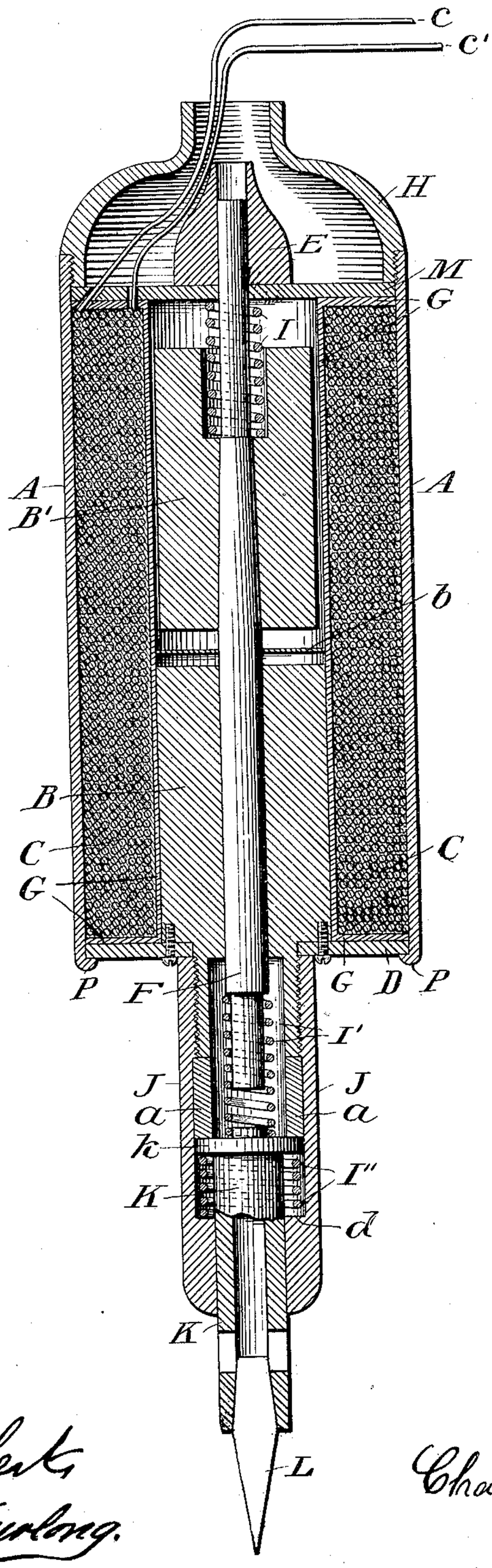
(No Model.)

C. F. CARPENTER.

ELECTROMAGNETIC TOOL.

No. 545,149. Patented Aug. 27, 1895.



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ELECTROMAGNETIC TOOL.

SPECIFICATION forming part of Letters Patent No. 545,149, dated August 27, 1895.

Application filed August 20, 1894. Serial No. 520,851. (No model.)

To all whom it may concern:

Be it known that I, CHARLES F. CARPENTER, a citizen of the United States, residing at Louisville, in the county of Jefferson and State of Kentucky, have invented certain new and useful Improvements in Electromagnetic Tools; and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to use the same.

The figure of the drawing is a longitudinal section.

This invention has relation to electromagnetic tools or machines having a reciprocating motion for effecting rapid intermittent blows or strokes when influenced by an electric current, and is designed chiefly for cutting stone and other hard substances.

In the accompanying drawing, the letter A designates a cylinder or casing of soft iron, having a rim P projecting inwardly and supporting an iron bottom plate D, to which is connected an inner hollow or bored cylinder or core B of soft iron, which is surrounded by part of the coil or helix C of insulated wire, (the size of the wire is according to the voltage of the electric current that is to pass through it—a one-hundred-and-ten-volt current and a No. 28 wire work well together,) forming an electromagnet.

The cylinder B has a male screw on its lower end for the attachment of a tubular guide J.

B′ represents another cylinder of soft iron inside of cylinder A, surrounded by part of the coil or helix C, forming another electromagnet.

F is a central rod-hammer of no magnetic power, preferably of aluminum bronze, which moves with a reciprocating or to-and-fro motion through the cylinder or electromagnet B. Its lower end operates on the end of the anvil-piece or bit-carrier K. The other end of the said central rod-hammer plays to and fro in a hole in the bearing E, which aids in keeping the said hammer-rod in proper position, so that the cylindrical armature or electromagnet B′, which is attached to the rod-hammer, can play to and fro within the coil or helix C.

I is a balancing or equipoising spring, and I′ is also a balancing or equipoising spring.

I″ is a retracting-spring between the lower interior shoulder *d* of the tubular guide J and the collar *k* of the anvil-piece or bit-carrier K.

Attached to the cylinder B by a screw is the brass tubular guide J, within which is carried the anvil-piece or bit-carrier K, having upon it a guide-collar *k*. This anvil-piece is preferably of a cylindrical form, as is also the hammer-rod, and these parts are in axial relation to the electromagnets or cylinders B and B′.

G is a spool of non-magnetic material arranged inside of the cylinder A, and around the cylinders B and B′ on this spool is wound the coil or helix C, the ends of the wire coming out at *c c′*.

M is a brass yoke-piece, to which is attached the bearing E, supporting the end of the hammer-rod F.

H is a brass cap screwing into the end of the casing A, securing all the internal parts in proper position, and allowing the passage out of the wires *c c′*. By unscrewing and removing this cap all the interior construction will drop out.

b is a very thin disk of aluminum bronze or brass which, when the tool is in operation, rests on the top of the cylinder B, and prevents the cylinders B and B′ from coming in actual contact.

When an electric current passes through the wire *c c′* and helix C, the cylinders B and B′ become powerful magnets and are attracted toward each other. The force of the downward motion or blow is expended on the anvil-piece or bit-carrier K, causing the same to move forward sharply in its guide in an effective manner for working its bit or chisel in cutting stone. When the electric current is interrupted the cylinder B′ is separated from cylinder B by the force of the spring I′, and is then in position for another blow. The tool is therefore operated by an interrupted current of electricity. The outer casing being made of iron, the cylinders B and B′, surrounded by the same helix C and cylinder B, connected by the iron plate or yoke-piece D to the outer casing A, allows the magnetic current or lines of force to pass freely to nearly complete its circuit at the upper end of the tool, being, as it were, "iron-clad" nearly. The result is a magnetic field of

greater intensity between the cylinders B and B', consequently greater power in the tool.

In tools or machines of this character it has previously been found impossible to get over about twelve hundred blows per minute, and then they will not satisfactorily cut granite, although the tool might make powerful strokes. The character, number, and velocity of the blows were not suited for that work, and when the number of breaks in the current exceeded about twelve hundred per minute the tool ceased to work. By using the balancing or equipoising springs I I', I have increased the rapidity of the blows to over the almost incredible number of two thousand per minute, and at the same time they have the peculiar impact blow required in working granite.

The two balancing or equipoising springs I I' may be made of the same piece of wire. The spring I should be long enough and strong enough to move the cylinder B' until it is almost in contact with the cylinder B, when the tool is in a horizontal position. The spring I' should be long enough and strong enough to force back the cylinder B' against the pressure of the spring I the proper distance from the cylinder B, which distance varies according to the electromotive force of the current used. By thus balancing or equipoising the cylinder B' between two elastic forces I have obtained much greater rapidity in action and efficiency in electromagnetic tools.

I am aware that various devices called "buffers" have been used to arrest the upper end of the hammer-rod F nearly at the end of the slight blow upward from the force of a spring that separated an armature from a magnet. The action of these buffers is very limited, and that, too, at nearly the end of the upward stroke, so as to take the shock off the tool.

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

1. In an electro-magnetic tool the combination of a fixed electro-magnet having its extension on the outer side of the motor coil, a solenoid or motor coil, an electro-magnet with axial hammer rod having a reciprocating motion therein, and counterbalancing or equipoising springs, substantially as described.

2. In an electro-magnetic tool, the combination of a helix, an iron exterior casing, an iron yoke piece, a fixed electro-magnet, and an electro-magnet held in balance, or equipoised, between two elastic forces, substantially as described.

CHARLES F. CARPENTER.

Witnesses:
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