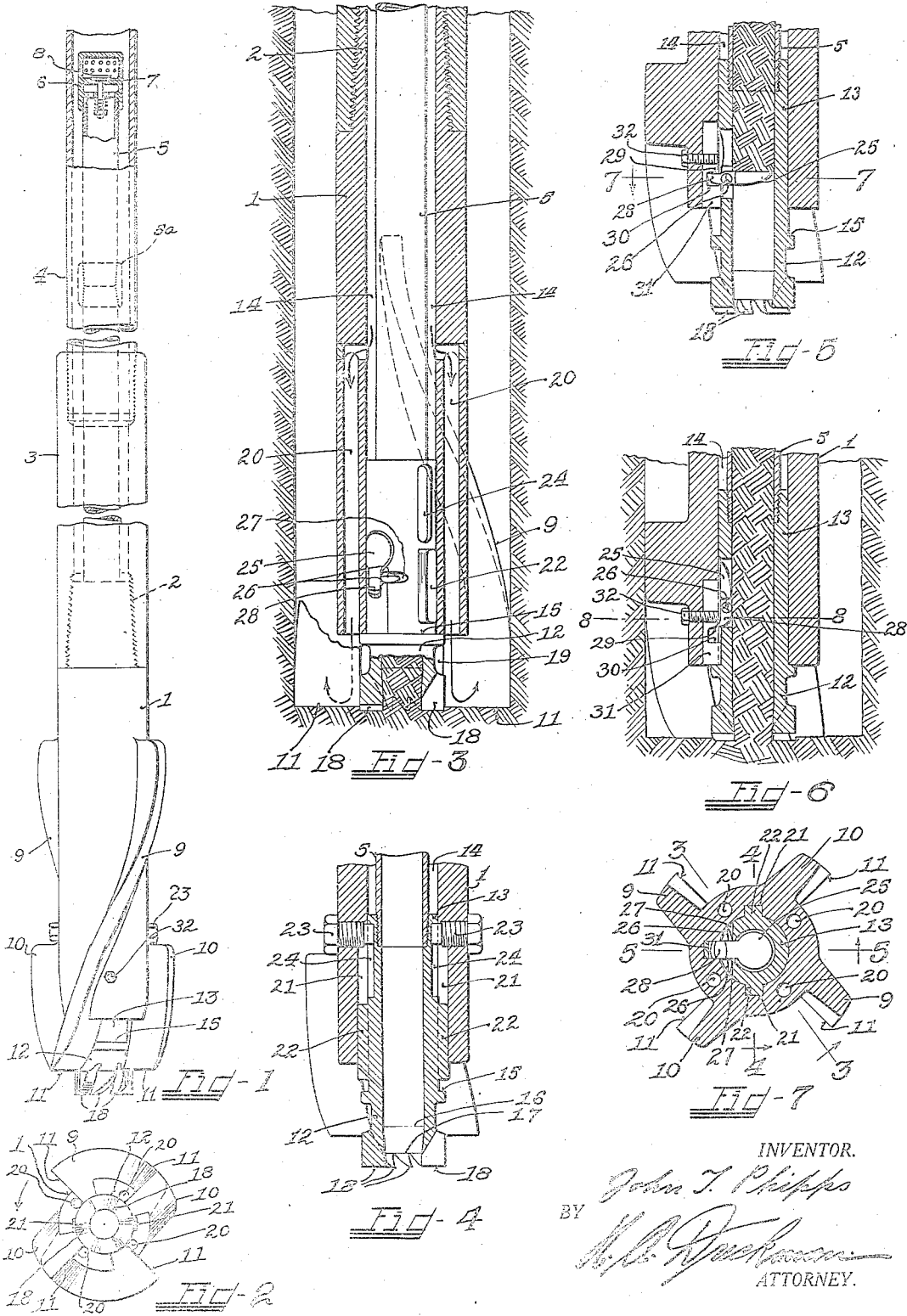
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1,774,522

EARTH BORING DRILL

Filed July 27, 1927

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

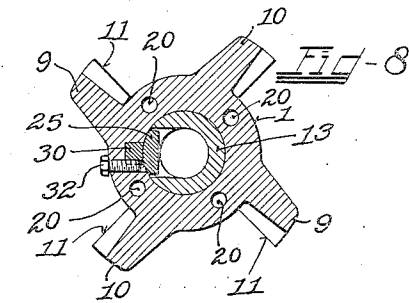


FIG-9

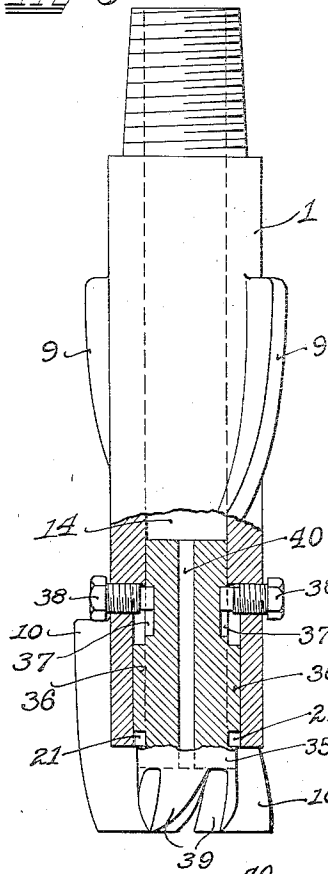


FIG-10

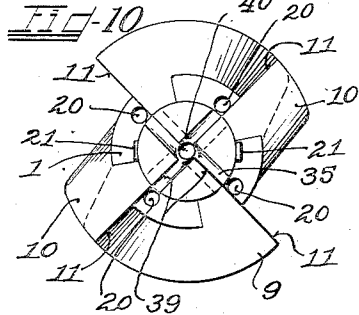
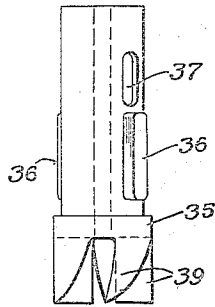


FIG-12

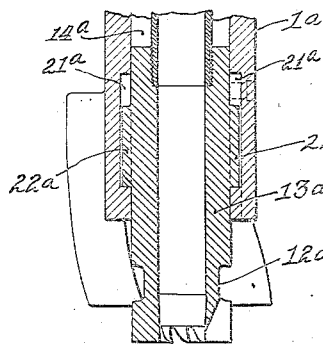


FIG-13

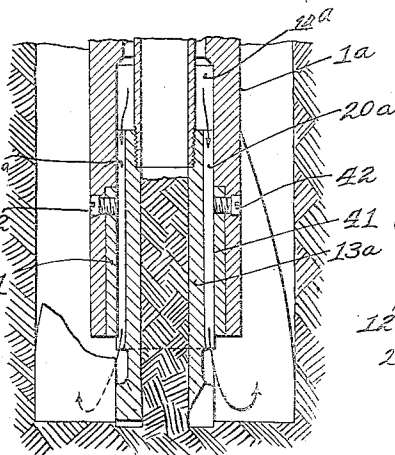


FIG-14

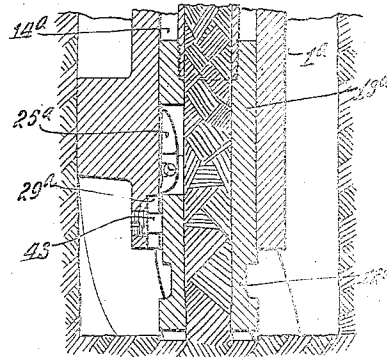


FIG-15

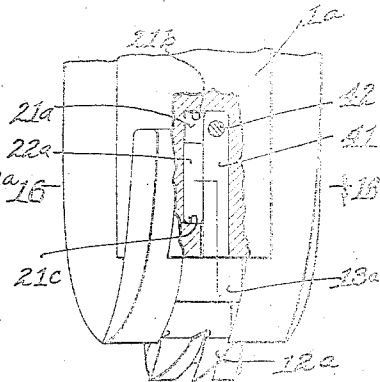
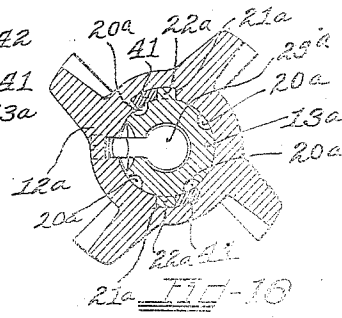


FIG-16



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EARTH-BORING DRILL

Application filed July 27, 1927. Serial No. 203,370.

This is a new application filed in place of my abandoned application, Serial Number 685,025, filed January 8, 1924, for earth boring drill.

This invention relates to earth boring drills, and is particularly directed to a drill of the rotary type having provisions for taking a core of the formation drilled through.

It is an object of the present invention to provide a drill in which the drill body is provided with spiral boring and reaming cutters effecting a swirling of the circulating mud water and promoting a rapid elevation of the borings away from the cutting blades in a manner which tends to prevent clogging of the cutters and freezing of the drill within the well bore, and further it is an object to provide spiral reaming cutters which, collectively, extend approximately a complete circle so as to insure a straight well bore.

A further object is to provide a core-drill having a core retaining means which is maintained in inoperative position during a boring operation and automatically moved to core retaining position upon elevation of the drill from the bottom of the well bore.

Another object is to provide a core drill having a longitudinally movable core-bit and core-barrel, and a core retaining means operated by the movements of said bit and barrel, with the bit restrained against rotary movement within the body and limited as to the extent of its longitudinal movements.

A further object is to provide a drill of the above character in which the core-bit and barrel may be interchanged with a central boring bit.

Various other objects and advantages will be more fully apparent from the following description of the accompanying drawings, which form a part of this disclosure, and which illustrate a preferred form of embodiment of the invention.

Of the drawings:

Fig. 1 is an elevation of the drill in normal condition.

Fig. 2 is a bottom plan view.

Fig. 3 is an enlarged vertical section show-

ing the drill in operating position in a well bore, and taken on line 3—3 of Fig. 7.

Fig. 4 is a vertical section of the lower portion of the drill, taken on line 4—4 of Fig. 7.

Fig. 5 is a similar section on line 5—5 of Fig. 7.

Fig. 6 is a section similar to Fig. 5 and in which the drill is shown in operating position in a well bore.

Fig. 7 is a plan section on line 7—7 of Fig. 5.

Fig. 8 is a plan section on line 8—8 of Fig. 6.

Fig. 9 is an elevation, partly in section, showing a central boring bit assembled in the body in place of the core-bit and core barrel.

Fig. 10 is a bottom plan view of the drill shown in Fig. 9.

Fig. 11 is an elevation of the central boring bit shown in Figs. 9 and 10.

Figs. 12, 13, 14 are sectional views showing another form of structure, Fig. 12 being similar to Fig. 4, Fig. 13 being similar to Fig. 3, and Fig. 14 being similar to Fig. 6.

Fig. 15 is an elevation of the lower portion of the drill illustrated in Figs. 12 to 14, said elevation being partly in section to show more clearly the bayonet-slot connection between the bore-bit and the drill body, and

Fig. 16 is a plan section on line 16—16 of Fig. 15.

Referring particularly to Figs. 1 to 8, the complete device as a core-drill comprises a tubular drill body 1 which at its upper end is provided with a tapered screw-threaded pin 2 adapted to screw into a tubular sub-connection 3 of suitable length and of the standard type having its upper end threaded to receive the drill-pipe 4. The core-barrel 5 is carried by the core-bit, which will later be described, and extends upwardly through the body bore and the bore of the sub 3 and into the drill pipe 4, said barrel being of any desired length and consisting of one or more sections joined by couplings 5^a. The upper end of said core-barrel is closed by a valve cage 6 providing a valve seat 7 and having a spring closed valve 8 co-operating with said seat to prevent the circulating mud-water

from entering the core-barrel while at the same time permitting water or air within said barrel to be expelled. The upper portion of the valve cage 6 has perforations in its side walls and functions as a screen protecting the valve against becoming fouled by mud or other substances.

The body 1 of the drill is provided with outwardly projecting circularly spaced reaming blades, there being two diametrically opposed long blades 9 extending nearly the entire length of the body, and two diametrically opposed short blades 10 extending only part way up the body.

All these blades terminate below the lower end of the body and are formed to provide transverse cutting edges 11 extending radially inward to the core-bit, (see Figs. 2 and 3). The several cutting blades throughout their entire lengths are spiralled rearwardly and upwardly from the cutting edges 11, and collectively extend approximately entirely around the body, as is shown in Fig. 2. Thus there is provided a body having spiral boring cutters extending below the body and longitudinally extending upwardly along the body to provide reaming blades having nearly a full circular contact with the walls of the well bore, whereby, the boring action is made easier, the circulating mud-water is swirled to promote a thorough mixing of the borings with said circulating mud water, and a quick elevation of the borings is obtained. Further by reason of the angular disposition of the cutting blades their cutting edges 11 will be maintained sharper under wear than would perpendicular blades.

The cylindrical core-bit 12 has a shank 13 of a diameter adapting it to be inserted upwardly into the bore 14 of the body and to slide longitudinally therein, and has a shoulder 15 providing an upthrust bearing limiting its upward movement.

The core-barrel 5 is screw threaded into the upper end of the shank 13 and the bore of the shank down to a point 16 is of the same internal diameter as the core-barrel. From said point 16 downwardly to a point 17 the bore is slightly tapered to a smaller diameter, this form of bore providing relief for the core to prevent burning thereof.

Below the shoulder 15 the core-bit 12 is reduced in diameter and the lower end of said bit is formed to provide a plurality of radially disposed teeth 18 which are angled rearwardly, (see Fig. 1). The bases of the notches defining the teeth 18 are angled upwardly and outwardly from the point 17 to points within the space 19 formed by the reduced diameter portion of the bit so that the borings may easily discharge upwardly and outwardly into the path of the cutting blades and circulating mud-water, (see Fig. 3).

The body 1 is provided with four circular

tion ports 20 communicating with the body bore 14 above the core-bit shank and discharging at the lower end of the body, one of said posts discharging immediately in front of each respective cutting blade. (See Figs. 2 and 7.)

To form a connection between the core-bit shank and the body which will prevent relative rotary movement and will at the same time permit longitudinal movement of the core-bit, I provide diametrically opposed key-ways 21 cut into the wall of the body bore upwardly from its lower end, and form on the shank 13 of the core-bit radially disposed keys 22 adapted to engage within said keyways. (See Figs. 3, 4 and 7.)

The upward movement of the core-bit 12 is limited by the shoulder 15 engaging the lower surface of the drill body 1, and to limit the downward movement and to prevent the core-bit and core-barrel from dropping from the drill, there are provided stop screws 23 which are screw-threaded into the body 1 and project into elongated grooves 24 cut in the wall of the shank 13 above the keys 22. (See Figs. 3 and 4.)

This construction provides a core-bit, and core-barrel which is longitudinally slidable within the drill body and is restrained against rotary movement therein, and it further provides means whereby the extent of longitudinal movement of the core-bit and core-barrel is limited and whereby they are prevented from dropping free of the body.

The longitudinal sliding movement of the core-bit within the body bore is utilized to manipulate a core retaining means adapted to engage and retain the core within the core barrel during the withdrawal of the drill from a well bore. The core retaining means consists of a core-retainer 25 which is positioned within an opening in the wall of the core-bit shank 13 and is provided with trunnions 26 having a pivotal engagement within lateral notches 27 in said shank on opposite sides of said opening. (See Fig. 3.) One end of the retainer 25 is of circular form and is adapted to nearly close the core-bit bore when the retainer is in normal horizontal position, (See Figs. 5 and 7) and its opposite end is extended beyond the trunnions to provide a nose 28 normally projecting between upper and lower cam shoulders 29, 30 formed on a block 31 removably inserted upwardly into a companion recess in the body and retained therein by a screw 32.

With the parts in their normal positions as shown in Figs. 5 and 7, the weight of the core-bit and core-barrel will maintain the core-bit extended and the cam shoulder 29 will hold the retainer 25 in horizontal position. In this condition the drill is lowered into the well bore and upon reaching the bottom thereof the core-bit will first engage the formation and the body of the drill continues

its downward travel until its lower surface engages the abutment shoulder 15 on the core-bit shank. During this independent movement of the drill body the cam shoulder 29 engages the nose 28 of the core retainer 25, and moves said retainer upwardly out of the core-bit bore to the vertical position shown in Figs. 3 and 6, where it will remain during a drilling operation, and in which position the nose 28 projects slightly into the path of the cam shoulder 30.

The drilling operation is continued until a core of desired length is obtained and the drill is then withdrawn from the well, and during the first portion of such withdrawal the weight of the core-bit and core-barrel will maintain the core-bit upon the bottom of the well bore while the drill body moves upwards. During such independent movement of the drill body, the cam shoulder 30 will engage the nose 28 of the core retainer 25 and force said retainer into engagement with the core, and if the core is from relatively soft formation the retainer will be removed to the position illustrated in Fig. 5 to completely bridge across the core-bit bore and support the core, but with a core from relatively hard formation the retainer may only bite part way into the side of said core and come to a stop before the body has completed its independent upward movement, and in such event, as soon as the grip of the retainer upon the core is sufficient to overcome the weight of the core-bit and barrel they will then move upwardly with the drill body as a unit.

Upon withdrawal of the drill from the well bore, the stop-screws 23 and the retaining screw 32 will be removed from the drill body. The core-barrel 5 can then be unscrewed from the core-bit and the core-barrel sections uncoupled to facilitate the removal of the core.

With the construction above described I have provided a core-drill having a longitudinally translatable core-bit and barrel effective to project a core-retainer into the core receiving bore during a translation in one direction and to positively retract such core retainer from said bore during a translation in a reverse direction.

In Figs. 9 to 11, I have illustrated a modified arrangement in which a central boring bit 35 is assembled in the body 1 in place of the core-bit and core-barrel, such a bit having the keys 36 for engagement in the key-ways 21 of the body and grooves 37 which are shorter than the grooves 24 of the core-bit, and which are adapted to be engaged by stop-screws 38 similar to, but longer than, the stop-screws 23 previously described so they may be screwed up tight against the shank of the bit 35 and thus more rigidly retain said bit in place. The bit 35 has preferably four boring teeth 39 formed on its lower end, each in diametric alinement with the respective blades of the body and angled rear-

wardly to correspond to the disposition of said blades, and is provided with a central water-way 40 communicating with the central bore 14 of the body and discharging at the lower end of the bit between the teeth. When the body is thus utilized in conjunction with the central bit 35 to form a boring drill, the block 30 previously described will not be assembled therein.

It will be evident from the above that I have provided a drill body of more or less universal character which may be associated with the core-bit and core-barrel to form a core-drill, or with the central boring bit to form only a boring drill.

In Figs. 12 to 16, there is illustrated another form of construction of both the body and the core-bit. In this construction the shank 13^a of the core-bit 12^a has no upthrust shoulder and the body 1^a has no stop-screws, the keys 22^a on the shank 13^a in this instance engaging within bayonet grooves 21^a formed in the peripheral wall of the body bore and providing up-thrust and down-thrust shoulders 21^b and 21^c, respectively, (see Fig. 15). In inserting the shank 13^a upwardly into the bore 14^a of the body 1^a, the keys 22^a enter the vertical portions of the bayonet grooves 21^a and the core-bit 12^a is then slightly rotated to bring said keys into the lateral portions of said grooves. A thrust block 41 is then inserted upwardly into the vertical portion of each bayonet groove 21^a and maintained in place by a screw 42 entering a companion orifice in the body 1^a and screw-threaded into said thrust block (see Fig. 13). The core-retainer 25^a is of the same form as the core-retainer 25 previously described while its operating means is slightly changed in that instead of the block 30 as previously employed, in this instance the upper cam shoulder 29^a is formed directly on the body 1^a and the cam shoulder 30^a is in this instance the inner portion of a screw 43 carried by the body 1^a in spaced relation to the shoulder 29^a. (See Fig. 14.)

A further construction change resides in the water-ways 20^a which in this form of core-bit, are formed by longitudinally grooving the peripheral wall of the core-bit shank 13^a, (as shown in Figs. 13 and 16).

An advantage incident to the bayonet groove construction resides in the fact that in event of wear of the grooves or keys, the trust blocks 41 can be renewed or replaced with others which are slightly wider to compensate for such wear.

The water-ways 20^a, shown in Figs. 13 and 16, are of advantage from a standpoint of cheapness and ease of manufacture and further have a very decided advantage in that with the core-bit removed from the body their entire lengths are exposed and may easily be cleaned.

While the mechanism herein illustrated

and described is fully capable of fulfilling all of the objects primarily stated it is to be understood that I do not wish to limit the invention to the specific form of embodiment herein disclosed, for it is susceptible of embodiment in various other forms all coming within the scope of the following claims.

Having described my invention, I claim:

1. In a drill of the nature disclosed, a tubular body, a core-bit movably mounted within the lower end of the body-bore, and a core-retainer carried by the bit, the body having means adapted to be engaged by the core-retainer during downward movement of the bit to move said core-retainer to a lower core-retaining position.

2. In a drill of the nature disclosed, a tubular body, a core-bit longitudinally slidable within the lower end of the body-bore and restrained against relative rotation therein, and a core-retainer carried by the bit, the body having means adapted to be engaged by the core-retainer during downward movement of the bit to move said core-retainer to a core-retaining position.

3. In a drill of the nature disclosed, a tubular body, a core-bit longitudinally slidable within the lower end of the body bore and restrained against relative rotation therein, a core-retainer carried by the bit, the body having means adapted to be engaged by the core-retainer during downward movement of the bit to move said core retainer to a core-retaining position, and means for limiting the movement of the core-bit.

4. In a drill of the nature disclosed, a tubular body provided with outwardly projecting circularly spaced reaming cutters terminating below the lower end of the body with their lower ends formed to provide transverse cutting edges, a core-bit having a toothed lower end and a shank longitudinally slidable within the lower end of the body-bore, a core-barrel carried by the bit, and a core-retaining means moved to core-retaining position by the longitudinal downward movement of the bit, the shank of said core-bit having longitudinally disposed peripheral grooves forming water ways communicating with the body-bore above the bit shank and discharging at the lower end of the body.

5. In a drill of the nature disclosed, a tubular body, a core-bit movably mounted within the lower end of the body-bore, and a core-retainer carried by the bit, the body having means adapted to be engaged by the core-retainer during downward movement of the bit to move said core-retainer to a lower core-retaining position, said tubular body being provided with outwardly projecting, circularly spaced blades longitudinally extending to form reaming cutters, said blades being integral with the body and being extended below the lower end of the body with

their lower ends formed to provide transverse cutting edges.

6. In a drill of the nature disclosed, a tubular body, a core-bit movably mounted within the lower end of the body-bore, and a core-retainer carried by the bit, the body having means adapted to be engaged by the core-retainer during downward movement of the bit to move said core-retainer to a lower core-retaining position, said tubular body provided with outwardly projecting circularly spaced spiral blades longitudinally extending to form reaming cutters, said blades being integrally formed with the body, and said blades being solid throughout the entire length thereof.

In testimony whereof, I affix my signature.
JOHN T. PHIPPS.