No. 9,320. PATENTED OCT. 12, 1852.

J. S. GUSTIN.

ELECTROMAGNETIC ENGINE.

2 SHEETS—SHEET 1.

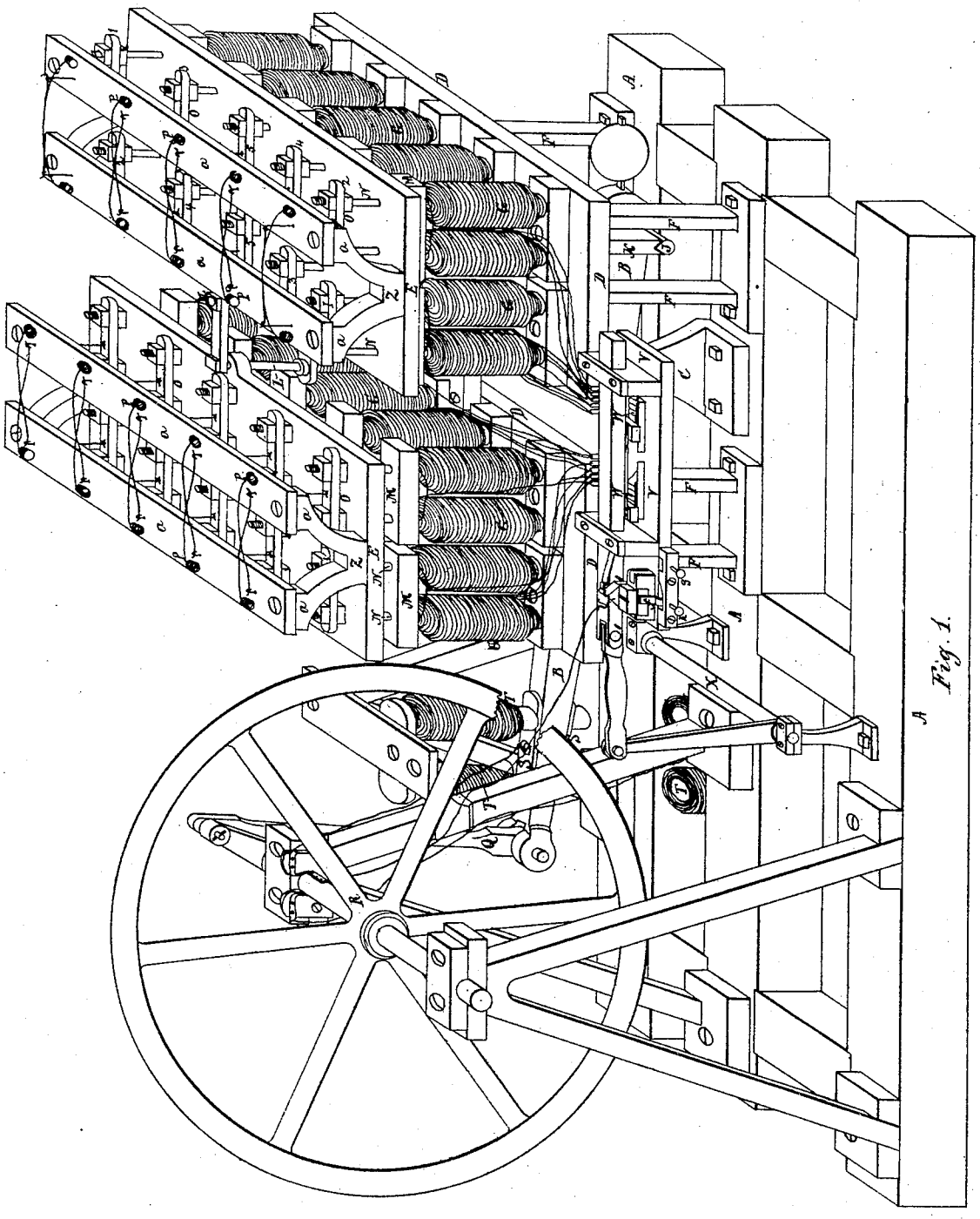

Fig. 1.

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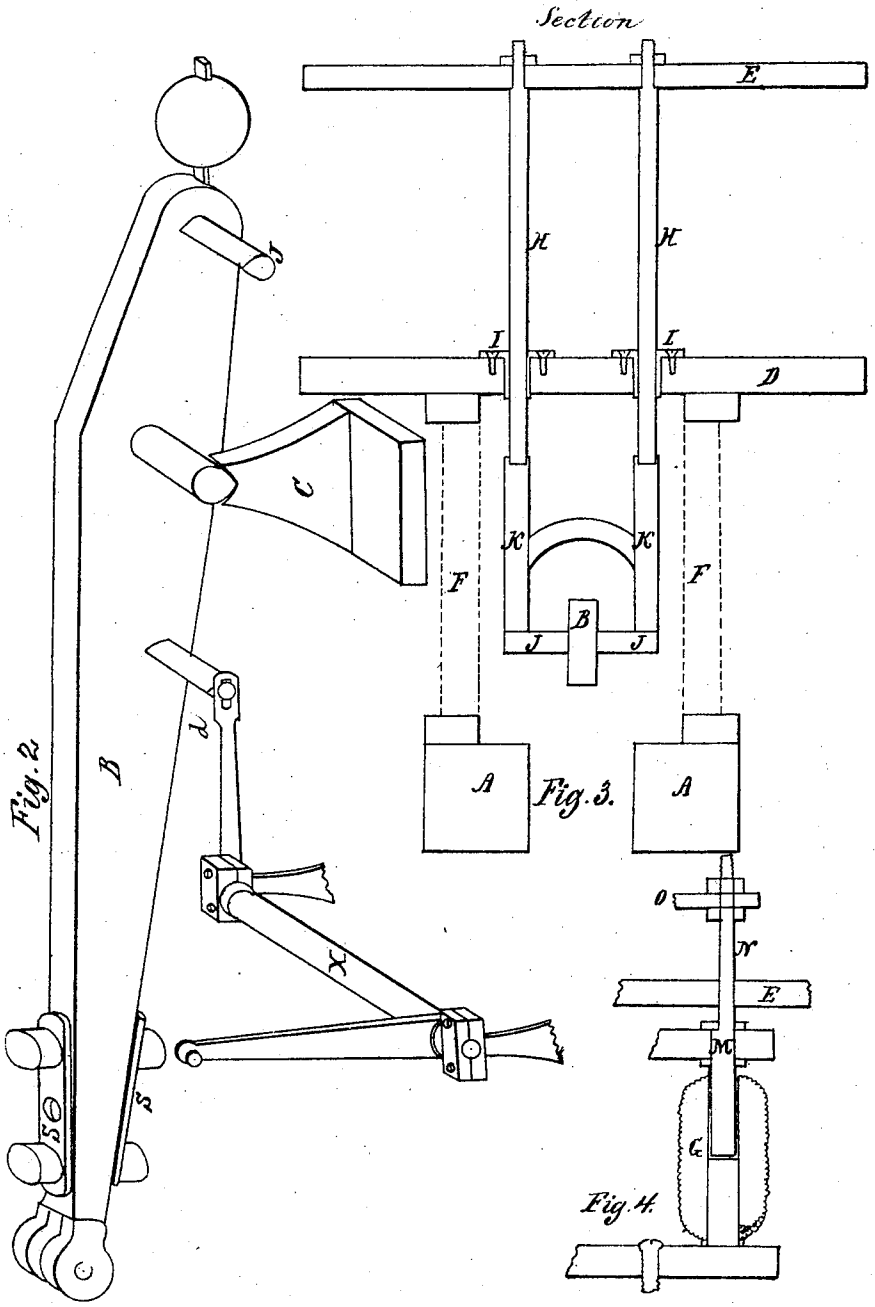

UNITED STATES PATENT OFFICE.

JOHN S. GUSTIN, OF TRENTON, NEW JERSEY.

IMPROVEMENT IN ELECTRO-MAGNETIC ENGINES.

Specification forming part of Letters Patent No. **9,320**, dated October 12, 1852.

To all whom it may concern:

Be it known that I, JOHN S. GUSTIN, of the city of Trenton, county of Mercer, and State of New Jersey, have invented a new and useful Improvement in the Electro-Magnetic Engine; and I do hereby declare that the following is a full, clear, and exact description of the construction and operation of the same, reference being had to the annexed drawings, making part of this specification.

Figure 1 is an isometrical perspective of the engine. Fig. 2 is the lever-beam B. Fig. 3 is a cross-section through Z Z. Fig. 4 is a section of the helices and magnets.

The same letters of reference apply to the same parts in the different drawings.

The nature of my invention consists in so arranging the electro-magnets, and the parts connected therewith, that their great power of attraction in close proximity is continued through the required length of stroke of a reciprocating engine of large or small size.

To enable others skilled in the art to make and use my improvement, I will proceed to describe its construction and operation.

A is the bed-frame. B is a lever-beam working on bearings C C. Over the lever-beam, and on each side of those bearings, is the bottom magnet-plates, D D, and top plates, E E, making two sets. The bottom ones are secured by bolts to iron frames or columns F F, which are bolted to the bed-frame. On these bottom plates are set and secured, by bolts, the electro-magnets G G G. The number of magnets used on each side or set is determined by the length of stroke and the number of successive actions to be employed in making it, always having two to act together with their line of bearing running diagonally through the center of the plate, as shown in Fig. 1.

The top plates are made of cast-iron, and are supported on two upright rods, H H, Fig. 3, passing down through two metal boxes, I I, set in the bottom plates. Between the bottom ends of these rods and their bearings J J on the lever-beam is a cradle-piece, K, which yields to the vibrating motion of the bearings. These plates are also held in their line of motion by guide-rods L L. They have suspended under them the upper part or armatures, M M M, of the electro-magnets by two slide-rods, N N, to each, passing up easily through the plates, with a screw and nut resting on the upper side of the plate and a check-nut to secure it. By these rods the position of the armature is adjusted, and the force of attraction between the magnet and armature is brought to bear on the top plate.

Between the nut and check-nut is the cross-piece O O, to which the arm of the balance-springs P P, by a wire, is suspended. These balance springs are supported on bearers *a* raised from the top plates. The lever-beam is made of sufficient length to extend out, and by a connecting-rod, Q, to communicate its motion through a crank to the fly-wheel R. Near that end of the lever-beam, and secured to it are two armatures, S S, both on the upper and lower sides, which are attracted by two magnets, T T. These exert their force when the crank is near its center and while the battery-current is being changed by the pendulum U from one to the other sets of magnets on the plates.

V is a small plate, of dry wood or some other non-conducting substance, on which are placed the break-pieces W.

X is a rock-shaft with two arms, one of which is connected by a slot (shown at *d*, Fig. 2) working on a pin in the lever-beam,) and the other extending up, and by a rod gives motion to the slides or valves that close and break the battery-current with the different break-pieces connected with the several helices in their proper order. On the same rod to which the valves are attached are two pins that move the pendulum, breaking the current with one and closing it on the other conductor, on which the slide-valve moves, and from which the current is conducted to the different break-pieces over which they move and are brought in contact.

To further illustrate its construction and operation, I will assume that the engine is to have six inches motion at the magnetic plates, with five successive actions of two magnets acting at one time, making ten magnets for each side or set.

The legs of the magnets should be three inches in diameter and nine inches long, those of the armatures to be of the same length, but one-quarter of an inch less in diameter, to admit them to move freely in the helices. The helices should be made of insulated copper

wire, about one-twelfth of an inch in diameter, wound and connected in the usual way, so as to produce opposite polarity in the two legs of the magnet. Their length should be that of the leg of the magnet and armature together, and the thickness of the layers of wire should be not less than the diameter of the legs, making the outside diameter of the helices nine inches, one of the plates being extended to its extreme height, and the armatures being suspended to it by the slide-rods, with their adjusting-nuts resting on the upper side of the plate, the ten armatures being adjusted to act in pairs. I will number them Nos. 1, 2, 3, 4, 5. Their distance from their magnets would be, for No. 1, one inch, No. 2 two inches, and so on, each pair increasing its distance one inch more than its preceding number. The battery-current being now closed on No. 1, its attractive force brings down the plate, and as No. 1 closes on its magnet No. 2 has been brought to within one inch of its magnet, and the current broken on No. 1 and closed on No. 2. A like result is produced as upon No. 1, and so on until they all have performed their part, the stroke not yet being complete when the fifth pair of magnets close, and the current being closed on the magnets at the end of the lever-beam, they exert their force and finish the stroke, closing just before the crank reaches the top or bottom center. One set or side having performed its work, the other is ready to follow in like manner. This motion of the top plates is communicated through their bearing-rods and cradle-piece to the lever-beam, and is by it carried to the crank and fly-wheel, producing rotary motion. The construction of the electro-magnets at the end of the lever-beam is further illustrated in Fig. 1, and those used on the plates in Fig. 4. The length of the slide-rods that suspend the armatures to the plates will be determined by their position. No. 1 should have its rods sufficiently long to have five and a half inches space between the upper side of the armature and the under side of the top plate; also, to pass through the plate and receive the two nuts and cross-piece. No. 2 should be one inch shorter, and so on, each pair one inch shorter than its preceding number. The top plate is thus enabled to pass down to its terminating point without having come in contact with the armatures. The rods passing easily their apertures, no friction or obstruction is presented to its motion.

The balance-springs may be made in any convenient form, and should bear nearly all the weight of the armatures, except so much as is necessary to keep them in their places. Thus a balance in weight of the two top plates on the lever-beam is very nearly maintained, notwithstanding the armatures rest on their several magnets as they close. To balance the lever-beam and connecting-rod, one of the top plates is made nearly the required weight for that purpose, leaving a small portion to be adjusted by a ball on the short end of the lever-beam.

Between the nut on the slide-rod of the armatures and the top plates is placed a washer of vulcanized india-rubber, also very thin pieces of the same material between the armatures and magnets. These prevent the violent concussion of those parts when in motion, and also prevent the adhesion of the armature to the magnet when the current is broken. The connecting wires or leaders are each pair carried to one break-piece, while all the negative ones are brought to one point behind the engine, and have a set-screw by which to attach that pole to the battery.

For an engine as thus described I should use a Grove's Battery of thirty pairs of plates four by six, arranged in two sets of fifteen intensity. The strength of the top plates, their bearing-rods, the size of the plates, strength of suspension or slide rods to the armatures, size and strength of the lever-beam, and the other parts, will readily suggest themselves to a practical mind, and need no description. The break-piece connecting the current with the helices of the magnets at the end of the lever-beam may be made at any convenient place where the proper motion can be obtained, either at the fly-wheel shaft or such place as may suit the taste of the constructor of the engine. The set-screw *g* connects the positive pole of the battery with a piece of sheet copper, the end of which is brought over the copper piece *f*, so set that when the set-screw *h* is turned back they spring apart and disconnect or break the connection with the battery and stop the engine, and by reverse turn of the screw they are brought in contact and the engine put in motion.

What I claim as my invention, and desire to secure by Letters Patent, is—

Supporting the principal part of the weight of the armatures of the electro-magnets, mounted upon sliding guides or their equivalents, upon the reciprocating frame, as described, by means of springs or their equivalents attached to said frame, so as to preserve the balance of weight in the moving parts, substantially as set forth.

JOHN S. GUSTIN.

Witnesses:
JOHN WHITTAKER.
JOHN H. WHITTAKER.