Oct. 25, 1949. T. S. BRISKIN ET AL 2,486,254

CONTROL MECHANISM FOR ELECTRICALLY DRIVEN TOOLS

Filed Nov. 10, 1944 4 Sheets-Sheet 1

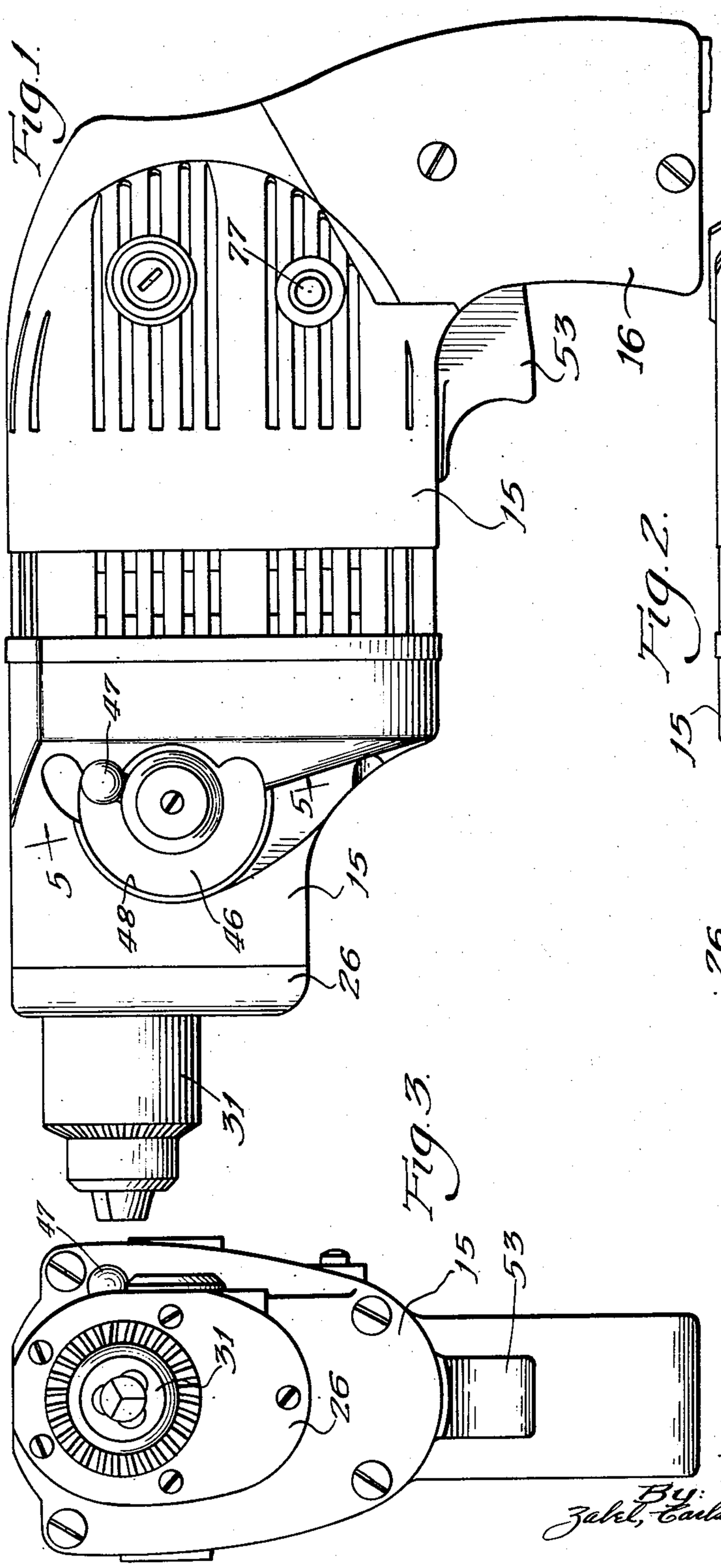

Fig. 1.

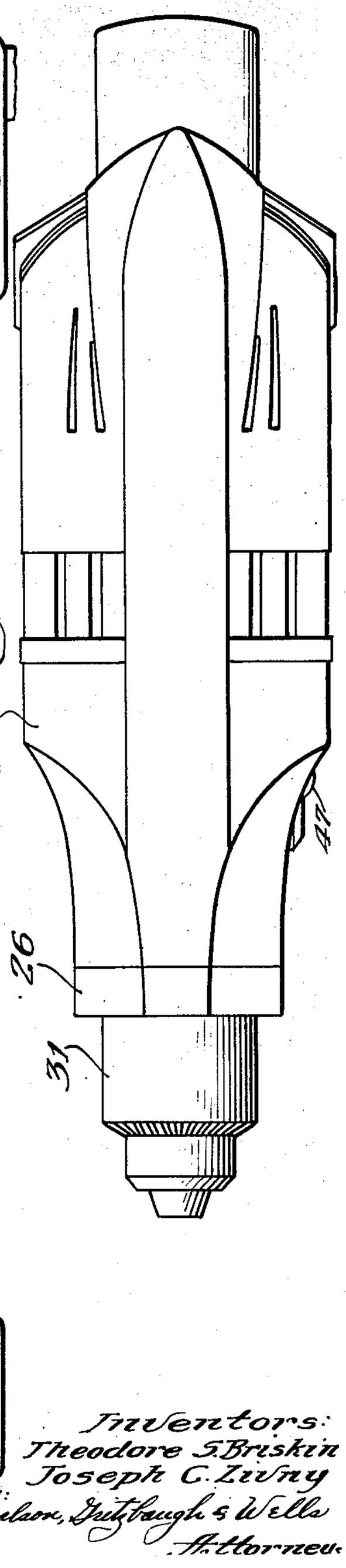

Fig. 2.

Fig. 3.

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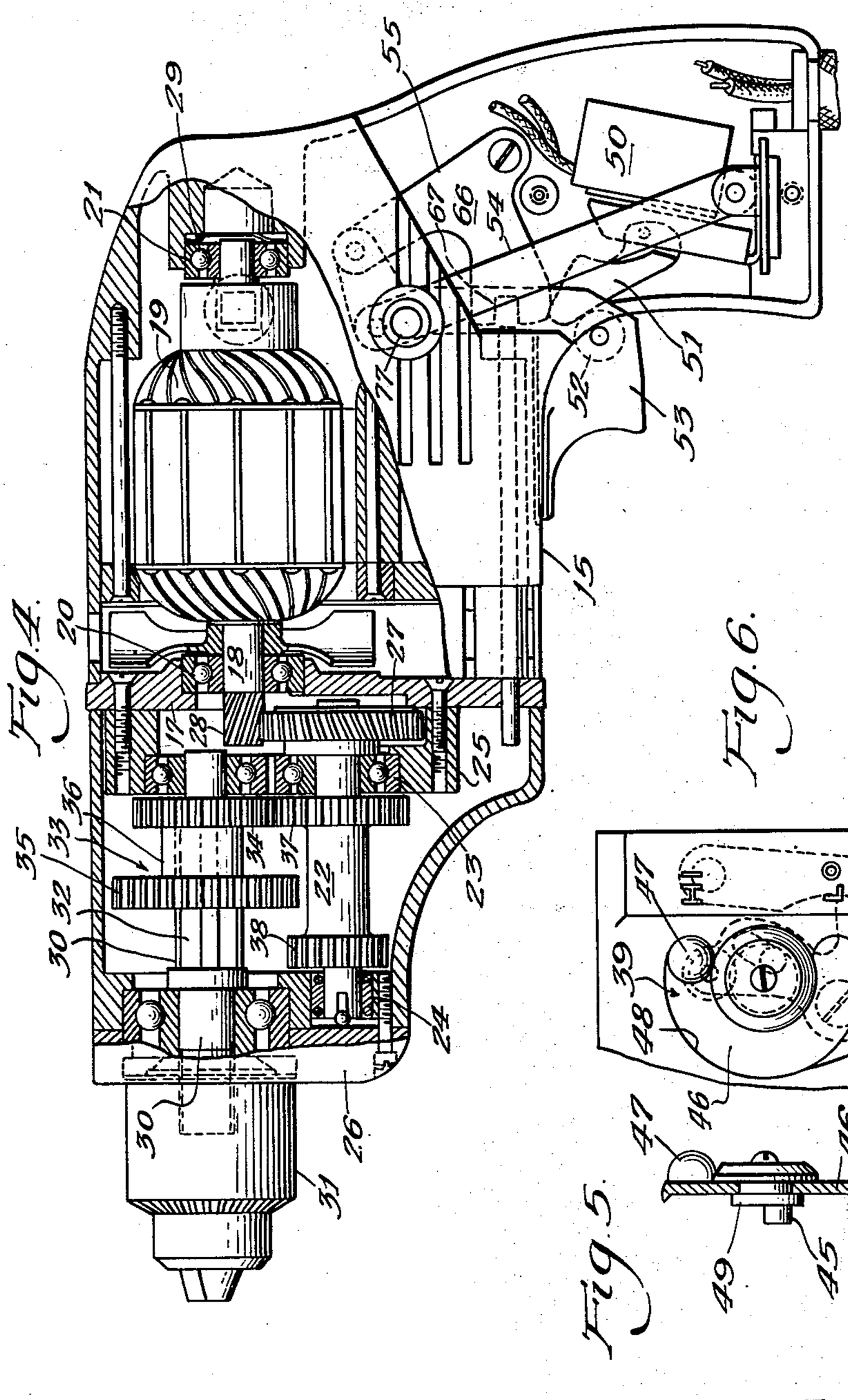

Fig. 4.

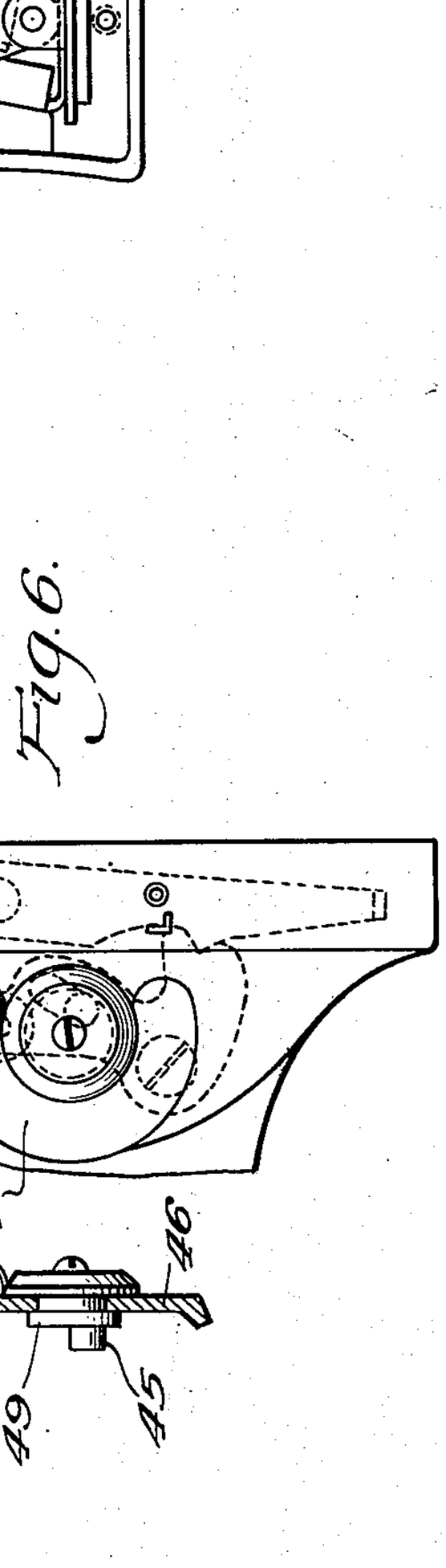

Fig. 6.

Fig. 5.

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CONTROL MECHANISM FOR ELECTRICALLY DRIVEN TOOLS

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Fig. 7.

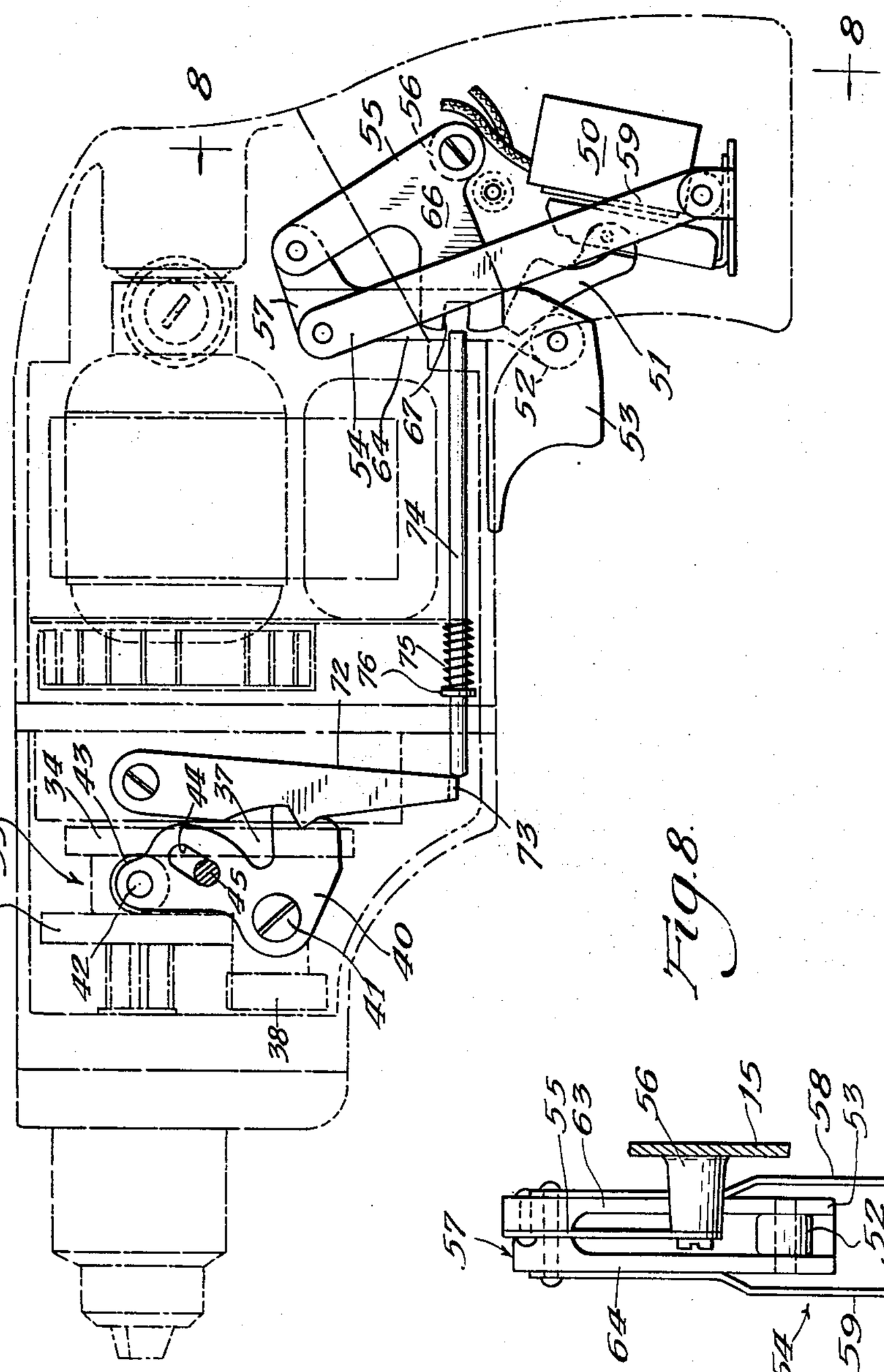

Fig. 8.

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CONTROL MECHANISM FOR ELECTRICALLY DRIVEN TOOLS

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Fig. 9.

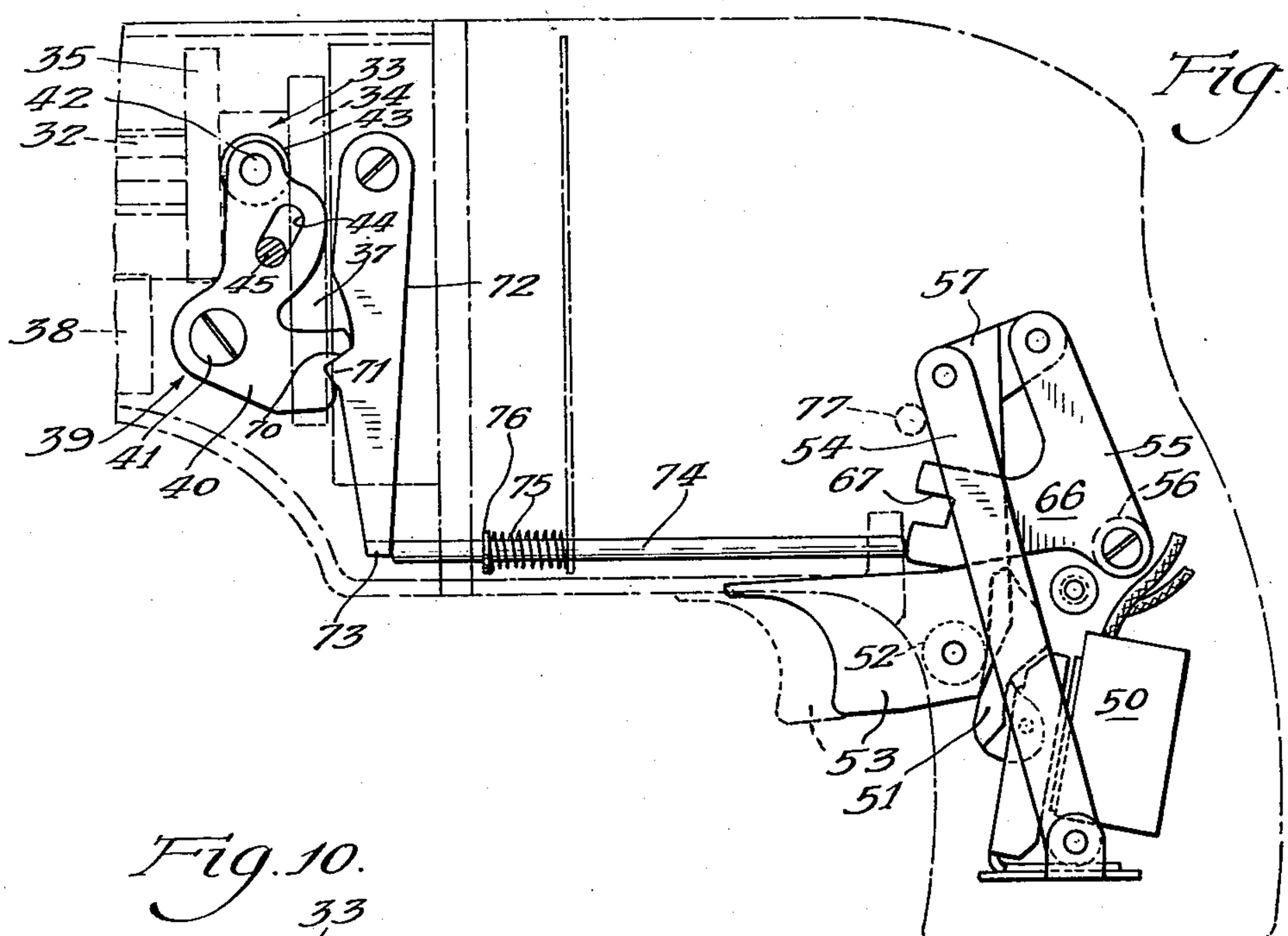
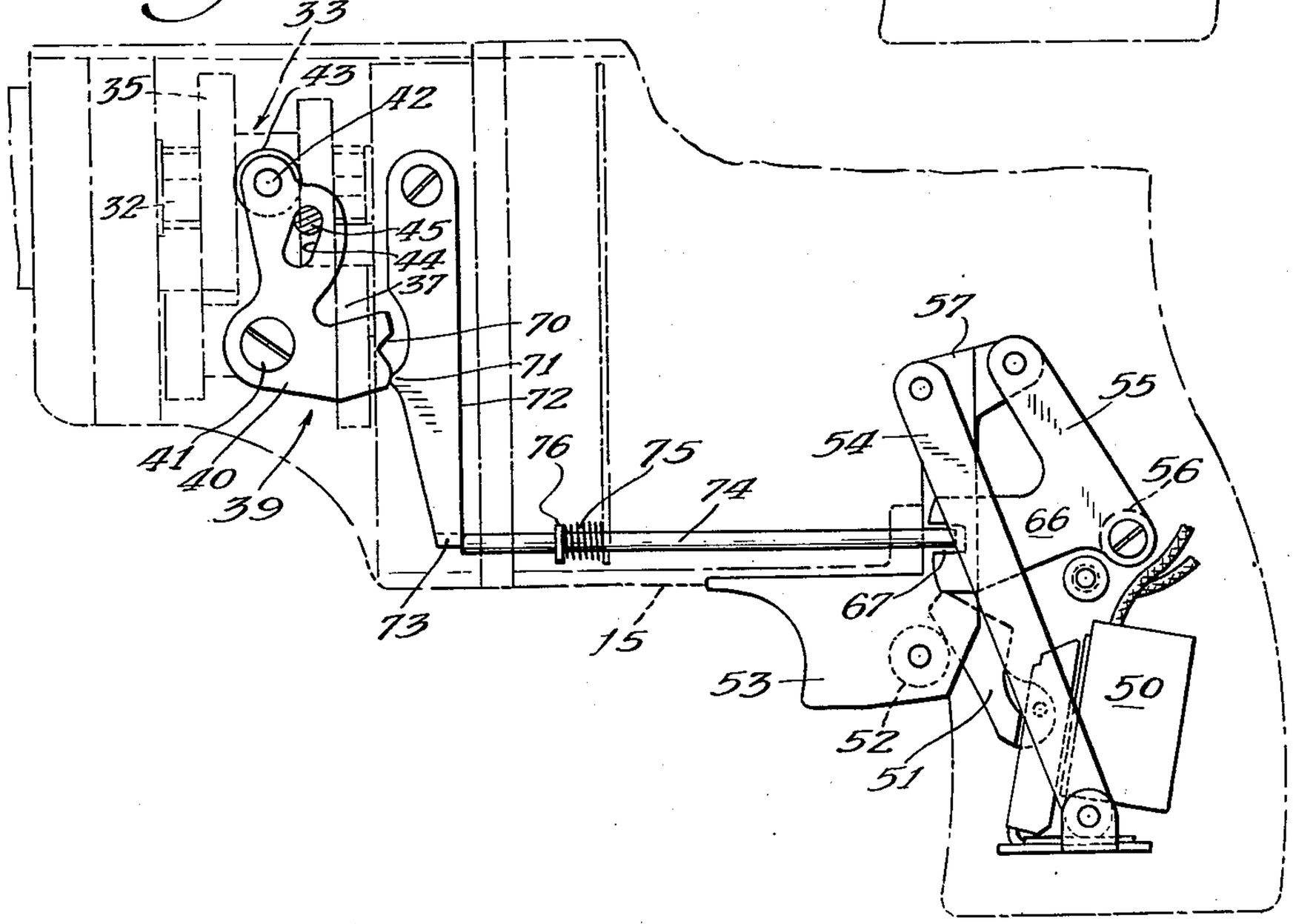


Fig. 10.



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UNITED STATES PATENT OFFICE

2,486,254

CONTROL MECHANISM FOR ELECTRICALLY DRIVEN TOOLS

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Application November 10, 1944, Serial No. 562,897

5 Claims. (Cl. 74—472)

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This invention relates to electrically driven tools, and in particular to one provided with a dual speed.

Electrically driven tools and other tools are subjected to widely differing conditions of use, and it is therefore desirable to provide a drill or tool which can be operated at different speeds. Previous attempts to change the speed by means of a rheostat or the like have not been successful. The present invention contemplates the use of a gear shift device by means of which a change in speed of the driven element may be effected.

It is an object of this invention to provide an improved electric tool embodying a gear shift mechanism to the end that a plurality of speeds may be provided for different types of work.

It is a further object of this invention to provide a simple and compact mechanism for changing the speed of an electrical drill.

It is another object of this invention to provide, in a drill having a trigger actuated switch, an improved mounting means for the trigger.

A still further object is to provide an interlocking means between the gear shift control mechanism and the switch control mechanism to the end that the gears cannot be shifted except when the motor is off, and to the end that the motor cannot be operated when the gear shift mechanism is in disengaged or neutral position.

Other objects, features and advantages of this invention will become apparent as the description proceeds.

With reference now to the accompanying drawings which illustrate a preferred embodiment of this invention and in which like reference numerals designate like parts,

Fig. 1 is an elevation of an electric drill;

Fig. 2 is a top view thereof;

Fig. 3 is an end view thereof;

Fig. 4 is a sectional elevation;

Fig. 5 is a detailed section taken along line 5—5 of Fig. 1;

Fig. 6 is a detailed elevation of the gear shift control mechanism, the underlying parts being shown in dotted lines;

Fig. 7 is a view similar to Fig. 4 but showing only the switch control and gear shift control and interlocking mechanisms in solid lines, the other parts being shown in phantom;

Fig. 8 is an end view of the switch control mechanism taken along the line 8—8 of Fig. 7;

Fig. 9 is a view similar to Fig. 7 but showing the parts in a changed position; and

Fig. 10 is a view similar to Fig. 9 but showing a still further change in the position of the parts.

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With reference now to Fig. 4, the reference numeral 15 designates the housing of an electric drill, the drill being provided with a pistol grip and a trigger 53 for actuating a switch for the motor of the drill. At the opposite end of the drill there is the usual drill chuck 31. The housing includes a removable plate 16 which covers a portion of the grip, removal of this plate exposing the switch and switch control mechanism as indicated by Fig. 4.

Within the housing is disposed a mounting plate 17 in the form of a partition, in which mounting plate is journalled by means of ball bearings 20 an armature shaft 18. The rear end of the armature shaft is journalled in a bearing 21 which is suitably mounted in a portion of the housing. The drill is driven by the usual electric motor which includes an armature 19 mounted on the armature shaft 18. In the forward portion of the drill housing there is provided a countershaft 22 which is mounted at opposite ends in bearings 23 and 24, bearing 23 being received in a second mounting plate 25 which is secured with respect to the first mounting plate by suitable dowels and screws. Bearing 24 is received in a recessed portion of the forward wall of housing 15, and the end of the drill is protected by a cover plate 26.

The armature shaft 18 is provided with a helical pinion 28 which meshes with and drives a helical gear 27 mounted on the countershaft 22. The helical teeth on gear 27 and pinion 28 produce a forward thrust of the armature shaft and end play of the shaft is consumed by a spring washer 29 disposed at the rear end of the armature shaft 18.

The drill chuck 31 is mounted on a shaft 30 which is parallel with and spaced from the countershaft 22, the shaft 30 being provided with splines 32. A gear cluster 33 is mounted on the splined shaft 30 and comprises gears 34 and 35 which are associated with each other by means of a splined hub 36. The countershaft 22 is provided with gears 37 and 38, gear 37 being adapted to mesh with gear 34 to drive shaft 30 at a high speed, and gear 38 being adapted to mesh with gear 35 to drive the shaft at low speed. This change in speed is effected by shifting the gear cluster 33 to the right or to the left respectively as the parts are shown in Fig. 4.

The means for causing the shift of the cluster are designated generally by the reference numeral 39 and comprise a plate 40 which is pivoted on a screw 41 which in turn takes into a suitable lug projected upwardly from the

bottom wall of housing 15. The plate 40 is provided with a stud 42 on which is mounted a roller 43, the roller extending into the space between the gears 34 and 35 so as to shift the gear cluster 33 into high speed or low speed position as the plate 40 is rocked. The plate 40 is also provided with a slot 44, into which slot extends a pin 45. The pin is eccentrically mounted with respect to a rotatable control plate 46, a control knob 47 being provided on the plate 46 so as to permit the same to be rotated manually. The knob 47 extends through an arc-shaped slot 48 in the housing 15. The control plate 46 also includes a hub member 49 which is journalled in a suitable aperture in housing 15, the pin 45 projecting from the hub member 49.

In operation it will be seen that the control knob 47 when in the "HI" position shown in Fig. 6 causes the plate 40 to assume a position at the clockwise limit of its rotation. This position of the parts is also shown in Figs. 7 and 8, the pin 45 being engaged with the lower end of the slot 44. As the control knob 47 and the pin 45 are rotated in the counterclockwise direction the plate 40 will be rocked in the counterclockwise direction, also causing the gear cluster 33 to be displaced into an intermediate position as shown in Fig. 10 and then further to the low speed position wherein gears 38 and 35 are in mesh.

The operation of the motor is controlled by a switch 50 which is provided with an operating lever 51. The opearting lever is depressed upon engagement by a roller 52 which is carried by trigger 53. When the trigger is pulled back, the motor circuit will be closed, and when the trigger is released the motor circuit will be open. The operating lever 51 is biased to the open circuit position, the bias being sufficiently strong so as to push the trigger 53 forwardly at such times as it is disengaged by the operator's finger. The trigger is mounted for substantially rectilinear movement by means of a linkage which includes a lever 54 which is pivoted at a point close to the base of the pistol grip, a lever 55 which is pivoted on a lug 56 extending inwardly from housing 15 and a connecting link 57. The lever 54 comprises two arms 58 and 59 as shown in Fig. 8, the lower portions of these arms being mounted on a pivot pin 65 which is supported in lugs 60 and 61. The lugs 60 and 61 may be secured to the housing 15 in any suitable manner. The levers 54 and 55, the link 57, and the housing constitute a four-member linkage, the housing being one of the links.

The connecting link 57 is in the form of a block 62 which has a depending bifurcated portion providing arms 63 and 64. The roller 52 is journalled between the arms 63 and 64. Forwardly of the roller 52 the arms merge again into a single piece which comprises the trigger 53, the housing being suitably slotted so that the trigger may be extended therethrough.

In operation, it will be seen that the motion of the trigger is confined by the linkage to a substantially rectilinear motion. It actually makes little difference whether the motion of the trigger follows a straight line or follows the arc of a substantially large radius, the important thing being that this linkage provides a trigger mounting of very low friction and provides a much greater throw of the trigger than would be permitted by a pivoted mounting which would necessarily have a small radius. By this linkage mounting for the trigger, the usual flange and

groove constrution employed where rectilinear motion is desired, is eliminated.

The lever 55 includes a forwardly projecting portion 66 having a slot 67 therein. This slot forms a part of an interlocking mechanism by means of which the knob 47 cannot be operated except when the switch operating lever 51 is in the off position, and by means of which the motor cannot be operated when the gear cluster is in a disengaged or neutral position.

The interlocking mechanism also includes a notch 70 in plate 40, which notch is adapted to be engaged by a projection 71 on a lever 72. The lever 72 is pivotally mounted on a suitable part of the device such as mounting plate 25, and is provided at its lower extremity with a bent over portion 73. The lever 72 is so shaped that the projection 71 and the notch 70 are in cooperative engagement when the gear cluster is in its high speed position, as shown in Figs. 7 and 9. As the control knob 47 is rotated out of high speed position, the shape of the parts is such that the lever 72 will be cammed out of the notch 70, as shown in Fig. 10. Further movement of the control knob 47 to low speed position will cause the lever 72 to drop back to its original position.

A rod 74 is slidably mounted in a suitable bore of the housing 15 and is biased into engagement with the bent over end portion 73 of the lever 72, this bias being effected by a spring 75 which is confined between a collar 76 on the rod and a portion of the housing. Thus it will be seen that as the control knob 47 is rotated into or out of one of the two driving positions that the rod 74 will be displaced rearwardly. The rear end of the rod is adapted to extend into the slot 67 when the trigger 53 is in open circuit position. Thus the control knob 47 can be actuated at all times except when the trigger is depressed. Depression of the trigger causes a rocking of lever 55, as shown in Fig. 9, so that the forwardly projecting portion 66 of lever 55 blocks any rearward displacement of the rod 74. Thus, when the trigger is in closed circuit position, movement of the rod, and consequently of the control knob 47, is prevented. A button 77 may be mounted in the housing to maintain lever 54 and associated parts in closed circuit position.

If the control knob 47 is not thrown over completely into one of the operating positions, but is left in an intermediate position so that the gear cluster 33 is disengaged, then the rod 74 extends into the slot 67 and prevents movement of lever 55 and hence of trigger 53. This interlocking feature prevents operation of the device when the driving gears are disengaged or only partially engaged, thus avoiding damage to the parts.

The operation of the drill has been pointed out in detail in connection with the operation of the various parts thereof. In general it will be seen that before the motor circuit is closed, the control knob 47 may be thrown into either high or low speed driving relationship, and then the trigger may be depressed to energize the motor. While the motor is operating, the control knob cannot be moved. Furthermore, if the gears are not moved into fully engaged relationship the motor cannot be operated.

While there have been shown and described certain embodiments of the invention, it is to be understood that it is capable of many modifications. Changes, therefore, may be made without departing from the scope of the invention as

described in the appended claims, in which it is the intention to claim all novelty inherent in the invention as broadly as possible, in view of the prior art.

We claim:

1. In a portable power hand tool having a housing, a four-member linkage including said housing as one of the links thereof, a manual control member mounted on one of said links for substantially rectilinear motion, an electric switch engaged by said manual control element, a blocking member forming a portion of another of said links, a gear shifting device having a plurality of operative positions, a pivoted member for controlling the position of said gear shifting device, and displaceable means engaging said pivoted member and said blocking member, said displaceable means being operative when said blocking member is in blocking position to lock said pivoted member in one of a plurality of positions each of which corresponds to an operative position of said gear shifting device whereby said gear shifting device cannot be moved from one operative position to another except when said manual control element is in a certain position.

2. In a portable power hand tool having a housing, a four member linkage including said housing as one of the links thereof, a manual control member mounted on one of said links for substantially rectilinear motion, an electric switch engaged by said manual control element, a gear shifting device having a plurality of operative positions, and a displaceable member the position of which is determined by the position of said gear shifting device, said displaceable member extending into proximity to said linkage to block the movement thereof except at such times as said gear shifting device is in an operative position, whereby said manual control element is rendered inoperative.

3. In a portable power hand tool having a housing, a four member linkage including said housing, a manual control member mounted on one of said links for substantially rectilinear motion, an electric switch engaged by said manual control element, a slotted member forming a portion of another of said links, a gear shifting device having a plurality of operative positions, a pivoted member for controlling the position of said gear shifting device, and displaceable means engaged by said pivoted member for projection into said slotted member to prevent operation of said linkage except at such times as said gear shifting device is in an operative position.

4. In a portable power hand tool having a housing, a four member linkage including said housing, a manual control member mounted on one of said links for substantially rectilinear motion, an electric switch engaged by said manual control element, a slotted blocking element forming a portion of another of said links, a gear shifting device having a plurality of operative positions, a pivoted member for controlling the position of said gear shifting device, and displaceable means for engaging said pivoted member and said slotted blocking member whereby operation of said pivoted member is prevented except when said slotted blocking member is in a predetermined position, and whereby operation of said linkage is prevented by the projection of said displaceable means into said slotted member at such times as said pivoted member is in a predetermined angular position, which corresponds to an inoperative position of said gear shifting mechanism.

5. A portable power hand tool comprising an armature shaft, a countershaft driven thereby and a driven shaft driven by said countershaft, a helical pinion on said armature shaft, a helical gear on said countershaft meshing therewith, a resilient mounting at one end of said armature shaft to take up the end thrust developed by said helical gears, axially spaced driving gears on said countershaft, and a gear cluster splined to said driven shaft, said gear cluster comprising a plurality of axially spaced gears, one being provided for each of said driving gears on said countershaft, the spacing between said cluster gears differing from the spacing of said driving gears so that a shifting of said cluster will result in the meshing of one or another of said driving and cluster gears, the gear ratio between the several driving gears and their cooperating cluster gears varying from one pair to another so that an axial shifting of said gear cluster will result in a change of the speed of said driven shaft.

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