UNITED STATES PATENT OFFICE.

EDOUARD DELAMARE DEBOUTTEVILLE AND LÉON PAUL CHARLES MALANDIN, OF FONTAINE-LE-BOURG, FRANCE.

STARTING-GEAR FOR GAS-ENGINES.

SPECIFICATION forming part of Letters Patent No. 411,644, dated September 24, 1889.

Application filed February 4, 1889. Serial No. 298,661. (No model.) Patented in France January 16, 1888, No. 188,161; in Italy February 18, 1888, No. 23,061; in England February 24, 1888, No. 2,805; in Spain May 18, 1888, No. 7,946, and in Belgium August 24, 1888, No. 83,003.

To all whom it may concern:

Be it known that we, EDOUARD DELAMARE DEBOUTTEVILLE, engineer, and LÉON PAUL CHARLES MALANDIN, mechanician, residing at Fontaine-le-Bourg, canton de Clères, (Seine-Inférieure,) in the Republic of France, have invented Improvements in Starting-Gear for Gas-Engines, (for which we have obtained Letters Patent in France, No. 188,161, January 16, 1888; Italy, No. 23,061, February 18, 1888; Great Britain, No. 2,805, February 24, 1888; Spain, No. 7,946, May 18, 1888; Belgium, No. 83,003, August 24, 1888,) of which the following is a specification.

The difficulty heretofore experienced in starting gas-engines, especially those of considerable power, has proved a serious obstacle to the general use of these engines in practice. Many special methods have been proposed with a view to facilitating the starting of the engines, but have not been found to work satisfactorily.

The present invention has for its object a new system of starting-gear applicable to gas-engines. This starting-gear is illustrated in the figures on the annexed drawings, the same letters of reference indicating corresponding parts in all the figures.

Figure 1 of the accompanying drawings is an elevation partly in section, illustrating starting-gear arranged according to this invention and suitable for a motor of twenty-five horse-power, working with poor gas, for example. This view shows the admission-valve box and gas-chamber *g*. It also represents in dotted lines an ignitor J, which is connected with the gas-box *g* by a three-way cock *k*, connected to a branch *h* by means of a rubber tube *i*. Fig. 2 is a diagram illustrating the four periods or cycles of the engine, with the division for the explosion period, special starting division. Fig. 3 is an elevation of the three-way cock *k*, fitted onto the chamber of the ignitor *j*, which is shown in section in this figure with the two insulated conducting-wires. The cock *k*, which should be as perpendicular as possible, should not exceed an angle of twenty degrees to work well. Fig. 4 shows the cock *k* in section. Fig. 5 is a view, in elevation, of the said cock. Fig. 6 is an end view, in elevation, of the induction or transformer coil. Fig. 7 is a plan of a commutator or switch arrangement. Fig. 8 is a view of my improved starting-gear as independently applied to any gas-motor. Fig. 9 represents the working-cylinder provided with a cock.

The motor being at rest, the fly-wheel is turned by hand so as to bring the connecting-rod to the dead-point forward—that is to say, to the point *c*, Fig. 2. This point is where the explosion takes place when the engine is running. The strength of one man is enough to turn the fly-wheel for the one or two necessary revolutions if the motor does not exceed twenty-five horse-power. For a motor exceeding this a winch or other suitable gear may be employed to turn the fly-wheel. When the connecting-rod is at the dead-point *c*, a gas-cock Z, placed on the valve-box *g*, Fig. 1, is opened in the ordinary position for starting. Then the three-way cock *k* is opened as indicated in Figs. 1, 3, 4, and 5. The fly-wheel then is turned so as to bring the connecting-rod a little beyond the angle of ninety degrees—*i. e.*, approximately to the point *e*. The fly-wheel must be turned slowly in order to give the gaseous mixture time to fill the cylinder. The gas entering at *o*, Figs. 3 and 4, mixes thoroughly with the air entering at *n* and penetrates to the ignition-chamber, and passes on into the working-cylinder of the motor. It must be understood that during this time the vibration of the hammer or contact-maker of the coil is stopped, so that the spark cannot pass between the two ends of the platinum wire. The three-way cock *k* is now shut, a small stop *m* preventing the key *l* from turning through more than a quarter-turn. The fly-wheel is then turned backward to bring the connecting-rod in a position corresponding with the point *e'*, a little in front of the position *f*, Fig. 2. This is done in order to slightly compress the mixture in the cylinder, thus facilitating ignition and giving a longer stroke to the connecting-rod at

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RECIPROCATING BRICK MACHINE.

No. 411,645. Patented Sept. 24, 1889.

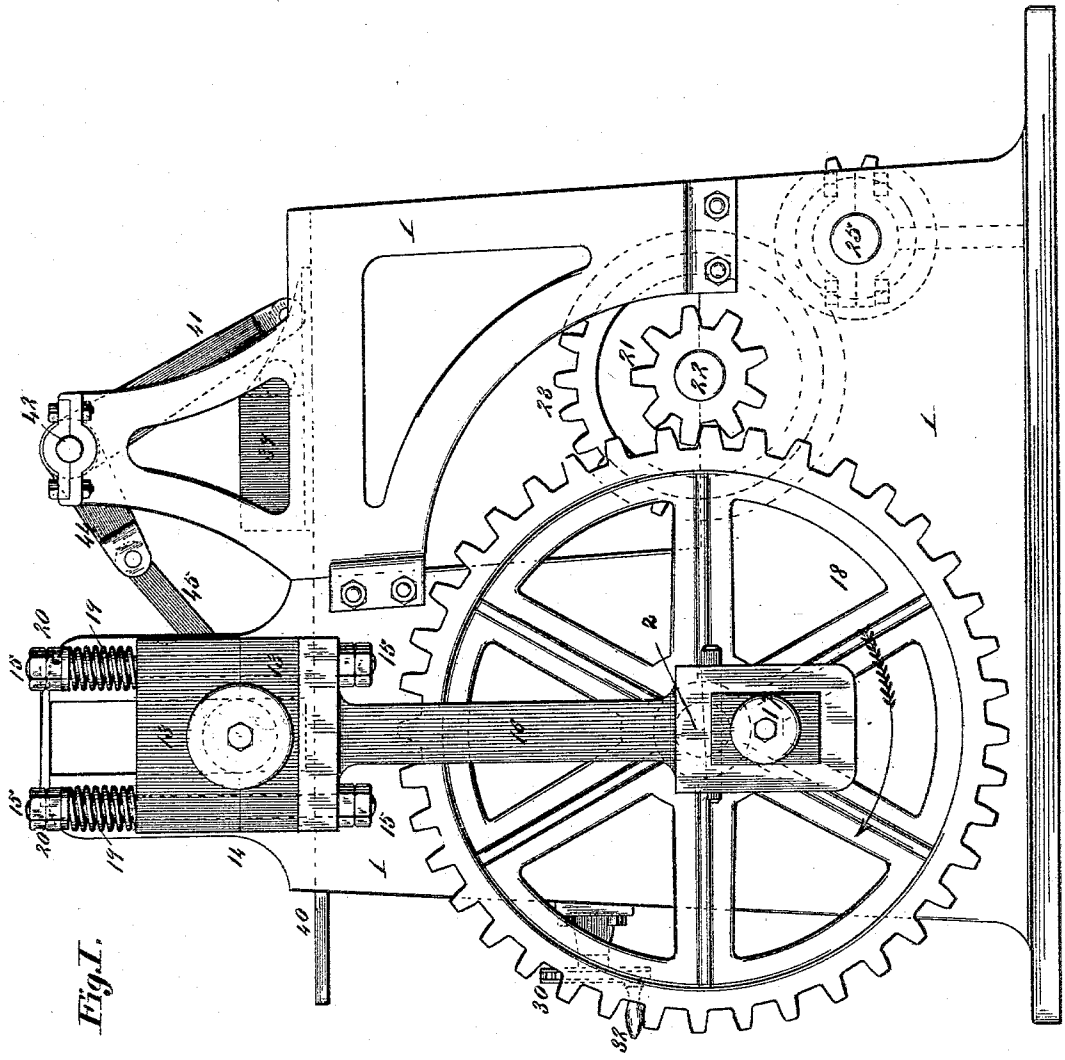

Fig. 1.

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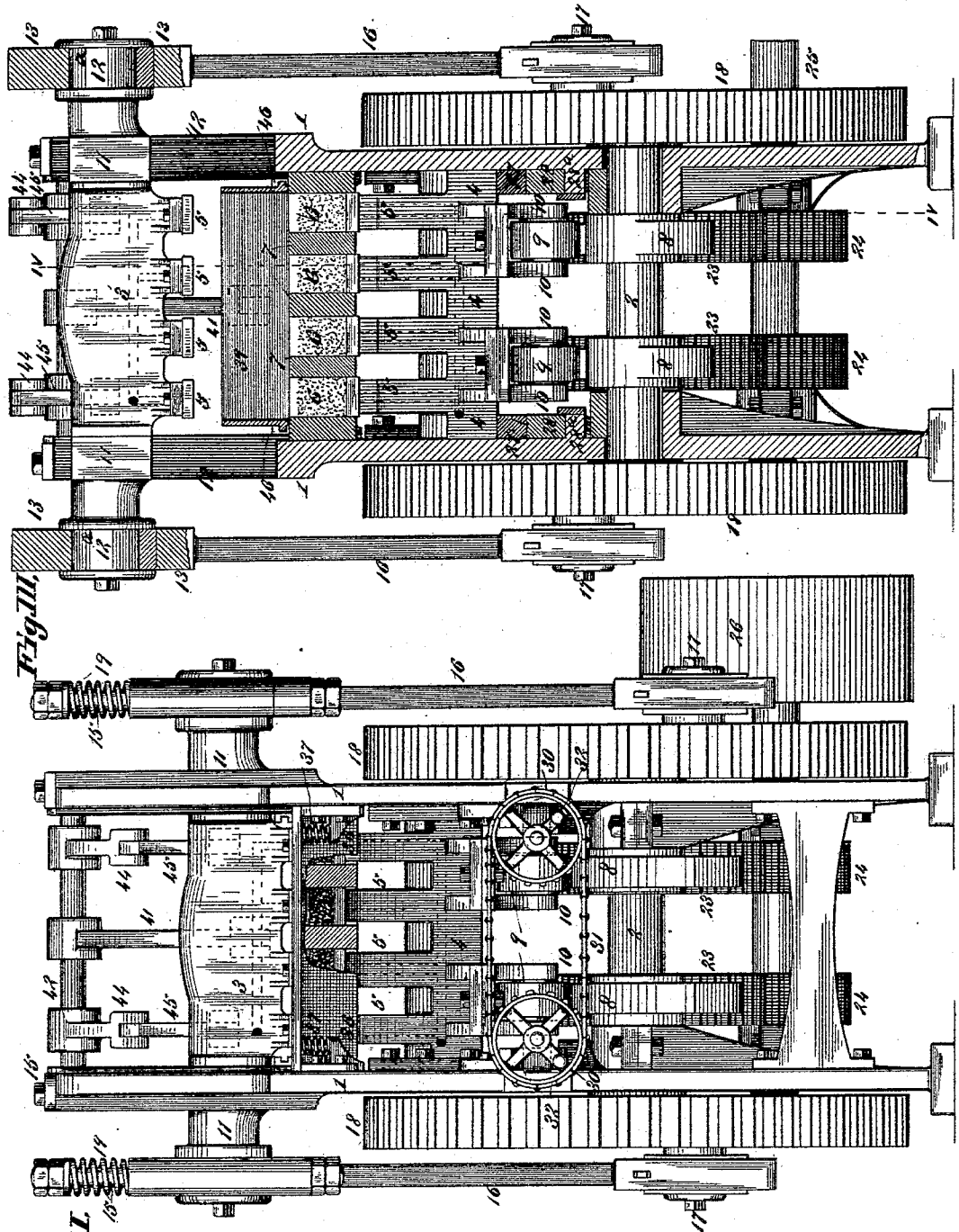

Fig. II.

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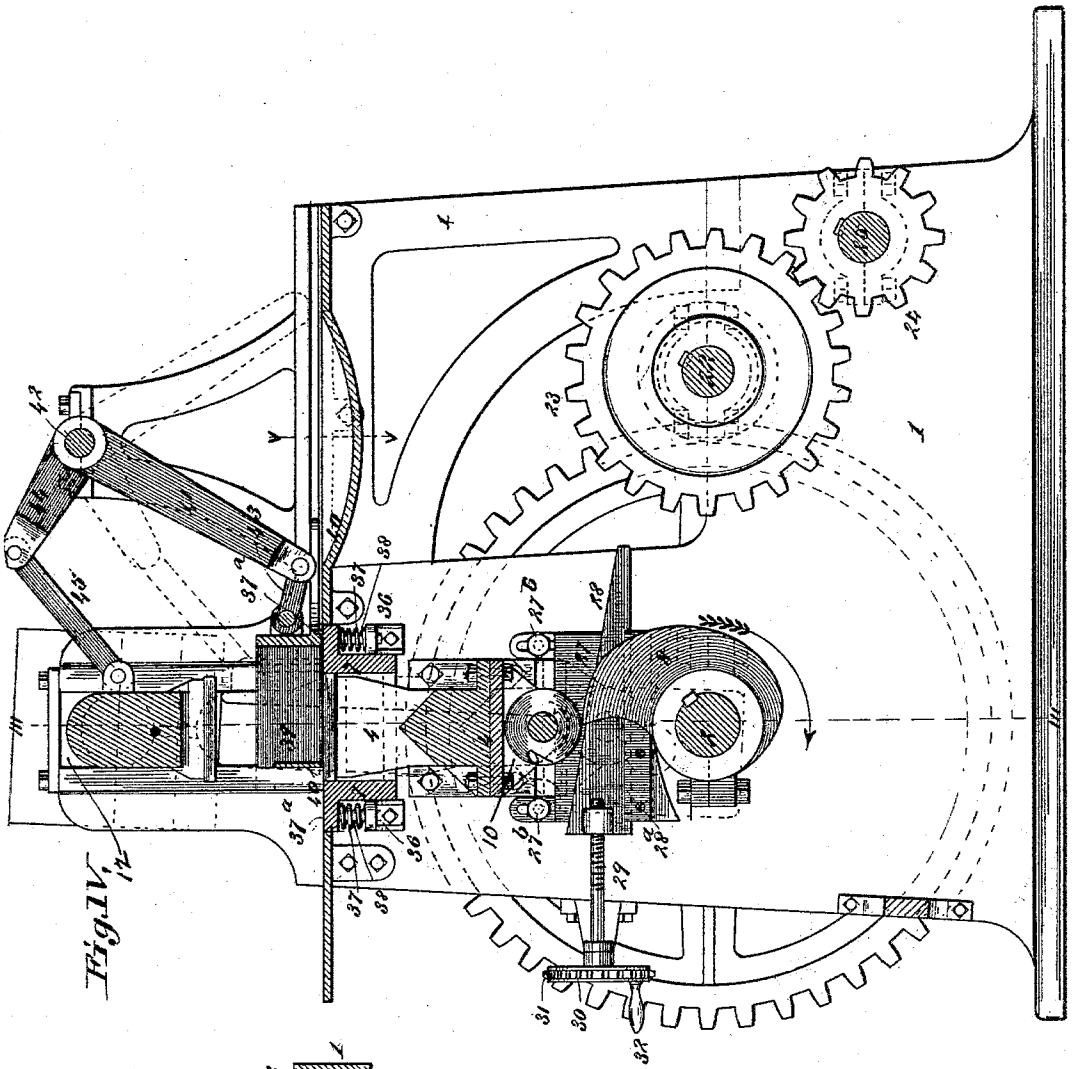

Fig. IV.

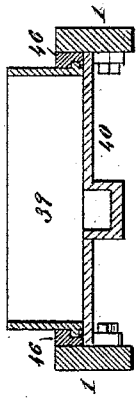

Fig. V.

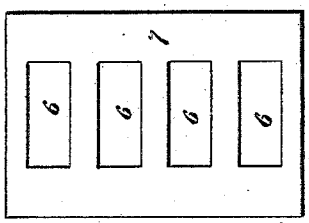

Fig. VI.

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