

(No Model.)

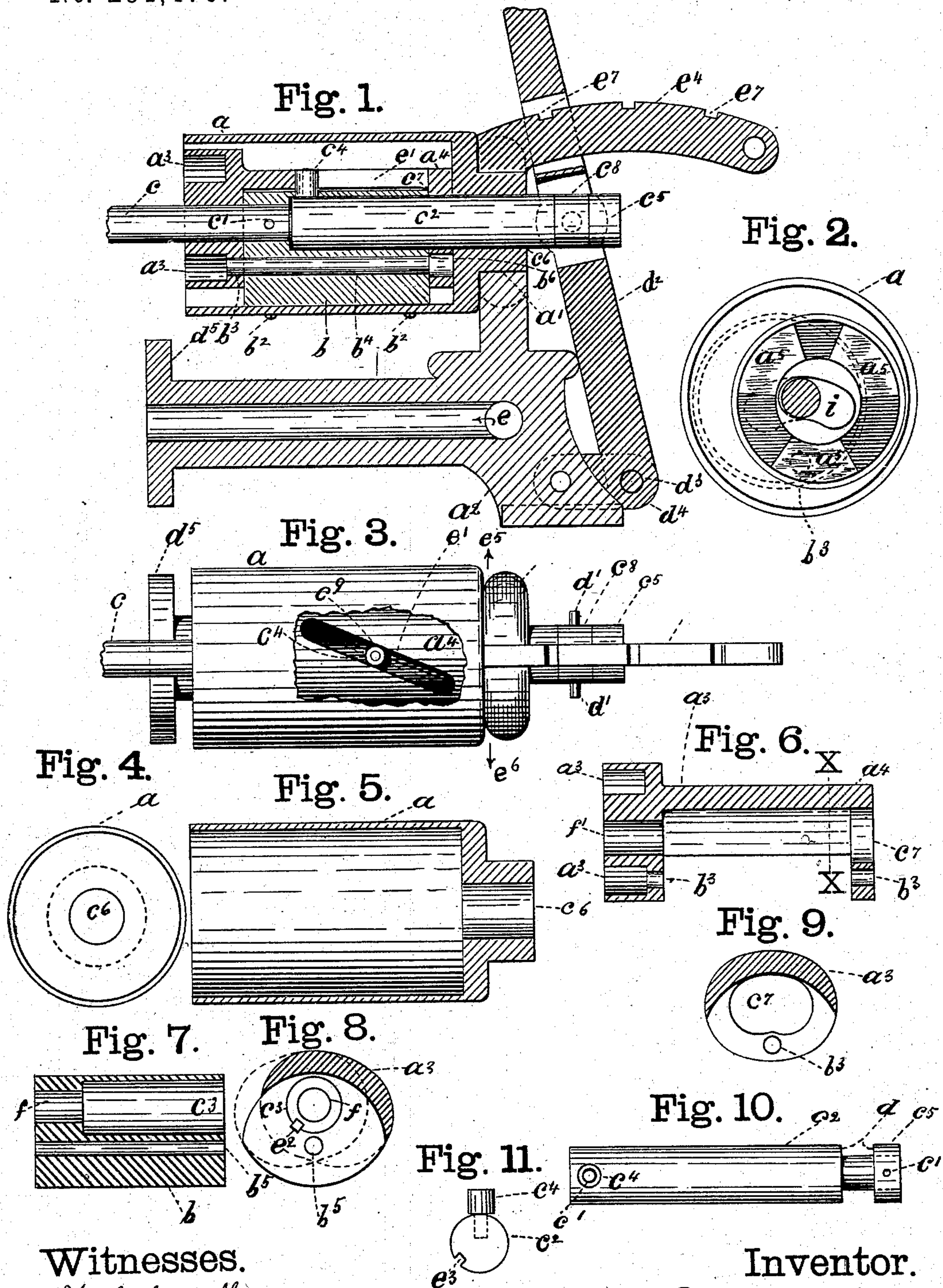
2 Sheets—Sheet 1.

F. A. GARDNER.

VALVE GEAR.

No. 291,476.

Patented Jan. 1, 1884.



Witnesses.

J. H. Baldwin.  
A. J. Sangster

Inventor.

Frederick A. Gardner  
By James Sangster  
Atty.



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Fig. 12.

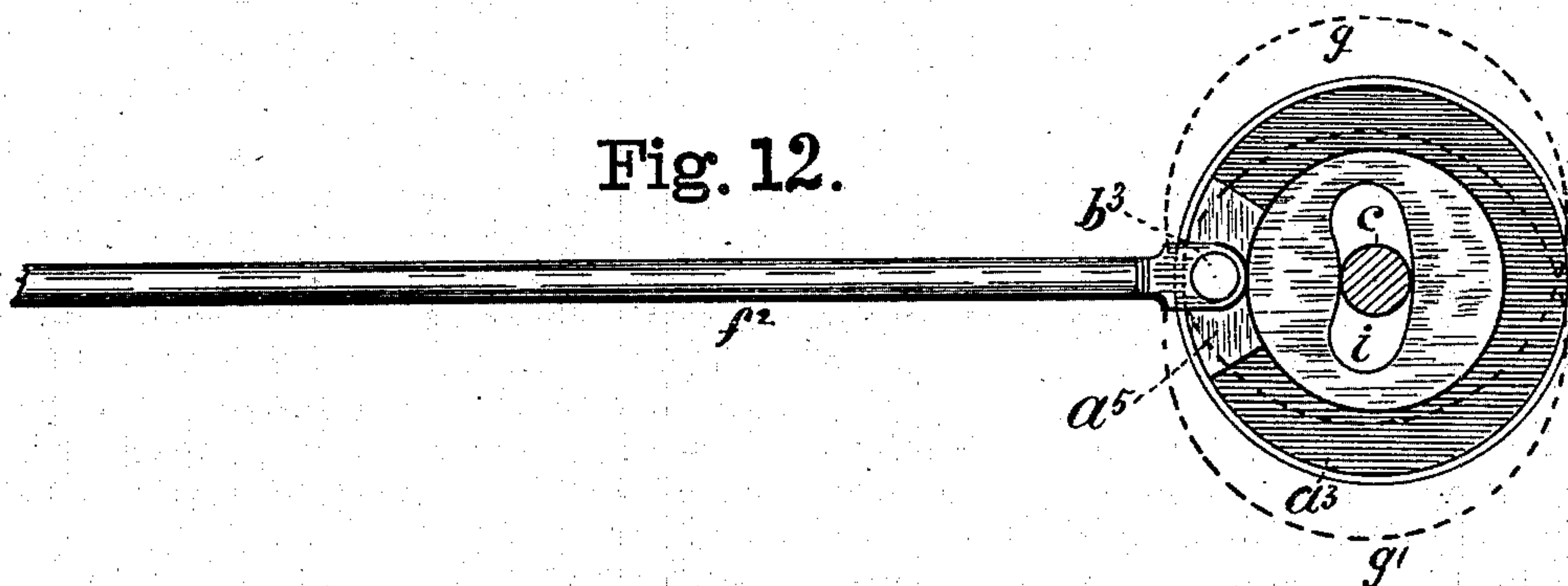
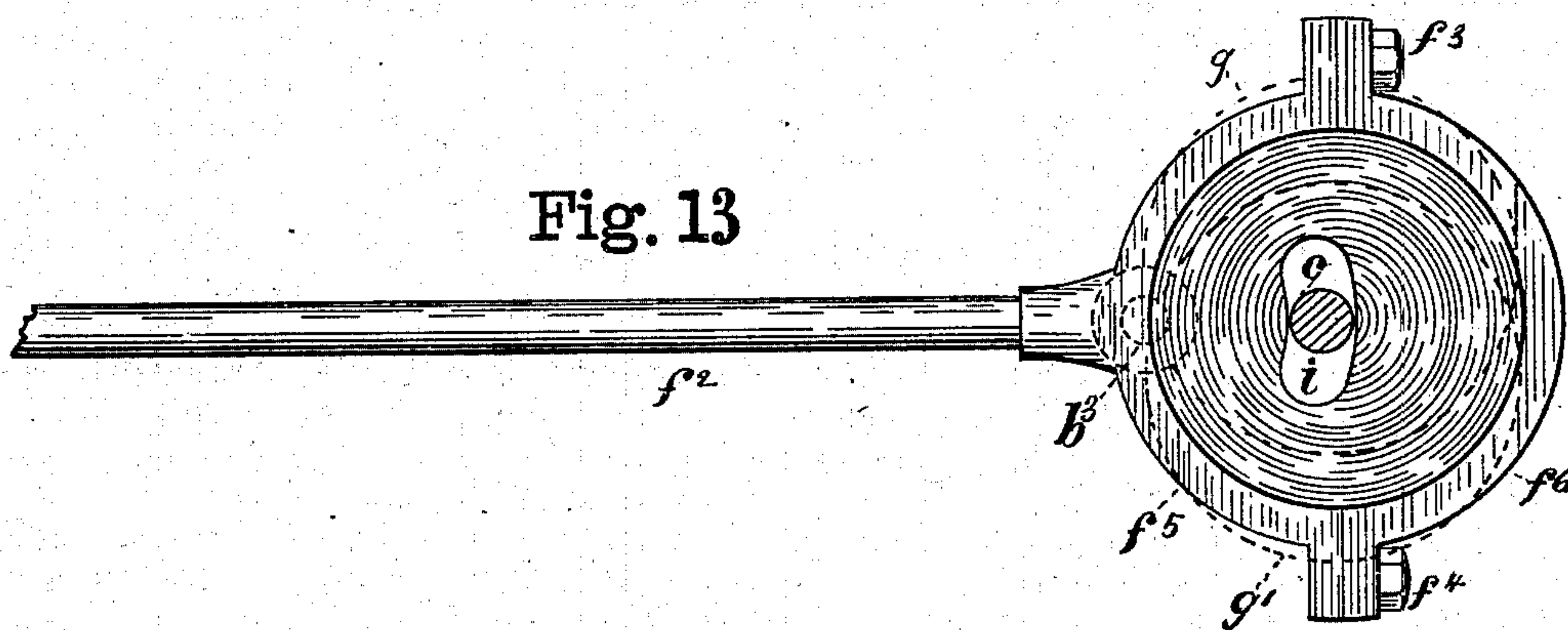


Fig. 13



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# UNITED STATES PATENT OFFICE.

FREDERICK A. GARDNER, OF BUFFALO, NEW YORK.

## VALVE-GEAR.

SPECIFICATION forming part of Letters Patent No. 291,476, dated January 1, 1884.

Application filed March 30, 1883. (No model.)

*To all whom it may concern:*

Be it known that I, FREDERICK A. GARDNER, a subject of the Queen of Great Britain, residing in Buffalo, in the county of Erie and State of New York, have invented certain new and useful Improvements in Valve-Gears, of which the following is a specification.

The object of this invention is to provide a simple and efficient means for reversing an engine, whereby the lead of the valve is preserved during every portion of the reversing movement, all of which will be fully and clearly hereinafter shown by reference to the accompanying drawings, in which—

Figure 1 is a sectional elevation of the greater portion of the reversing-gear, a part of the reversing apparatus being shown as a side elevation. Fig. 2 is an enlarged front elevation of the eccentric and casing surrounding it. Fig. 3 is a top view of the device, a portion being broken away to expose the eccentric-reversing mechanism. Fig. 4 is a front view of the case, and Fig. 5 represents a vertical central section through the case. Fig. 6 is a vertical longitudinal section through the eccentric. Fig. 7 is a vertical section through the center of the device upon which the eccentric turns. Fig. 8 represents an end view of the same and a section through the eccentric cradle or frame on line X X, Fig. 6, showing that portion of the eccentric in its position on the supporting device upon which it swings. Fig. 9 is a section through line X X, Fig. 6, separate from the supporting device. Fig. 10 is a detached side elevation of the reversing-bar. Fig. 11 represents an end view of the same. Fig. 12 is a side elevation of the eccentric and a partial view of the valve-stem, showing the position of the center for reversing; and Fig. 13 represents a similar view of valve-stem and eccentric, showing the invention applied to an ordinary engine.

$a$  is the case for inclosing the eccentric and its connections. It is provided with a bearing,  $a'$ , in the frame  $a^2$ , so as to turn easily and smoothly therein. The eccentric consists of the eccentric  $a^3$  and the frame-work  $a^4$ . (See Figs. 1, 3, and 6.) The eccentric  $a^3$  is a hollow grooved eccentric, into which the curved pieces  $a^5$  are fitted, so as to move easily therein, and to which the valve-stem is connected;

but any other form of eccentric may be used and connected with a single valve-stem for operating a single engine. The connecting-rod or valve-stem is connected to the curved block  $a^5$  by a joint,  $b^3$ , and its opposite end is connected in any well-known way to the valve. The block  $a^5$  is fitted in the eccentric or groove  $a^3$ , so that as the eccentric turns the curved block is made to move the valve-rod back and forth in the direction of its length and operate the valve; but the said block has no other movement, as the valve-rod should be held in guideways either substantially as shown in my Patent No. 226,055, or in any other well-known way. The eccentric is fitted to the holding-piece  $b$ , which is fastened to the case  $a$  by screws  $b^2$ , so as to turn easily on the journals  $b^3$ , a rod,  $b^4$ , being passed through the hole  $b^5$  of the supporting-piece  $b$  for the purpose, the head  $b^6$  of the piece  $b^4$  being made larger, so as to be retained in place by the parts when put together. The engine-shaft  $c$  is secured to the part  $b$  by a pin,  $c'$ . The reversing-bar  $c^2$  passes in through the center,  $c^6$ , of the case  $a$ , through the end of the eccentric-opening  $c'$  and the part  $c^3$  of the supporting device. Its forward end is provided with a loose friction-roller,  $c^4$ , arranged on a pin,  $c^5$ , and at the opposite end with a collar,  $c^5$ , and loose collar  $c^3$  between the shoulders  $d$ , it being arranged so as to turn easily, but has no movement longitudinally on the shaft. It is provided with pins  $d'$ , by which it is fastened to the lever  $d^2$ , which lever is fastened by a pin,  $d^3$ , to a link,  $d^4$ , the link being fastened to the frame  $a^2$ . The front flange,  $d^5$ , of the frame is adapted to fasten to the engine by means of screws.  $e$  is the inlet-port for the steam. The top of the eccentric is provided with a diagonal slot,  $e'$ , up into which the friction-roller  $c^4$  projects. The reversing-bar  $c^2$  is prevented from turning by means of the feather and groove  $e^2$  and  $e^3$ , Figs. 8 and 11. It will now be seen that the eccentric will be made to turn in the direction of the arrow  $e^6$ , drawing the bar  $c^2$  backward, and that a forward movement will reverse its action.

$e^4$  is the ordinary quadrant, having notches into which the ordinary reversing-lever catches and holds it when operated for reversing. The positions of the eccentric are shown in Fig. 2,



in full and dotted lines. It will be noticed that the case  $a$  and the whole reversing-gear turns while the engine is in operation. The hole  $i$  or segmental slot through the fore part of the eccentric is made sufficiently wide to allow for its movement from side to side in reversing the engine. The method of finding the center upon which the eccentric turns and its applicability to either kind of engines may be seen by reference to Figs. 12 and 13. The eccentric shaft or stem  $f^2$  is fastened to the eccentric in any well-known way in each case, Figs. 12, 13, and opposite that center or on the other side is the center upon which it turns. The turning-point is always at the edge of a common eccentric and in a grooved eccentric in the center of the groove, as shown in Fig. 12. The dotted lines show its position one way,  $g$ , for running the engine in one direction, and an opposite direction,  $g'$ , for reversing it. It is shown on the drawings in the position for moving it on the dead-center; but of course it can be moved from any other point as readily, but from the point shown it would not move the eccentric-rod or valve-stem, as will be readily understood by reference to the drawings and foregoing description.

The curved pieces  $a^5$ , their construction, their object, and connection with the valve is fully shown and described in my Patent No. 226,055, dated March 26, 1880; therefore a further description is not required here. The curved slot through the eccentric, and through which the shaft passes, and which allows it to be moved freely from side to side, should not be placed in the center of the eccentric, but at a point nearest or toward the center of the journal  $b^3$ , (see Fig. 13,) in which the position of the slot through which the shaft passes is shown. The object of this is to preserve the

lead of the valve at any point the eccentric may be adjusted, to one side or the other.

I claim—

1. The case  $a$ , the frame  $a^2$ , and frame  $a^3 a^4$ , provided with the diagonal slot  $e'$ , the reversing-arm  $c^2$  and its reversing-roller, and the reversing-gear, substantially as specified, in combination with the supporting device  $b$  and the joints upon which it swings, for the purposes described.

2. The casing  $a$ , jointed to the frame  $a^2$ , and the device  $b$ , secured with the casing, in combination with the eccentric jointed thereto and provided with a diagonal slot and with a reversing bar and lever, substantially as described.

3. The arm  $d^2$  and reversing-bar  $c^2$ , provided with a roller,  $c^4$ , arranged within a diagonal slot, in combination with the eccentric, set on journals in the part  $b$ , substantially as and for the purposes described.

4. A pivoted eccentric for engines, having the curved slot, through which the shaft  $c$  passes, placed to one side or slightly out of the center, or at a point between the center of the eccentric and the center of the journal  $b^3$ , or nearer the periphery at the point upon which it turns, and having the pivot  $b^3$  arranged at a point on a line with the periphery of the eccentric, so that the eccentric may be moved from one position for reversing the direction of movement to the other without moving the valve-rod while the engine is on the dead-center, the crank being on the same side, whereby the lead of the valve is kept in its proper position at all times, substantially as specified.

FREDERICK A. GARDNER.

Witnesses:

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