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A. J. DREMEL

2,233,862

ELECTRICALLY RECIPROCATED TOOL

Filed May 13, 1940

Fig. 1.

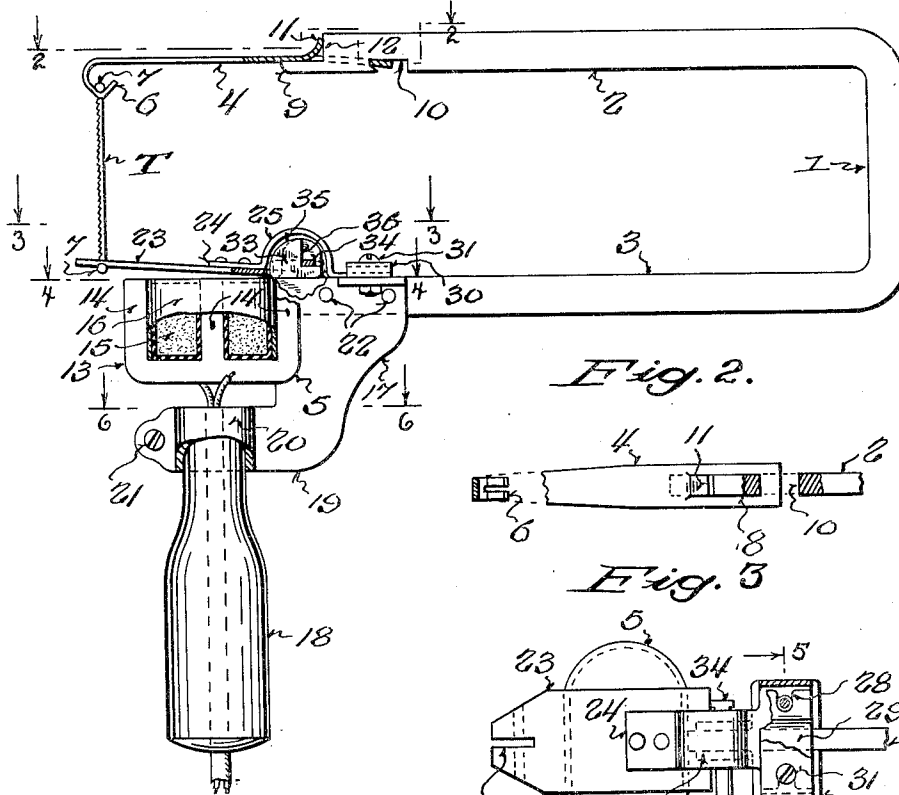


Fig. 2.

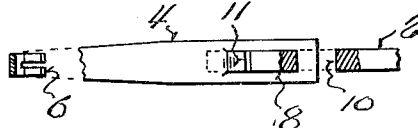


Fig. 3.

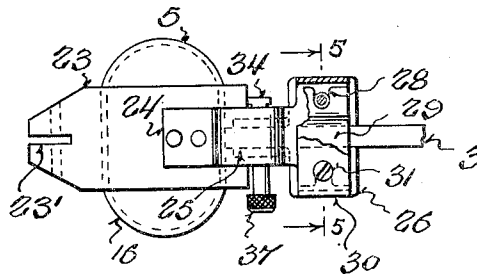


Fig. 4.

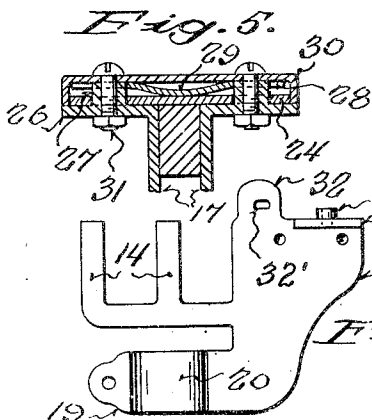
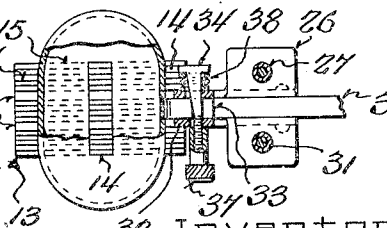
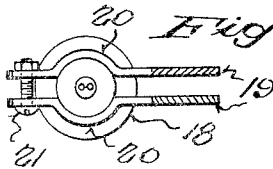


Fig. 5.



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Fig. 6.



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ELECTRICALLY RECIPROCATED TOOL

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13 Claims. (Cl. 172—126)

This invention pertains generally to electrically operated, reciprocative tools, such as jigsaws and the like, and more particularly to a rapidly reciprocated tool actuated by an alternating electromagnet.

While it is an important object of the present invention to provide a simple, light, compact structure particularly applicable to hand manipulated tools, it is to be understood that various features of the invention may be applied advantageously to bench tools, and although the invention is illustrated and described in connection with a hand manipulated jigsaw merely for the purpose of explanation, it is to be understood that the same shall not be limited other than as hereinafter claimed.

The primary object of the invention is to provide a magnetically actuated, reciprocative tool of exceedingly simple, inexpensive and compact structure, and at the same time affording maximum stroke and power.

Incidental to the foregoing, a more specific object of the invention resides in the provision of a reciprocative tool actuated by a spring-mounted armature of an electromagnetic motor, in which the flexing point of the spring is in substantial vertical alignment with one of the spaced magnetic core arms.

A further object with respect to factors of stroke and power, is to provide an electromagnet in which the armature is inclined at an angle to the plane of the ends of the spaced core arms of the magnet, the inner end of the armature being positioned closely adjacent the end of one of the core arms, while the tool is connected to the outer end, whereby the magnetic force of the inner core arm initially affects the adjacent end of the armature to draw the remaining portion of the armature within the magnetic path of the outer core arm, thus rapidly and progressively overcoming resistance to attraction of the armature as the tension of the armature spring increases.

A further object resides in the provision of novel means for regulating the stroke of the armature.

Another object is to provide a yieldable mounting for the armature spring to absorb a portion of its flexure and reduce crystallization.

A still further object is to provide a rigid non-yieldable arm interposed between the magnetic motor and resilient tool carrier, whereby vibratory action of the armature will not be transmitted to the arm to affect reciprocative action imparted to the tool by the armature.

With the above and other objects in view, which will appear as the description proceeds, the invention resides in the novel construction, combination, and arrangement of parts, substantially as hereinafter described, and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the herein disclosed invention may be made as come within the scope of the claims.

In the accompanying drawing is illustrated one complete example of the physical embodiment of the present invention constructed according to the best mode so far devised for the practical application of the principles thereof.

In the drawing:

Figure 1 is a side elevational view of a hand manipulated jigsaw embodying the principles of the present invention, parts being broken away and in section to more clearly illustrate structural details;

Figure 2 is a detail sectional view taken on the line 2—2 of Figure 1, illustrating more particularly the resilient tool carrier;

Figure 3 is a detail section taken on the line 3—3 of Figure 1;

Figure 4 is a similar section taken on the line 4—4 of Figure 1;

Figure 5 is an enlarged, transverse section through the armature spring mounting, taken on the line 5—5 of Figure 3;

Figure 6 is a detail section taken on the line 6—6 of Figure 1; and

Figure 7 is a side elevation of one of the plates forming a connecting bracket between the electromagnet, manipulating handle, and tool arm.

Referring now more particularly to the accompanying drawing, in that form of the invention illustrated the numeral 1 designates a yoke comprising upper and lower arms 2 and 3 respectively, the upper arm being provided at its outer end with a resilient tool carrier 4, while an electromagnet 5 is rigidly connected to the lower arm 3 in the manner hereinafter described.

The tool carrier 4 consists of a flat spring provided at its outer end with a notched hook 6, for reception of a head 7 formed on the upper end of a tool T, which in the present instance is illustrated as a jigsaw blade. The inner end of the carrier 4 is provided with a slot 8 for reception of the end of the arm 2, which terminates in a finger 9 to support the carrier intermediate its ends. The arm 2 adjacent its outer end is provided with a restricted notch 10 for reception of the inner end of the carrier,

while a spring finger 11 struck out of the carrier in forming the slot 8, abuts the end face 12 of the arm 2 to detachably latch the carrier on the arm.

As will be noted in Figures 1 and 4, the magnet 5 consists of an E-shaped core 13 formed by a plurality of laminations and including arms 14. A conventional winding 15 is provided for the intermediate arm, and is protected by a cover 16.

As will be noted in Figures 1 and 4, two of the core laminations comprise bracket plates 17, which serve to connect the yoke 1, the magnet 5, and a manipulating handle 18. The plates 17 are provided at their lower ends with laterally projecting arms 19, having formed therein adjacent their ends semicircular portions 20, which straddle the upper end of the manipulating handle 18, and a bolt 21 passing through the outer ends of the arms 19 serves to clamp the same securely upon the handle 18.

The lower arm 3 of the yoke 1 extends between the upper ends of the plates 17, and is secured thereto by rivets 22, thus forming a rigid connection between the yoke and the magnet 5.

Cooperating with the magnet 5 is an armature 23, the outer end of which is provided with a notch 23' for reception of the lower end of the tool T, which is also provided with a retaining head 7. The inner end of the armature 23 is riveted or otherwise attached to one end of a leaf spring 24, provided intermediate its ends with an arcuate flexing portion 25.

To mount the opposite end of the spring 24, the upper edges of the plates 17 are provided with offset ears 26 having vertically extending bosses 27 formed therein. As best shown in Figures 3 and 5, the supporting end of the spring 24 is positioned on the bosses 27 and supported by the ears 26. Superimposed upon the supported end of the spring 24, is an auxiliary leaf spring 29 having notches 28 at its ends to straddle the bosses 27 and prevent displacement of the spring. A plate 30 provided with depending edges is secured upon the bosses by bolts 31 to lock the entire assembly in place. Obviously, the spring 29 permits limited upward movement of the inner end of the spring 24, thus serving to reduce flexure of the arcuate portion 25 as the tension upon the spring increases through actuation of the armature 23.

For the purpose of regulating the stroke or movement of the armature 23, the plates 17 are provided at their upper edges with vertical ears 32 extending into the arcuate portion 25 of the armature spring 24. Disposed between the ears 32, and slidably mounted upon the end of the arm 3 and the end of the adjacent core arm, is a non-metallic block 33 provided at its front end with an arcuate face 35 conforming to the contour of the arcuate flexing portion 25 of the spring 24, when the armature 23 is in its attracted position.

The block 33 is longitudinally adjusted between the ears 32 by means of a flat tapered stud 34, which extends through elongated openings 32' formed in the ears, to engage the shoulder 36 formed in the block by notching its rear end. A thumbnut 37 threaded on one end of the stud 34 serves to adjust the same within the ears 32, while a coil spring 38 disposed between one of the ears 32 and the head of the stud 34, serves to urge the stud to projected position as the thumbnut is run off.

It will be apparent that in its projected position, the tapered stud 34 permits the block 33 to

move rearwardly out of contact with the arcuate portion 25 of the spring 24, thus allowing the armature to be drawn into engagement with the magnet core 13, resulting in a full stroke of the armature. However, as the tapered stud 34 is retracted within the ears 32, by turning up on the thumbnut 37, the tapered edge working against the shoulder 36 forces the block 33 forwardly to engage and limit the flexing action of the arcuate portion 25 of the spring 24, thus limiting movement of the armature 23 to reduce the stroke of the tool.

Operation of the invention will be obvious, in that energization of the electromagnet 5 by alternating current will attract and release the armature 23, to impart reciprocative movement to the tool T, the upper end of which is detachably connected to the resilient carrier 4. The carrier 4 is only of sufficient predetermined tension to maintain the desired taughtness on the tool T, without appreciable affect upon the action of the armature spring 24.

Should the carrier 4 require replacement, the same is accomplished by springing its rear end out of the restricted notch 10 against the tension of the spring finger 11, which normally latches the carrier within the notch.

It will be further apparent that the normal inclined position of the armature relative to the core arms of the electromagnet is highly important, in that inclination of the armature allows its inner end to be positioned closely adjacent one of the fields, while the tool carrying end is substantially spaced from the field to provide maximum stroke of the tool with minimum power, as explained in the preceding objects of the invention.

In connection with the foregoing, the position of the flexure portion of the armature spring relative to the magnetic core is essential to operation of the present inclined armature.

By exhaustive tests it was found that in rigidly anchoring or fastening the armature spring to the bracket plates or frame, rapid crystallization and, consequently, frequent breakage of the springs occurred. Therefore, to overcome this problem, an important feature of the invention resides in yieldably anchoring the armature spring, whereby as the tension of the spring is increased through the action of the armature, flexing is relieved through yield of the end of the spring on its support.

A further novel feature of the invention consists in controlling movement of the armature by adjustable means, such as the block 33, capable of positively limiting movement of the armature toward the electromagnet. Heretofore, it has been customary to accomplish the foregoing by devices affecting either the armature or armature spring, to limit movement of the armature away from the electromagnet, thus varying its normal position relative to the electromagnet, and consequently varying the effective action of the magnetic lines of force. Preferably, the block 33 is formed of non-metallic material to reduce the noise of impact between the armature spring and block.

Lastly, it is desirable that the connection disposed between the electromagnet and flexible tool carrier be rigid and non-yieldable, to avoid as far as possible the setting up of vibrations in said connection, which in turn would materially offset or affect vibratory movement of the armature.

From the foregoing explanation considered in connection with the accompanying drawing, it

will be seen that an exceedingly light, simple, and compact electrically operated, reciprocative tool has been provided, in which a maximum stroke is obtained with minimum power. Although the invention has been illustrated and described in connection with a hand manipulated tool, it will be appreciated that its principles are applicable to bench tools, in which the electromagnet may be attached to a table having mounted thereon an arm for the resilient tool carrier.

I claim:

1. An electrically operated, reciprocative tool comprising, an alternating electromagnet, an armature exposed to the field of said magnet and inclined relative thereto to progressively vary the distance between said armature and magnetic field, a tool connected at one end to the armature at a point more remotely spaced from the field than its closest portion, and a resilient carrier for the opposite end of said tool.

2. An electrically operated, reciprocative tool comprising, an alternating electromagnet, an oscillatory armature exposed to the field of said magnet and inclined relative thereto to progressively vary the distance between said armature and magnetic field, a support for said armature to permit its oscillation about an axis closely adjacent that portion of the field and armature in closest relative position, a tool connected to said armature at a point substantially spaced from its oscillatory axis, and a resilient carrier for the opposite end of said tool.

3. An electrically operated, reciprocative tool comprising, an alternating electromagnet, an armature exposed to the field of said magnet and inclined relative thereto to progressively vary the distance between said armature and magnetic field, a spring support for said armature, said spring having its flexure portion in substantial alignment with that portion of the field and armature in closest relative position, a tool connected to the armature at a point more remotely spaced from the field than its closest portion, and a resilient carrier for the opposite end of said tool.

4. An electrically operated, reciprocative tool comprising, an alternating electromagnet, an armature responsive to said magnet, a tool connected to one end of the armature, a U-shaped supporting spring having one end for connection to the armature, a yieldable mounting for the opposite end of said spring, and a resilient carrier for the opposite end of the tool.

5. An electrically operated reciprocative tool comprising, an alternating electromagnet, an armature responsive to said magnet, a tool connected to one end of the armature, a U-shaped supporting spring for the opposite end of the armature, a yieldable mounting for said spring, a resilient carrier for the opposite end of the tool, and a rigid arm interposed between said electromagnet and carrier.

6. An electrically operated, reciprocative tool comprising, an alternating electromagnet, an armature responsive to said magnet, a tool connected to one end of the armature, a supporting spring for the opposite end of the armature, a yieldable mounting for said spring, a resilient

carrier for the opposite end of the tool, and a rigid arm interposed between said electromagnet and carrier.

7. An electrically operated, reciprocative tool comprising, an alternating electromagnet, an armature responsive to said magnet, a spring secured to one end of said magnet, an adjustable block positioned within said spring to positively limit its movement in one direction, a tool connected to the opposite end of said armature, and a resilient carrier for the opposite end of the tool.

8. An electrically operated, reciprocative tool comprising, an alternating electromagnet, an armature responsive to said magnet, a tool connected to said armature, a resilient carrier for the opposite end of said tool, and an arm interposed between said magnet and said carrier, said carrier being detachably latched on the end of said arm.

9. An electrically operated, reciprocative tool comprising, an alternating electromagnet, an armature responsive to said magnet, a U-shaped spring secured to one end of said magnet, an adjustable block positioned within said U-shaped spring to positively limit its movement in one direction, a tool connected to the opposite end of said armature, and a resilient carrier for the opposite end of the tool.

10. An electrically operated, reciprocative tool comprising, an alternating electromagnet, an armature responsive to said magnet, a U-shaped spring secured to one end of said magnet, a yieldable mounting for said spring, an adjustable block positioned within said U-shaped spring to positively limit its movement in one direction, a tool connected to the opposite end of said armature, and a resilient carrier for the opposite end of the tool.

11. An electrically operated, reciprocative hand tool comprising, an electromagnet, a U-shaped frame, a manipulating handle, said magnet, frame, and handle being rigidly connected, an armature responsive to said electromagnet, a tool connected at one end to said armature, and a resilient carrier connected to said frame for attachment to the opposite end of said tool.

12. A hand tool comprising, a substantially U-shaped rigid frame, a handle, an electromagnet having a laminated core, brackets connecting the handle with said frame and magnet, said brackets comprising laminations of the magnet core, an armature for the magnet, a leaf spring uniting the armature to the frame, a resilient carrier connected to the frame, and a tool connected to the carrier and armature.

13. A hand tool comprising, a substantially U-shaped frame, an electromagnet carried by one end of the frame, an armature for the magnet normally positioned at an angle to the face of said magnet, a substantially U-shaped spring uniting the armature to the frame, a resilient carrier connected to one end of the frame, a tool operatively connected to the carrier and armature, the flexing point of the U-shaped spring being adjacent one side of the magnet, whereby resistance of the spring to the attraction of the magnet is overcome with minimum power.

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