G. R. INSHAW.

PACKING FOR ROTARY ENGINES.

APPLICATION FILED JUNE 1, 1917.

1,292,324.

Patented Jan. 21, 1919.

3 SHEETS—SHEET 1.

Fig. 2.

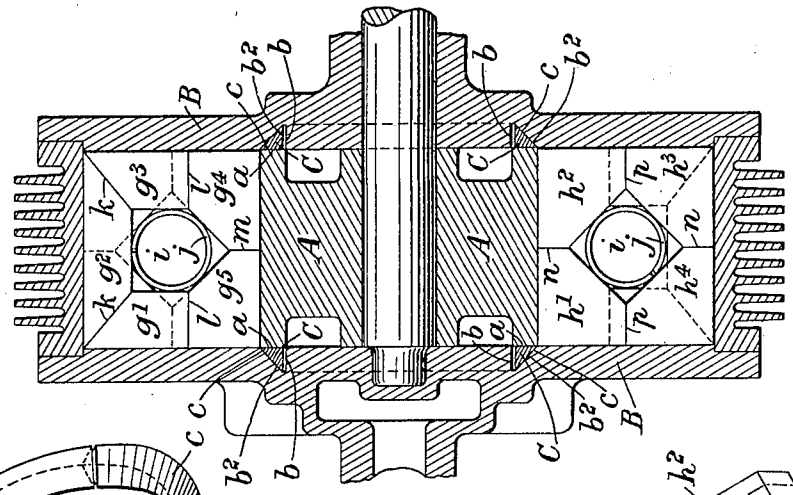


Fig. 3.

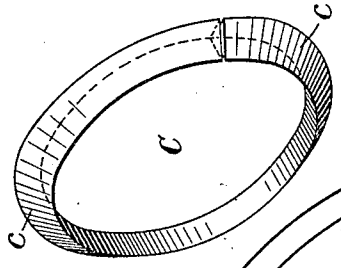


Fig. 4.

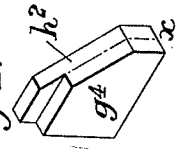
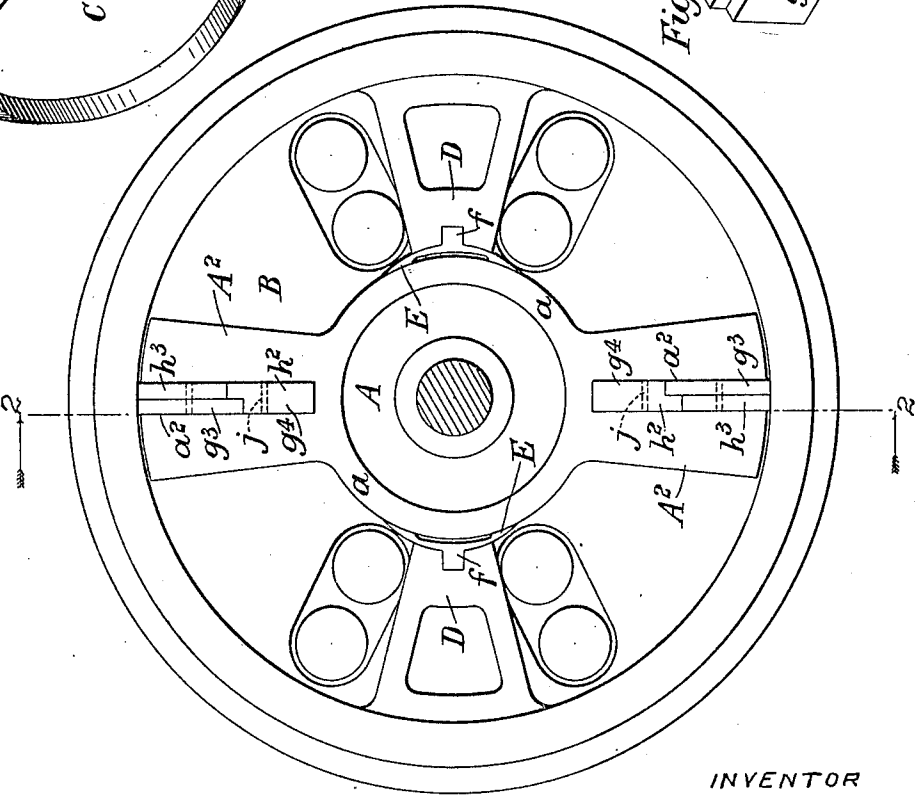


Fig. 1.



INVENTOR

GEORGE RICHARD INSHAW

BY Hinson and Hinson

ATTORNEYS

J. NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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3 SHEETS—SHEET 2.

Fig. 6.

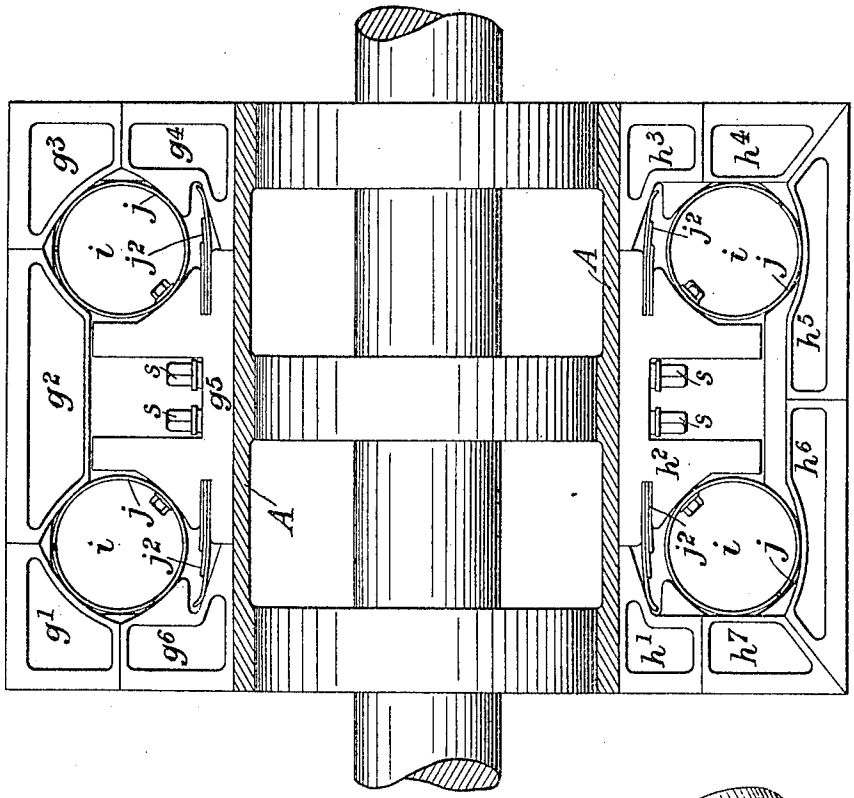


Fig. 7.

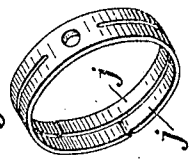
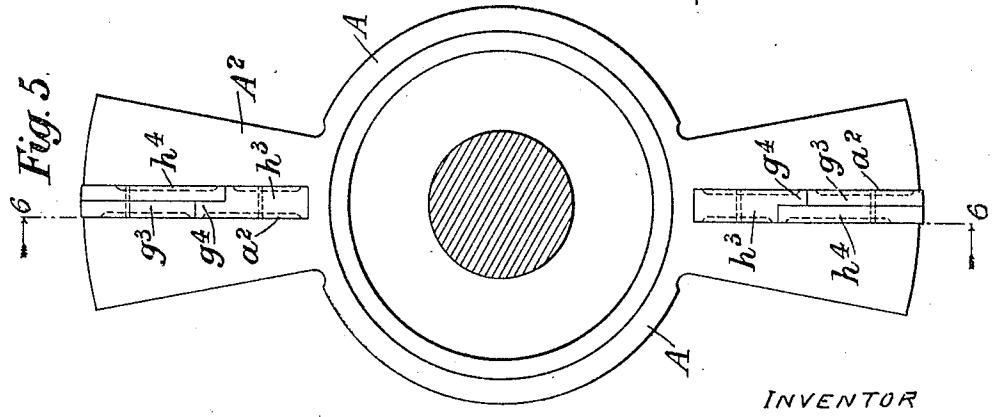


Fig. 5.



INVENTOR

GEORGE RICHARD INSHAW

BY Hopkins & Hopkins

ATTORNEYS

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

G. R. INSHAW.

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3 SHEETS—SHEET 3.

Fig. 9.

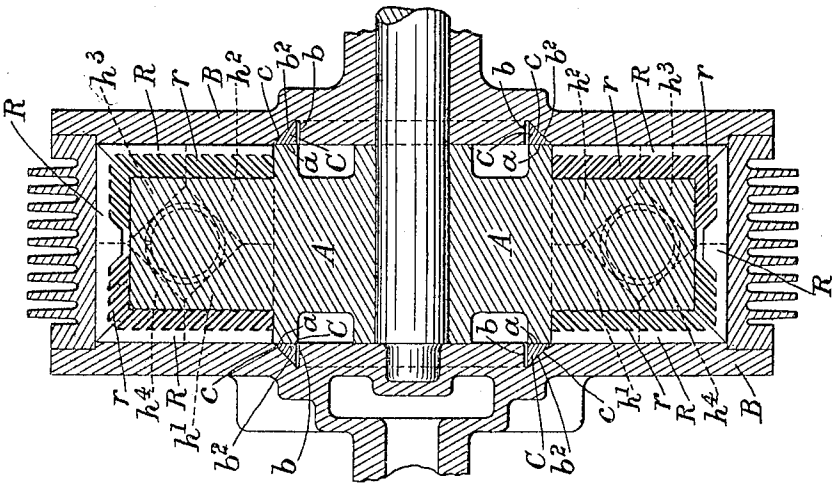
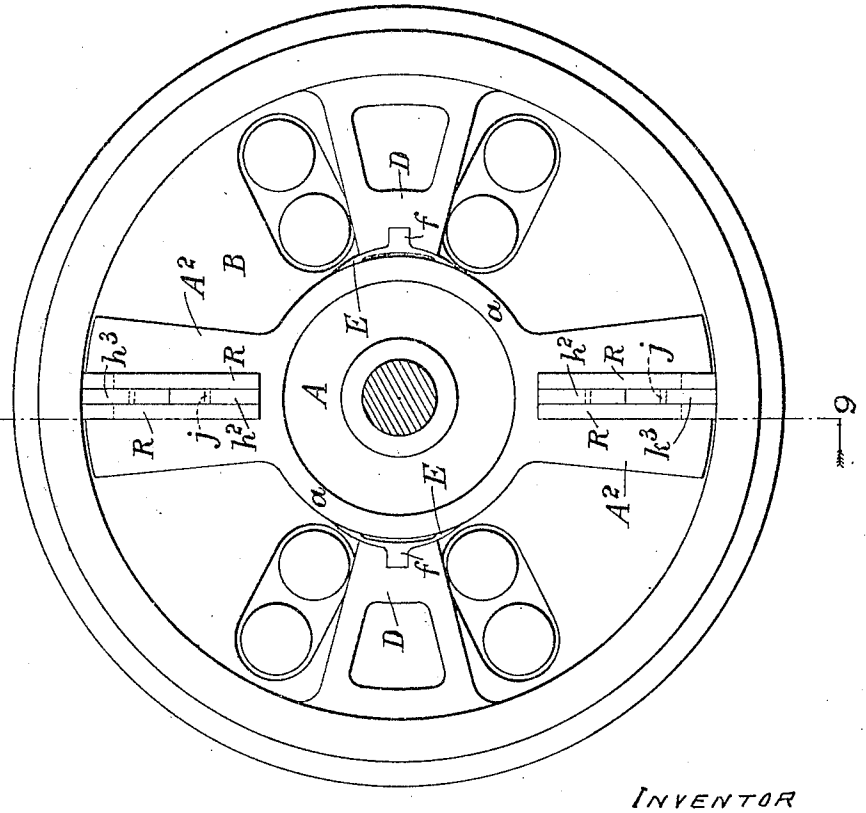


Fig. 8.



INVENTOR

GEORGE RICHARD INSHAW

BY Watson and Watson ATTORNEYS.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

GEORGE RICHARD INSHAW, OF LOCHWOOD HOUSE, NEAR GARTCOSH, SCOTLAND.

PACKING FOR ROTARY ENGINES.

1,292,324. Specification of Letters Patent. Patented Jan. 21, 1919.

Application filed June 1, 1917. Serial No. 172,217.

To all whom it may concern:

Be it known that I, GEORGE RICHARD INSHAW, a subject of the King of Great Britain, residing at Lochwood House, near Gartcosh, Lanarkshire, Scotland, have invented new and useful Improvements in Packing Especially Intended for Rotary Engines and the like, of which the following is a specification.

This invention has for its object to provide packing which is simple and economical and especially adapted for rotary engines and the like, such as rotary pumps, for example, but may also be used for other analogous purposes where packing is required which will give tight closure and yet allow of the requisite movement of the parts without undue friction.

I will describe the invention as applied to a rotary combustion engine from which its application to analogous purposes will also be readily understood.

In the type of rotary engine to which I will refer for illustration of the invention, vanes are employed, which vanes act alternately as pistons and abutments, one pair or set, of vanes being secured to a drum, or cylinder, co-acting with another pair, or set, of vanes secured to a boss and constituting the rotor carried by the shaft, the present invention providing means whereby leakage is prevented and efficient gas-tight joints are obtained, with a minimum of friction, between these two pairs, or sets of vanes and their adjacent parts.

According to my invention I make a packing, for bodies, which rotate relatively the one to the other, of a spring-ring having an inclined face which bears against the correspondingly inclined face of an annular recess in one of the bodies so that the expansion of the spring-ring causes the inclined face thereof to move along the inclined face of the recess and the said ring to press against the opposed surface of the other of the bodies. There may also be used, as a packing, a strip, or plate, carried by one of the bodies from which it projects and bears upon the other of the bodies so that fluid pressure will act upon it to press it with sufficient force against the said other of the bodies. Such strip, or plate, may be attached to the body by which it is carried by a rib and slot arrangement. Or I may use a packing consisting of sets of plates which are held, side by side, in a recess in one of the bodies so that their projecting edges bear on the opposed surfaces, the said plates being forced outward by suitable means such as spring-rings in recesses between the said plates. The respective sets of plates, have the spaces between either set overlapped by the plates of the other set. In engines which are of great breadth in proportion to their depth there may be two such arrangements of sets of plates and springs. If desired, in combination with such arrangements of sets of plates and springs, there may be employed metallic packing made of strips having inclined spring-like parts, this said packing being applied on each side of a single set of such plates and springs or the said packing being applied between two sets of such plates and springs.

In order that this invention may be well understood I will describe, with reference to the accompanying drawings how it may be performed as applied to a rotary internal combustion engine of the kind aforesaid.

Figures 1 and 2 show, in elevation with a cover removed and in section respectively, arrangements according to this invention. The section Fig. 2 is taken on the line 2, 2, Fig. 1. Figs. 3 and 4 being details of a packing ring and a packing plate as hereinafter described. Figs. 5 and 6 show, in sectional elevation, sufficient of a duplex arrangement for engines of great breadth, the section Fig. 6 being taken on the line 6—6, Fig. 5; and Fig. 7 shows a spring ring separately; while Figs. 8 and 9 are views corresponding to Figs. 1 and 2, showing a modification wherein strips with inclined springlike parts, are employed in combination with sets of plates as aforesaid. The section Fig. 9 is taken on the lines 9—9, Fig. 8.

According to this invention, in order to prevent leakage between the ends of the boss of the rotor A, and the side plates B, of the

cylinder, an annular recess b, is formed in each of the said side plates B, which recesses b are preferably of the same diameter as the boss of the rotor, and have an outwardly inclined face b^2, into each of which recesses is sprung, or fitted, a spring ring C, (shown separately in Fig. 3) having an inclined face c, which bears on the inclined face b^2, of the said annular recess b, and, as the said rings have a tendency to expand, they move outwardly along the inclined part of the recess b, and so press against the boss of the rotor at a, thus forming a gas-tight joint between the said boss of the rotor and the side plates.

In order to obtain a gas-tight joint between the vanes D, on the drum, or cylinder, and the boss of the rotor against which they bear, a plate, or strip, E, is arranged between the inner end of each vane D, and the adjacent boss of the rotor, the said plate E, being of sufficient width to extend, as shown, beyond each side of the vane and to lie on the surface of the boss. The said plate, or strip, E, can be secured to its vane in any suitable way, but it is convenient to secure it by forming at the inner end of the vane, a slot which may extend across the breadth of the vane into which slot a projecting part f, on the back of the said plate, or strip, E, is fitted. The pressure of gas in the engine acts on the exposed surface of the plates, or strips, E, and tends to press such plates, or strips, E, against the boss of the rotor, with sufficient force to very efficiently prevent leakage between the said parts.

It is also necessary to provide means for preventing leakage between the vanes, or arms, A^2, of the rotor and the walls of the casing, or cylinder, in which the said rotor works. In this packing, a transverse slot a^2, is formed in each rotor arm, or vane, A^2, into which slots are fitted two sets of plates marked respectively g^1, g^2, g^3, g^4, g^5, and h^1, h^2, h^3, h^4, the two sets of plates constituting two packing pieces, the several plates between them forming one packing, both sets of the said plates being so shaped and fitted as to form a rectangle, the edges of which bear on the ends and the inner periphery of the cylinder, as seen clearly in Fig. 2. The inner parts of the plates are formed so as to constitute between them a hollow, or recess, i, which may be rectangular, or polygonal, in shape, and which extends through both sets of plates. Into this recess is fitted a pair of circular springs j, which may be a connected pair, for example as shown in Fig. 7. The several plates of each set are so formed and fitted with reference to the adjacent plates that the spring by bearing against the inner sides of the plates, which surround the opening i, will cause the said sets of plates to expand radially, or diagonally, by the plates moving along on their meeting edges so as to prevent leakage between the vanes and inner periphery and ends of the cylinder. The two sets of plates (g^1 to g^5 and h^1 to h^4) and the spring (j) are arranged in the slot in each vane, or arm, so that the plates bear flat against each other, the plates of each set being arranged so that they overlap the joints of the other set and so prevent any leakage past the meeting edges of the plates. In the example illustrated one set of plates is composed of five plates (see the upper part of Fig. 2) with two diagonal joints (k) two horizontal joints (l) and one vertical joint (m) while the other packing consists of four plates (see the lower part of Fig. 2) with two vertical joints n and two horizontal joints p. It will be readily understood that when two such sets of plates are placed side by side in the slot in the vane, or arm, their joints will "break bond" (as clearly illustrated in Fig. 2) and that the spring j will tend to thrust the plates against the cylinder end-plates, or covers, and against the inner periphery of the cylinder, and against the inner end of the slot in the vane or arm, with diagonal thrust into the corners at the meeting of the end-plates, or covers, and the inner periphery of the cylinder and at the meeting of the end-plates, or covers, and the periphery of the rotor.

Where it may be convenient to do so what I have shown as two plates may be formed in one. For example (as shown in Fig. 4) the plates g^4 and h^2 (or the plates g^5 and h^1) instead of being made in two as indicated at x may be made in one.

For engines which are of great breadth in proportion to their depth, two pairs of springs may be provided for each set of plates in each vane, or arm, for instance as shown in Figs. 5 and 6. In this case, additional central plates may be employed, or the plates may be elongated, for example, six plates g^1 to g^6 (see the upper part of Fig. 6) may be in one set and other plates (seven are shown at the lower part of Fig. 6) be arranged in the second set relatively to the first set, as to constitute two hollows, or recesses, for the springs j (which may be made in connected pairs as shown in Fig. 7) and permit of outward radial and diagonal, displacements, as explained with regard to Figs. 1 and 2, the one set being so arranged with reference to the other set that the joints of the two sets of plates overlap as in the first instance.

In Fig. 6 I have shown the plates g^5 and h^2 bolted by the bolts s to the rotor and I have shown the springs j bolted to the said plates and I have also shown additional blade springs j^2 held in slots in the said plates and bearing upon the plates, g^4, g^6,

h^2 and h^3 which are shaped as shown to receive the impact of the springs.

In a further modification, which is illustrated in Figs. 8 and 9, I use in combination with a single set of plates of the character shown in Figs. 1 and 2 with a spring j in the central hole formed between them and on each side in the slot in the rotor vanes, or arms, a metallic packing made of strips R having a succession of inclined spring-like parts r, or there may be such a packing R r applied in the slot between two sets of packing plates of the character described with regard to Figs. 1 and 2.

The said packings may be made of cast iron, gun metal, or compressed graphite, or any other material suitable for the purpose required.

The corresponding parts which are shown in the respective figures are marked with the same reference numerals.

What I claim is:

1. A rotary engine having a hub rotor, a cylinder surrounding the same, a vane carried by the hub rotor and radially slotted to receive a packing, in combination with juxtaposed parallel sets of packing plates freely arranged in said slot, spring means for forcing said plates outward into engagement with the ends and inner periphery of the cylinder, independent plates of one set bearing against the periphery and against each end of the cylinder and making joint on an angle at both the outer corners of the vane and plates of the other set of angle shape located at said corners, the joints of the plates of one set breaking bond with the joints between the plates of the other set.

2. A rotary engine having a hub rotor, a cylinder surrounding the same, a vane carried by the hub rotor and radially slotted to receive a packing, in combination with parallel juxtaposed sets of packing plates arranged in said slot, together with spring means common to a plurality of said plates and forcing the latter independently outward radially and longitudinally into engagement with the periphery and ends of the cylinder.

3. A rotary engine having a hub rotor, a cylinder surrounding the same, a vane carried by the hub rotor and radially slotted throughout its depth to receive a packing, in combination with parallel sets of juxtaposed packing plates freely arranged in said slot and centrally arranged spring means common to a plurality of said plates for forcing the same outward into engagement with the periphery and ends of the cylinder.

4. A rotary engine having a hub rotor, a cylinder surrounding the same, a vane carried by the hub rotor and radially slotted throughout its depth to receive a packing, in combination with parallel sets of juxtaposed packing plates freely arranged in said slot and centrally arranged spring means for forcing the plates outward into engagement with the periphery and ends of the cylinder, the plates of one set being of different shape from the plates of the other set and breaking bond therewith at their respective joints.

5. A rotary engine having a hub rotor, a cylinder surrounding the same, a vane carried by the hub rotor and radially slotted throughout its depth to receive a packing, in combination with parallel sets of juxtaposed packing plates freely arranged in said slot and centrally arranged spring means common to the plates of both sets for forcing the plates outward into engagement with the periphery and ends of the cylinder, the plates of one set being of different shape from the plates of the other set and breaking bond therewith at their respective joints.

6. A rotary engine having a hub rotor, a cylinder surrounding the same, a vane on said cylinder approaching said hub rotor and bearing against the same, and a packing for said vane comprising a packing member interposed between the inner end of said vane and the said hub rotor, said packing lying against the end of the vane but projecting beyond the circumferential margins thereof, said projecting portions of the packing alone being exposed to the pressure within the cylinder.

7. A rotary engine having a hub rotor, a cylinder surrounding the same, a vane on said cylinder approaching said hub rotor and bearing against the same, said vane being transversely slotted at its inner end in a direction substantially parallel to the axis of the hub rotor, together with packing for said vane comprising a packing member bearing against the inner end of the vane and interposed between the latter and the hub rotor, said packing having a rib engaging the slot in said vane and projecting beyond the circumferential margins of the latter, said projecting portions of the packing alone being exposed to the pressure within the cylinder.

8. A rotary engine having a hub rotor, a cylinder surrounding the same, a vane carried by the hub rotor and radially slotted to receive a packing, in combination with a vane packing comprising parallel sets of plates lying in said slot, the meeting edges of the plates of each set being inclined with relation to each other, and the plates of the respective sets being of different shape to insure their overlap and to thus afford a bearing surface at all points to prevent leakage, together with a packing ring carried by the cylinder head, said ring having a flat surface bearing against the hub end and an inclined surface bearing against the cylinder head, the latter being recessed to receive said ring and the inclination of the coöperating

surfaces of the ring and recess being such that on the expansion of the ring the latter is forced inward against the hub end, the outer edge of the bearing surface of the ring, in contact with the hub, being contiguous with the inner end of the vane packing.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses.

GEORGE RICHARD INSHAW.

Witnesses:
G. T. TYSON,
EDWD. GEO. DAVIES.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."