

1,297,925.

3 SHEETS—SHEET 1.



H. I. STAGE.
 AUTOMATIC PNEUMATIC FEED.
 APPLICATION FILED FEB. 27, 1917.

1,297,925.

Patented Mar. 18, 1919.
 3 SHEETS—SHEET 2.

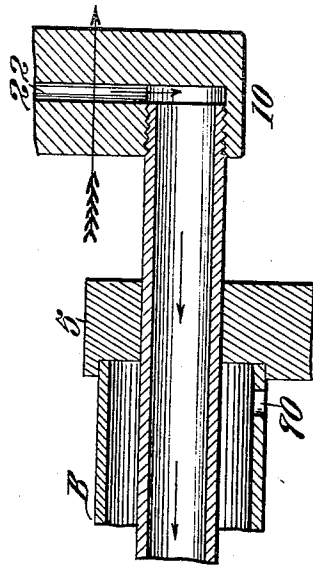


Fig. 4.

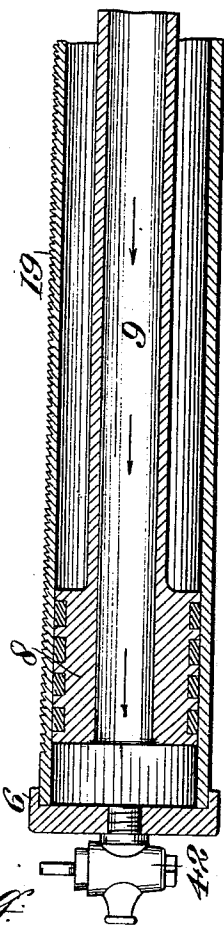
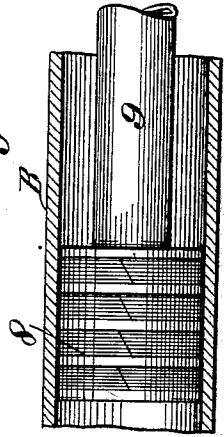


Fig. 5.



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Charles Pickles
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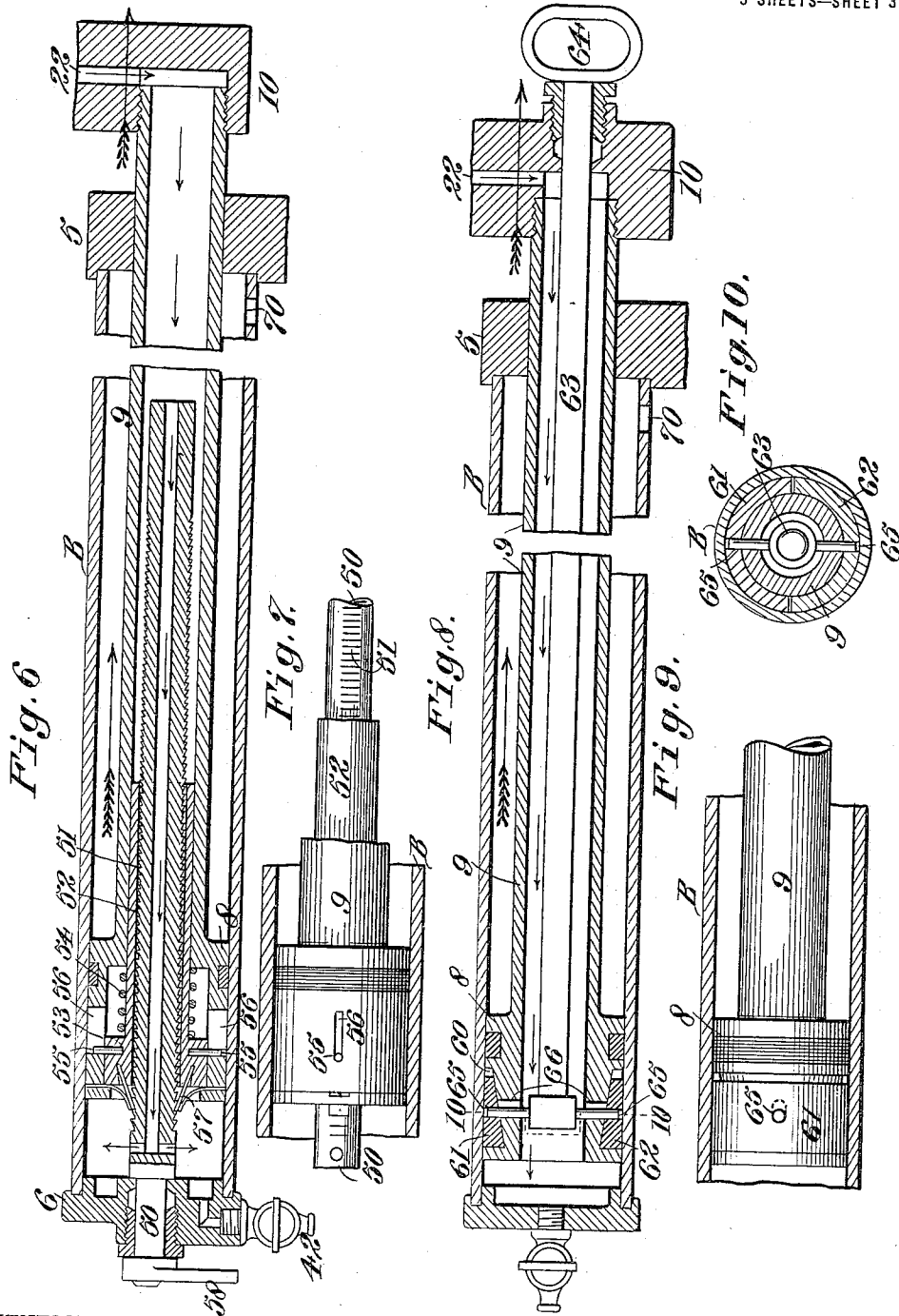
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UNITED STATES PATENT OFFICE.

HAROLD I. STAGE, OF SOULSBYVILLE, CALIFORNIA.

AUTOMATIC PNEUMATIC FEED.

1,297,925.

Specification of Letters Patent.

Patented Mar. 18, 1919.

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To all whom it may concern:

Be it known that I, HAROLD I. STAGE, a citizen of the United States, residing at Soulsbyville, in the county of Tuolumne and State of California, have invented new and useful Improvements in Automatic Pneumatic Feeds, of which the following is a specification.

This invention relates to an automatic, pneumatic feed for pneumatic impact tools.

One of the objects of the present invention is to provide a simple, substantial mounting for pneumatic drills and like impact tools, and particularly an air or pneumatic means which is adapted to hold the drill against its work and automatically advance the same as the depth of the hole increases. Another object of the invention is to provide an automatic feed actuated by the recoil of the hammer which will feed the hammer and drill in a forward direction and which will permit the pneumatic drill to be universally used in mining, that is, for stopping, sinking or drifting.

Further objects will hereinafter appear.

The invention consists of the parts and the construction and combination of parts as hereinafter more fully described and claimed, having reference to the accompanying drawings, in which—

Figure 1 is a side elevation of a pneumatic drill partly broken away, showing the mounting and the feed which form the subject-matter of the present invention.

Fig. 2 is a plan view of Fig. 1.

Fig. 3 is a detail side elevation, taken from the opposite side of Fig. 1, showing the air valve in section which automatically cuts off the air when the drill has advanced a predetermined distance.

Fig. 4 is an enlarged, central, longitudinal section through the feeding cylinder B.

Fig. 5 is a detail view of the piston employed in the cylinder B.

Fig. 6 is a section, similar to Fig. 4, showing a modified form of construction.

Fig. 7 is a detail view of the piston employed in the construction shown in Fig. 6.

Fig. 8 is a view, similar to Fig. 6, showing another modification.

Fig. 9 is a detail view of the piston employed in Fig. 8.

Fig. 10 is a cross section on line 10—10 of Fig. 8.

Referring to the drawings in detail, A indicates, in general, a cylinder of a stand-

ard form of pneumatic drill, 2 the chuck, 3 the drill carried by same, and 4 the valve head. Positioned below the cylinder A and adapted to support the pneumatic drill as a whole and provide a carriage upon which it may slide is a cylinder, generally indicated at B. This cylinder is provided with a forward head 5 and a rear head 6 which are secured upon the cylinder by means of a pair of tie-rods 7, positioned one on each side of the cylinder and running parallel with same.

Mounted interiorly of the cylinder B is a hollow piston 8, of suitable construction, and secured to said piston or formed integrally therewith is a hollow piston-rod 9 which extends through the forward head 5. Secured on the outer forward end of the piston-rod 9 is a head member 10 which is adapted to support the chuck 2 of the pneumatic drill and securing the chuck rigidly to the head 10, by means of bolts 11, is a clamp 12. Secured to the rear end of the cylinder A is an arm 13, the rear end of which is downwardly extended to form a pair of bearing members 14 which are adapted to slide upon the rods 7.

Formed on the upper surface of the arm 13 is a pair of lugs 15 and slidably mounted in said lugs is a rod 16, on the outer end of which is secured a head member 17 supporting a feeding pawl 18 which is adapted to engage with ratchet teeth 19 formed on the upper side of cylinder B. Formed on the rod 16 between the bearing lugs 15 is a collar 20, and interposed between said collar and the forward lug 15 is a coil spring 21 which is always under compression. The head 17 is provided with a lip 17^a extending beneath a part of the arm 13. Movement of the cylinder A relative to the cylinder B forming the carriage of the construction, in a retrograde direction, is limited by the distance between the head 17 and end of the arm 13, shown at *d*. This in practice is about one-fourth to three-eighths of an inch so that the total retrograde movement of the cylinder A is this amount plus the distance between the teeth of the rack 19 or about three eighths to one-half of an inch. Formed in the head member 10 is a cored passage 22, the lower end of which communicates with the hollow piston-rod 9, as shown in Fig. 4, while the upper end is adapted to communicate with the cylinder A by means of a flexible con-

nection 23, a valve 24, and a nipple 25 which is screwed into a hole drilled in the lower side of the cylinder A. This hole communicates with the interior of the cylinder and is adapted to be covered and uncovered by the piston 26 during its reciprocating movement, as will hereinafter be described.

Adjustably secured to the tie-rod 7, on the opposite side of the cylinder, is a cut-off valve, generally indicated at C (see Figs. 2 and 3). This valve consists of a casing 28 having an inlet opening 29 which is adapted to be connected with a suitable source of supply, as a tank receiving air from a compressor or a main pipe line connected with a compressor. It is also provided with an outlet opening 30, which, in this instance, is connected with the valve head 4 by means of a flexible hose 31. Formed in the casing 28, opposite to the intake opening 29 is a stuffing-box 32, and slidably mounted in said stuffing-box is a rod 33, on the inner end of which is secured a valve 34 which is adapted to move into and out of engagement with a valve seat 35 formed at the inner end of the intake opening 29. Interposed between the valve 34 and the inner end of the stuffing-box is a coil spring 36 which is adapted to normally hold the valve against its seat; and secured on the outer end of the rod 33 is a trip lever 37 which is adapted to partly turn the rod 33 to release it with relation to a locking lug 38, as will hereinafter be described.

In actual operation, when employing a pneumatic drill supported upon a feeding cylinder as a carriage such as here shown, it is possible to secure the structure as a whole upon a column 39 in the usual manner. In the present instance the forward head 5 is provided with a swivel connection 40 and a clamp 41 which is adapted to grip the column 39 and secure the drill as a whole with relation to its work. With the pneumatic drill set up, as shown in Fig. 1, it is only necessary to turn on the air by opening the cut-off valve. This is accomplished by pulling the rod 33 in an outward direction against the tension of the spring 36 to move the valve 34 away from its seat. The rod is then turned inwardly to bring the trip lever 37 into engagement with the locking lug 38. This secures the rod and valve in opened position and, therefore, permits air under pressure from the source of supply to enter the intake 29 and pass through the hose 30 into the valve head 4 of the drill. The drill will in this manner be permitted to operate as the air under pressure entering same will cause the piston 26 within the cylinder A to reciprocate at a high speed.

Each forward movement of the piston 26 causes the port or vent 26^a, in the lower side

of the cylinder, to be uncovered and permits a certain portion of the already spent air still having considerable pressure to pass through the nipple 25, the valve 24 and hose 23 to enter the head 10. The air will here pass through the cored passages 22 and the hollow piston-rod in the direction of the unfeathered arrows (see Fig. 4). The air under pressure will thus enter the rear end of the cylinder B and force the piston 8, together with the rod 9, in a forward direction, as indicated by the large feathered arrow (see Figs. 1 and 4). The forward movement of the piston-rod, caused by the entering air under pressure, will naturally advance the drill proper as this is secured, by means of the head 10, to the forward end of the piston-rod. The hammer and drill are in this manner automatically advanced as the depth of the hole increases and the drill is at the same time always held against its work with a pressure proportionate to the air pressure within the feeding cylinder, said pressure being at all times regulated by a valve 42 mounted in the rear end of the cylinder B which may be partly opened or closed to produce any pressure desired.

The advance movement of the cylinder A, together with the drill 3, is in the present instance positively taken up by the pawl 18 engaging with the teeth 19. It is, therefore, not necessary to rely entirely upon the air pressure within the feeding cylinder to hold the drill against its work. The spring 21, interposed between the pawl and the main cylinder, furthermore forms a resilient stop against recoil when the piston strikes the drill, thereby permitting a certain amount of recoil and vibration to take place which is found to be very beneficial in practical operation as it prevents fitching of the drill, particularly when drilling through rock of non-uniform formation.

In actual operation it is found that considerable recoil or reciprocal movement is transmitted to the cylinder A from the piston or hammer when the drill is operating. This reciprocal movement transmitted is utilized for the purpose of feeding the cylinder and drill in a forward direction, while the air admitted to cylinder B merely serves the function of holding the cylinder A and the drill against the work. The feeding operation transmitted from the recoil or reciprocal movement of the cylinder A is substantially as follows:

When the piston or hammer within the cylinder A is reciprocating and striking the drill, considerable recoil is transmitted to the cylinder A. This recoil increases in proportion to the stroke of the piston therein; that is, the recoil of cylinder A is comparatively small when the piston is short stroked and gradually increases as the stroke

of the piston increases. The recoil of the cylinder A, as previously stated, is cushioned by the spring 21 as the lug 15 formed on arm 13 engages the end of said spring; the spring being in turn carried by the rod 16 which is held against rearward movement by means of the head 17 and the pawl 18 which engages the teeth 19. The recoil of cylinder A in a rearward direction is, therefore, taken up or cushioned by the spring 21, while the forward movement of the cylinder A is assisted by the stored energy in the spring 21.

The reciprocal or recoil movement of the cylinder, as before described, increases as the piston stroke increases and it can therefore be seen that the rearward recoil movement of the cylinder A gradually increases the tension in the spring 21 and thereby causes this to impel the cylinder A in a forward direction more and more as the piston stroke increases. This movement finally becomes so great that the pawl 18 will jump over one tooth or advance in a forward direction, thus immediately short stroking the piston and reducing the recoil in the cylinder A. This, however, gradually increases as the drill advances in the rock and the piston stroke proportionately increases and the recoil or reciprocal movement consequently becomes greater and greater until the pawl again jumps or advances one tooth. It can, therefore, be seen that the feeding of the drill, and the hammer and cylinder A in which they are mounted is transmitted from the reciprocal movement transmitted to the cylinder and that the feed thus obtained could not be possible unless the resilient spring 21 is employed.

The air once turned on by opening the cut-off valve described will keep the drill operating and permit it to automatically advance as the depth of the hole increases. Practically no attention is, therefore, required on the part of the operator while the hole is being drilled and it leaves the operator free for other work, for instance, he may be setting up and starting two or three other drills or he may devote his time to mucking while the drill is operating. From practical experience I have found that one drill operator can often do all his own mucking while the drill is operating.

The drill as a whole gradually advances upon the cylinder B until the rear bearing arm 14 engages the outer end of the tripping lever 37. The outer end of the trip lever is inclined, as at 37°, and will, therefore, climb up on the bearing arm 14 and out of engagement with the stop lug 38. The pressure of the spring will then force the rod and valve back against the seat 35 and automatically shut off the air supply to the drill the moment the lever 37 is tripped.

The cut-off valve, together with the stop

lug 38, is secured upon the tie-rod 7 and may be adjusted to assume any position between the heads 5 and 6. In other words, it is possible to set the drill so that it may be automatically shut off the moment a predetermined depth has been obtained. No attention is required on the part of the operator once the drill has been set up and started operating, as it not only automatically advances itself and holds the drill against the work but it is also automatically stopped the moment the drill has advanced the required distance or any predetermined distance desired.

In Fig. 6 a modified form of the structure shown in Fig. 1 is provided. Extending through the rear head 6 is a turnably mounted rod 50, on which is formed ratchet teeth 51. This rod is hollow to permit the incoming air from the piston-rod 9 to pass through same and exert its pressure on the rear end of the piston proper. Mounted interiorly of the piston and the hollow rod 9 is a slidably mounted sleeve 52, the rear end of which is provided with an annular shoulder 53, between which and the forward end of the piston is interposed a coil spring 54. Secured in the collar 53 is a pair of pins 55 which extend through slots 56 formed in the piston proper, and carried on the rear end of the collar is a pair of spring-actuated pawls 57 which are adapted to engage the teeth 51. The teeth and pawls 57, together with the spring 54, take the place of the spring 21 and the pawl 18 shown in Fig. 1.

The operation of the feeding cylinders shown in Fig. 6 is the same as that previously described; that is, the entering air forces the piston in a forward direction and recoil is taken up by the spring 54 and the pawls 57. If it is desired to return the piston to the rear end of the cylinder, once it has been fully advanced, it is only necessary to turn the rod 50 by means of a lever 58. This causes the teeth 51 to move out of engagement with the pawls and permits the piston and the drill as a whole to be returned to normal starting position. A reverse turning movement of the rod 50 will again bring the teeth into alignment with the pawls and will permit the same cycle of operation to occur.

Another modification of the cylinder B is shown in Fig. 8. The piston 8 is in this instance provided with an annular cone-shaped groove 60 in which are placed two similarly shaped segments 61 and 62. Air is admitted behind the piston in the manner previously described and tends to force the piston in the direction of the feathered arrows shown. Any recoil or back movement is checked by the segments 61 and 62 as the inclined faces formed between the piston and the segments will cause the segments to expand and grip the inner surface

of the cylinder, thus checking it against rearward movement. Extending through the hollow piston and rod and the head 10 is a rod 63 provided with a handle 64.

5 The rear end of this rod is provided with a pair of pins 65 which extend through slots 66 in the piston and perforations made in the segments. This rod permits the segments to be moved into locking or releasing position and is particularly employed

10 when it is desired to return the piston to normal starting position; that is, inward movement of the rod, by pressure on the handle 64, will move the segments away

15 from gripping position and, therefore, permits the piston to be returned; a vent opening 70 being provided in each instance to permit air to enter between the forward end of the piston and the head 10 when

20 the piston is being returned.

A pneumatic drill mounted and operated in the manner described permits the drill to be universally used for stopping, drifting and sinking. The bleeding valve 42

25 provided always permits the pressure within the cylinder B to be regulated. For instance, it can readily be seen that more pressure will be required on an up-hole as the weight of the machine and the drill

30 must be overcome before any pressure can be exerted to hold the drill against its work. Similarly, comparatively small pressure is required on a down-hole, as the weight of

35 the machine is here added to the pressure to hold the drill against its work. The air employed for this purpose does not decrease the efficiency of the machine nor the quantity of air required as the air is taken

40 only at the very end of the piston stroke. It is, therefore, practically speaking, exhaust air and in reality is exhausted at this time period or during the rearward movement of the piston.

The several attachments and the mounting provided are simple and substantial in construction and will not require more attention than is ordinarily the case. The mounting, furthermore, permits any type

50 of pneumatic drill to be employed and will not require the buying of new pneumatic drills when a feed of this type is employed.

The materials and finish of the several parts of the apparatus are such as the experience and judgment of the manufacturer

55 may dictate.

I wish it understood that various changes in form, proportion and details of construction may be resorted to within the scope of the appended claims and that I

60 do not wish to limit myself to the specific design and construction here shown.

Having thus described my invention, what I claim and desire to secure by Letters Patent is—

65 1. The combination with a pneumatic ham-

mer and drill and a carriage upon which they are slidably mounted, of pneumatically actuated means for holding the hammer and drill against the work when operating, and a resilient member coöperatively connecting the drill and carriage

70 permitting the recoil of the hammer while operating, said member also adapted to feed the hammer and drill in a forward direction on the carriage.

2. The combination with a pneumatic hammer and drill and a carriage upon which they are slidably mounted, of pneumatic actuated means for holding the hammer and drill against the work when operating, and

80 a resilient stop member coöperatively connecting the drill and carriage and coöperating with the pneumatic means to feed the drill in a forward direction.

3. The combination with a pneumatic hammer and drill and a carriage upon which they are slidably mounted, of pneumatic actuated means for holding the hammer and drill against the work when operating, and

90 a spring cushioned stop member mounted on the drill adapted to lock the hammer and drill against return movement on the carriage but permitting recoil of the same, said stop member being effected by the recoil of

95 the hammer and drill and coöperating with a toothed rack bar to feed the hammer and drill in a forward direction on the carriage.

4. The combination with a pneumatic hammer and a cylinder in which the hammer is mounted, of a carriage upon which the

100 cylinder and hammer are slidably mounted, pneumatically actuated means for holding the cylinder and hammer against the work when operating, resilient means coöperatively connecting the drill and carriage

105 securing the hammer and cylinder against rearward movement on the carriage but permitting recoil of the cylinder, and means for transmitting the recoil movement of the cylinder to feed the cylinder and hammer in a

110 forward direction on the carriage.

5. The combination with a pneumatic hammer and drill and a carriage on which they are slidably mounted, of pneumatic means for holding the hammer and drill

115 against the work when operating, and resilient means coöperatively connecting the drill and carriage actuated by a recoil produced in the hammer when the hammer is operating for automatically feeding the

120 hammer and drill in a forward direction upon the carriage.

6. The combination with the cylinder and drill of a pneumatic hammer and a carriage upon which they are slidably mounted, of

125 a rearwardly extending arm secured to the cylinder, a rod slidably mounted in said arm, a spring interposed between the rod, a lug formed on the arm through which the rod slides, a pawl on the end of the rod, 130

and teeth formed on the carriage with which said pawl is engageable.

5 7. The combination with a pneumatic hammer drill and a carriage upon which it is slidably mounted, of pneumatic actuated means for feeding and holding the drill against the work when operating and a resilient stop member coöperatively connecting the drill and carriage permitting a substantial retrograde movement of the drill and coöperating with the pneumatic feed to advance the drill to the work.

10 8. The combination with a pneumatic hammer drill and a carriage upon which it is slidably mounted, of pneumatic actuated means for feeding the hammer drill in a forward direction along the carriage when the drill is operating and a resilient stop member coöperatively connecting the drill and carriage permitting a substantial retrograde movement of the drill to take up the recoil of the drill whereby said resilient stop member may also act as an additional feeding member.

25 9. The combination with a pneumatic hammer drill and a carriage upon which it is slidably mounted, of pneumatic actuated means for feeding and holding the drill against the work when operating, and a spring cushioned stop member coöperatively connecting the drill and carriage permitting a substantial retrograde movement of the

drill and, coöperating with the pneumatic feed to advance the drill to the work.

10. The combination with a pneumatic hammer drill and a carriage upon which it is slidably mounted, of pneumatic actuated means for feeding and holding the drill against the work when operating, and a resilient stop member comprising a pawl mounted upon a coiled spring supported upon the drill and engaging a rack upon the carriage to permit the drill to move a substantial distance relative to its carriage and to coöperate with the pneumatic feed to advance the drill to the work.

11. The combination with a pneumatic hammer and drill and a carriage upon which they are slidably mounted, of pneumatically actuated means for forcing the hammer and drill against the work when operating, and a stop member resiliently connecting said drill and carriage permitting the recoil of the hammer while operating said member also adapted to feed the hammer in a forward direction on the carriage.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

HAROLD I. STAGE.

Witnesses:

ROYAL S. NICHOLLS,
ALAN R. BLOCKHAM.