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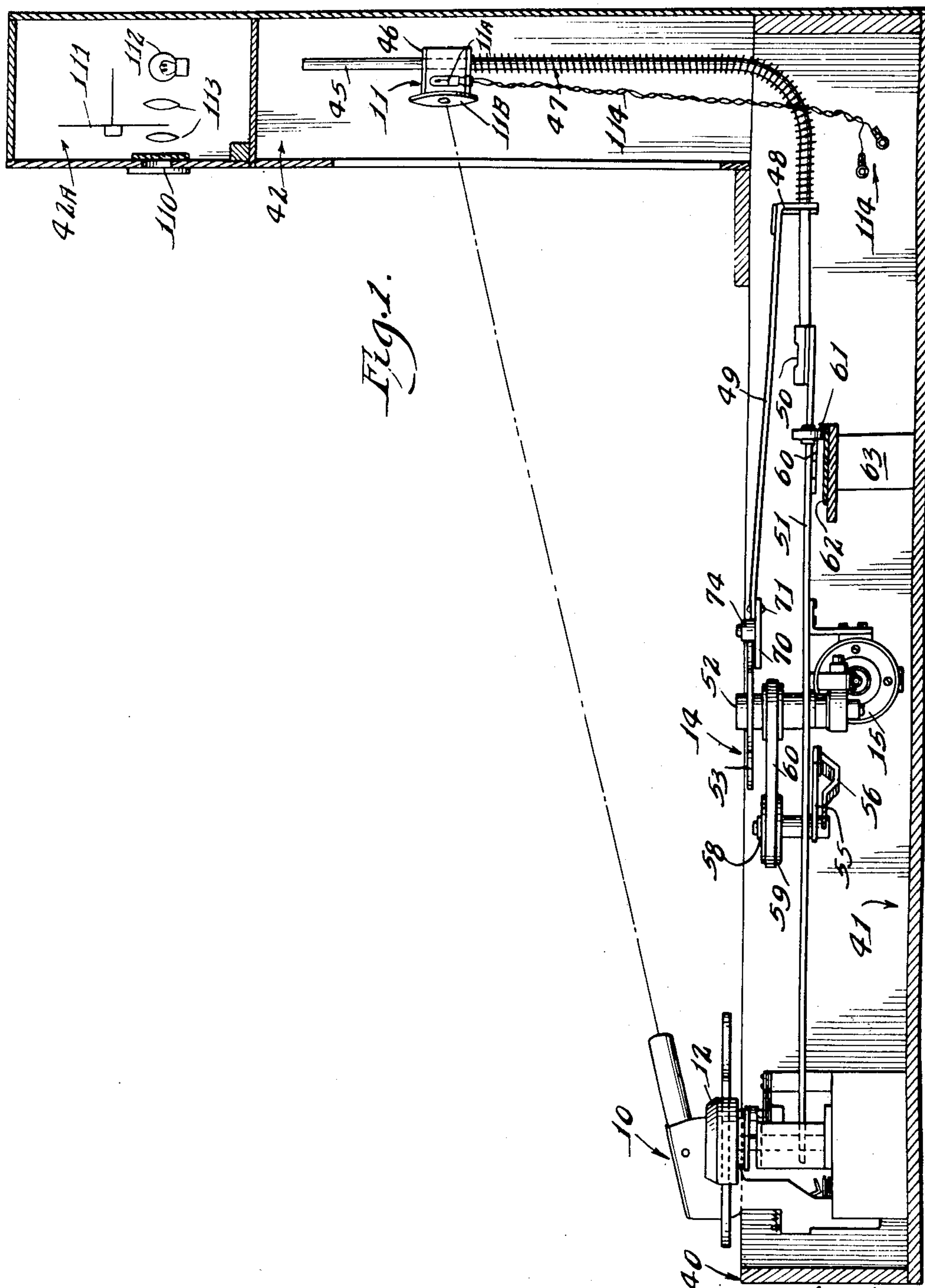
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2,659,606

LIGHT BEAM TARGET MECHANISM

Original Filed Nov. 18, 1946

3 Sheets-Sheet 1



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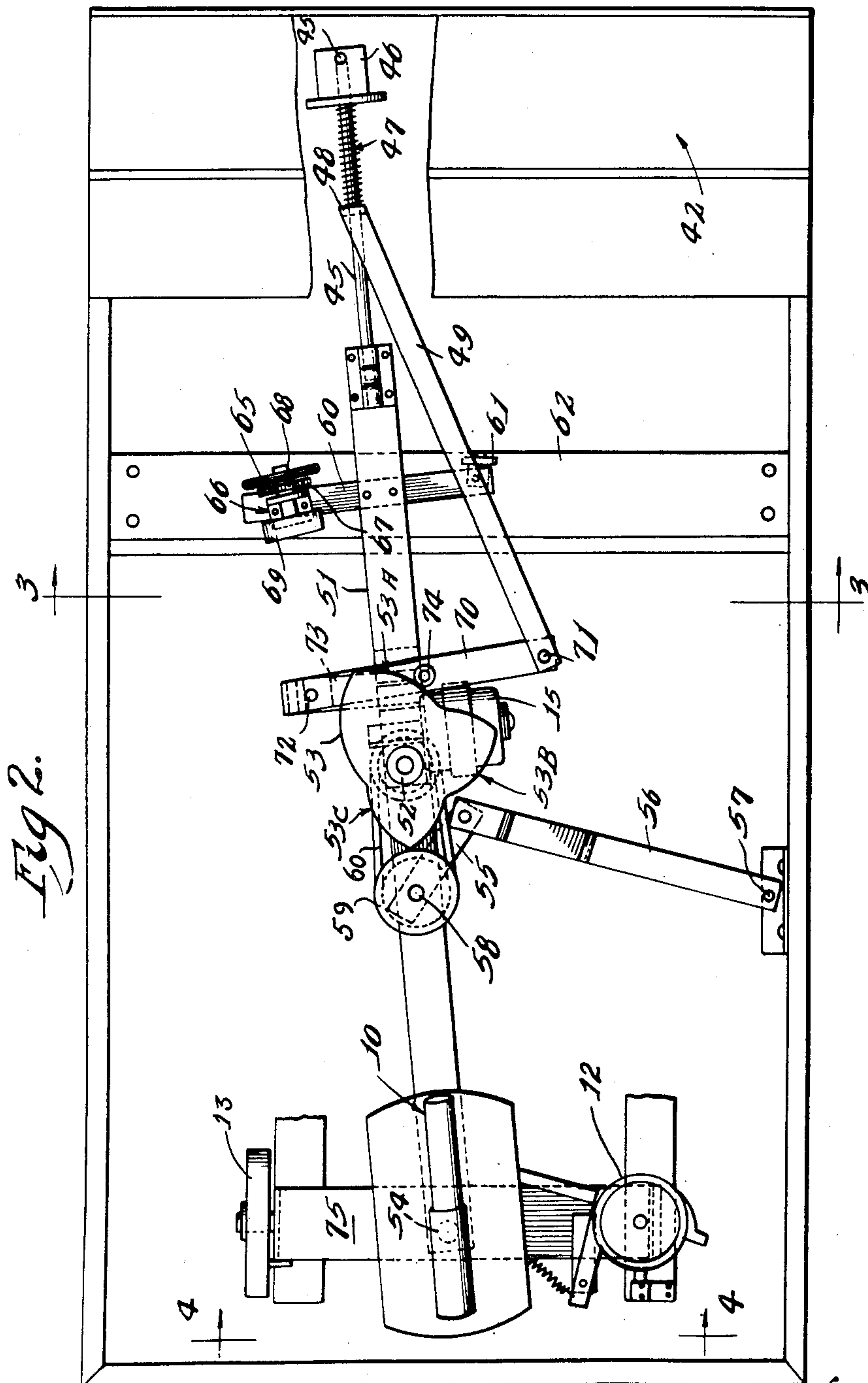
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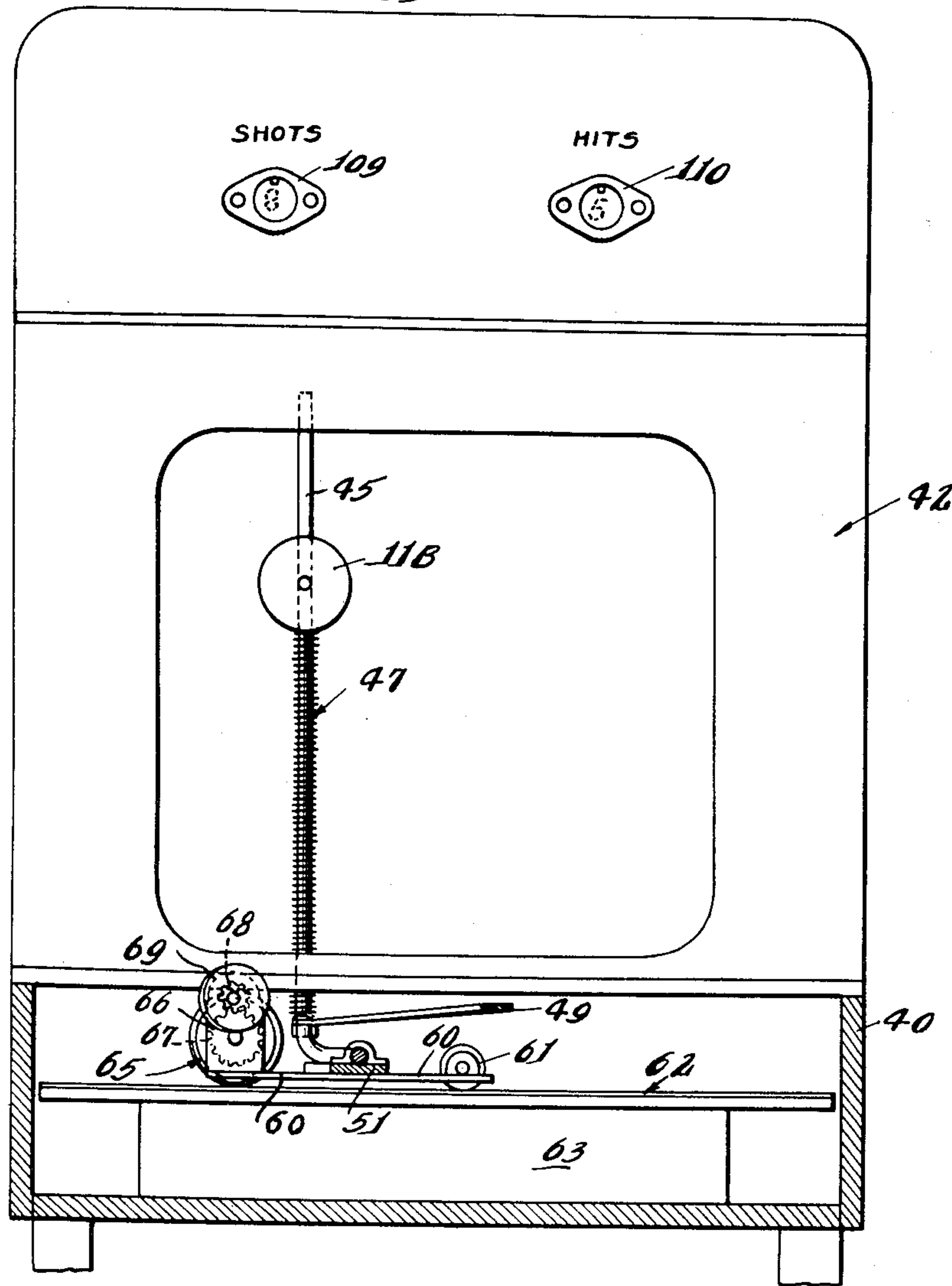
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Fig. 3.



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LIGHT BEAM TARGET MECHANISM

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Original application November 18, 1946, Serial
No. 710,464, now Patent No. 2,586,330, dated
February 19, 1952. Divided and this applica-
tion February 16, 1952, Serial No. 271,925

10 Claims. (Cl. 273—105.2)

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This invention pertains to photoelectric marksmanship apparatus of a type particularly, but not exclusively, adapted to utilization in coin-controlled amusement games, and the like, and the application is a division of an application filed November 18, 1946, Serial No. 710,464, by Earle G. Henry and Leo L. Galinski, for improvements in Photoelectric Marksmanship Apparatus, now Patent No. 2,586,330.

An important object is the provision of a moving photoelectric target and novel mechanism for imparting a scrambled, irregular, meandering motion thereto, for the purpose of rendering more difficult and interesting the exercise of skill in training the aiming piece or gun thereupon.

Additional objects are: the provision of target-actuating means in the nature of a mechanical unit affording a complex driving motion for the target including oscillatory and reciprocatory components of movement for the target; the provision of a dynamic stabilizing means for preventing jerky target movements notwithstanding speed variations in the scrambling action of the driving motion by which the travel of the target is rendered non-uniform so that the marksman cannot easily anticipate the future positions of the target to correct his aim.

Still further objects relate to the provision of a mechanical movement, especially but not exclusively, suited for use with target devices, to provide an irregular motion, and chiefly characterized by the use of an oscillating arm, a target member slidable thereon, a reciprocable arm supported in part to slide on the oscillatory arm and having a yieldable driving connection with the target member to move the latter back and forth responsive to reciprocations of the reciprocatory arm, and a driving motor common to both the oscillatory and reciprocable arms, together with an irregular-motion mechanism drivingly coupling the motor with both the oscillatory and reciprocable arms for the purpose of actuating the latter in their respective types of motion to produce a resultant compound or complex travel of the target member back and forth between opposite limits of horizontal displacement, as well as up and down between opposite limits of vertical displacement.

Additional objects and aspects of novelty will appear as the following description proceeds in view of the annexed drawings, in which:

Fig. 1 is a vertical cross section taken lengthwise through the game cabinet, showing the gun unit, the target-actuating mechanism and the target proper in elevation;

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Fig. 2 is a horizontal cross section through the game cabinet, showing the gun unit and target-actuating mechanism in plan;

Fig. 3 is a transverse vertical cross section through the game cabinet, looking in the direction of lines 3—3 of Fig. 2, and showing the target portion in elevation and parts of the target-actuating mechanism both in elevation and in section.

In Fig. 1, the relative disposition of the principal structural parts, including the gun 10, target 11, and target-actuating means 14, is shown in relation to a cabinet 40 having a trough-like bed portion 41 and an upright back cabinet section 42, it being pointed out that in these structural views the power pack, amplifier, and control relay and other circuit means are omitted for clarity.

The photoelectric target structure includes a vertical rod 45 upon which slides a U-shaped housing 46 containing the photo cell 11A shielded by a suitably apertured target face 11B.

Target housing 46 has sufficient weight to tend to slide downwardly on rod 45, but it is normally urged upwardly by a long spring 47 on said rod and bearing against the offset end 48 of a reciprocating arm 49, which offset end slides on the horizontally extending part adjoining the curved portion of said rod, the end of said portion being fixed as at 50 in the end of a horizontal sweep arm 51.

Sweep arm 51 carries affixed thereto the motor unit 15, which is of a type having a built-in speed reduction unit driving a vertical spindle 52 journaled in said arm and rotating an irregular scrambling cam 53, seen better in Fig. 2, in view of which the following parts are now described.

At its left-hand end, Fig. 2, the sweep arm 51 is pivotally anchored on a vertical rod 54, so that the opposite or right-hand portion of said sweep arm describes an arc in oscillatory or back and forth motion imparted thereto by means including a crank arm 55 pivotally connected to a radius arm 56 which is in turn pivotally anchored as at 57, the crank arm 55 rotating with spindle 53, which in turn is driven by pulley 59, fast thereon, through belt drive 60 with the motor spindle 52 (see also Fig. 1).

Near its outer or right-hand end, the sweep arm is provided with a cross arm 60 (Figs. 2 and 3) on one end of which is carried a roller 61 which rides on a metal plate 62 extending transversely of the cabinet trough on support 63.

On the opposite end of said cross arm 60 (Figs. 2 and 3) is a stabilizing means including a friction drive wheel 65 journaled in bracket

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66 and having rotatable therewith a large gear 67 (Fig. 3) which in turn drives a pinion 68 fast with a flywheel 69; thus, as the sweep arm oscillates back and forth, the flywheel 69 is rapidly rotated by its friction drive and resists jerky alterations in movement of sweep which otherwise appear owing to play in driving components of production embodiments of the game.

The foregoing oscillation of the sweep arm accounts for one component of motion of the target assembly, since the latter is carried by said sweep arm through connection of rod 45 at its lower end with the arm as at 50. The other component of the complex motion of the target is effected through reciprocation of arm 49 (Fig. 2), which exerts compression and relaxation efforts at offset 48 on spring 47, thus elevating and lowering the target housing 46.

An irregular or scrambled motion is imparted to the reciprocating arm 49 through the agency of an oscillatory drive arm 70 (Fig. 2) pivotally connected thereto as at 71 and having a pivotally anchored end 72 on an extension 73 from the sweep arm, there being a cam roller 74 between the said pivoted ends of arm 70 bearing against the irregularly developed edge portions 53A, 53B, 53C of the scrambling cam 53, which is slowly rotated through the speed reduction means of motor 15, it being observed that spring 47 serves also to press said cam roller into operative engagement with the scrambling cam by its action against the offset end 48 of arm 49.

Thus the irregular cam drive imparts a non-uniform motion vertically to the target unit, and owing to some compressibility permitted in spring means 47, there is some additional irregularity in the up and down movement of the target unit, with the result that it is very difficult to predict the position of the target from time to time.

The foregoing target drive means and target structure is regarded as one of the units of the game and is considered to be one of the important novel elements of the disclosure.

Any suitable light gun may be used with the roving target 11, the gun 10 shown in Fig. 1 being of a type especially adapted for use with the novel target mechanism shown.

The gun 10 is not described in detail herein since it does not per se constitute a part of the claimed invention. For purposes of illustration, however, the gun 10 will be understood to contain a light and shutter means (not seen) operable to project a beam of light upon the target 11 when the gun is properly aimed.

The target means 11—11B moves both horizontally and vertically in an irregular fashion, as heretofore described, and the gun 10 is accordingly adapted to execute such movements responsive to the manipulation of two manual control wheels or knobs 12 and 13 (Fig. 2). The wheel 12 affords the horizontal or azimuth sweep of the gun, while the wheel 13 produces the zenith or vertical aim. A gun of this type is disclosed in detail in U. S. Patent No. 2,586,330.

The photoelectric target cell 11A is adapted to be connected, as by flexible conductors 114, to any suitable amplifier means (not shown) for the purpose of actuating the score registering means shown schematically in Fig. 1, to include a rotatable dial 111 behind a score screen 110 (Fig. 3, also), and provided with a lamp 112 adapted to illuminate indicia (not seen) on the dial 111 and project an image thereof through lens means 113 onto screen 110. A score-registering device suitable for such cooperation with the

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photoelectric target means is fully illustrated in U. S. Patent No. 2,281,262 to Breitenstein. A similar register (not seen) is arranged behind another score screen 109 in the front of the cabinet 42 (as in Fig. 3) and is adapted to be connected in a circuit (not shown) for counting the number of shots. Thus the marksman is to be apprised of the number of shots taken and the number of hits scored upon the irregularly traveling target.

It will now be apparent that the objects of the invention are realized in one satisfactory embodiment consisting basically of an oscillatory sweep arm 51 carrying its own power plant 15, 52, etc., a reciprocating arm 49 carried by the oscillatory arm and coupled as at 70, 74 with the motor unit to be reciprocated thereby, a target arm 45 carried by the sweep arm, a movable target unit 11, 46, etc., slidable on the target arm, and a yieldably driving connection such as the long compression spring 47 interposed between the reciprocating arm and the target unit to impart movement to the latter in reaction to the back and forth movements of the reciprocating arm, so that the target unit moves linearly (up and down) and angularly (in a horizontal arc) simultaneously.

Moreover, it will also be now apparent that the travel of the target is characteristically a complex motion made so by reason of the relatively irregular movement imparted to the reciprocating arm by the cam means 53, 70—72—74; and the non-linear acceleration of the sweep arm produced by the crank means 55, 56, 57.

Thus, the novel target mechanism is seen to carry with it its own motive unit, and at least two mechanisms for producing irregular motion components, together with a dynamic stabilizing unit including the inertial system 65—69 for suppressing unwanted components to produce a relatively smooth resultant target motion.

It is contemplated that changes may be effected in the form of the various parts of the structure specifically described for illustrative purposes, all without departing from the scope of the invention as defined in the following claims:

I claim:

1. In photoelectric marksmanship apparatus, a roving target structure including a sweep arm, a motor carried by said arm, drive connections effecting oscillation of said arm under power of said motor, a target carrying rod movable with said arm, a target reciprocable on said rod, a reciprocating drive arm moving in part, at least, longitudinally of said rod, and a flexible connection between said drive arm and target for moving the latter responsive to reciprocating movements of said drive arm, and means drivingly interconnecting said motor and said drive arm for effecting scrambled reciprocating movement of the latter.

2. In photoelectric marksmanship apparatus, a sweep arm mounted for oscillatory motion in an approximately horizontal plane, a target arm carried by said sweep arm and projecting upwardly therefrom, a target unit mounted to ride up and down on said target arm, a reciprocating drive arm movable back and forth on said target arm, motor means carried by said sweep arm, and driving connections between said motor means, said sweep arm, and said drive arm for moving the sweep arm back and forth in oscillatory sweeps, and for moving said drive arm back and forth, and means encircling said target arm for

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drivingly interconnecting the target unit with said drive arm.

3. In target apparatus, means for traveling a target with complex motion and including a first arm movable back and forth in one plane, a second arm movable back and forth on the first arm and in a direction at an angle to the movement of said first arm, a target arm projecting into a vertical plane from said first arm, a target movable up and down on said target arm, a coil spring encircling said target arm freely between said target and an end portion of said second arm so as to be moved upwardly, at least, by movement of said second arm in one direction, said target following up and down movements of said spring, motor means carried by said first arm and including drive mechanism interconnecting operatively said first and second arms for back and forth motion thereof as aforesaid.

4. In target apparatus, a roving target including a horizontal sweep arm, a target arm connected to an end of the sweep arm opposite its axis of movement and projecting from the horizontal plane into a vertical plane, a reciprocating arm having an end member sliding on the horizontal part of said target arm, a scrambling cam carried on said sweep arm, lever means operable to oscillate said sweep arm, driving connection between said cam and reciprocating arm, motor means carried by the sweep arm for actuating said lever means and rotating said cam whereby to effect oscillatory sweep of said sweep arm and back and forth movement of said reciprocating arm, a target slidable up and down on the vertical portion of said target arm, a coil spring encircling said target arm freely and having one end bearing upwardly against said target and an opposite end bearing against said end member of the reciprocating arm such that advance of the latter pushes the spring and target upwardly, the target having weight to push the spring downwardly upon retraction of the reciprocating arm, and a rotary stabilizer on said sweep arm and having a friction drive with stationary parts relative to the sweep arm for imparting rotary drive to said stabilizer responsive to sweeping of said arm.

5. In a target structure, a horizontal sweep arm, a vertical target arm on said sweep arm remote from the sweeping axis thereof, a target movable back and forth on said target arm, a motor carried by said sweep arm, and driving mechanism interconnecting said motor, said sweep arm, and said target for causing the latter to move back and forth on the target arm with simultaneous back and forth sweep of the sweep arm, a stabilizing flywheel carried on said sweep arm, and friction drive means for said flywheel and engageable with relatively stationary means adjacent the path of sweep of the sweep arm for imparting rotary motion in reverse directions to the flywheel, depending upon the direction of movement of the sweep arm.

6. In target apparatus, an oscillatory target arm and means for oscillating same, and stabilizing means including a flywheel rotatable on said arm; means providing a stationary surface adjacent said arm, and a friction drive member for said flywheel and engageable with said stationary surface means for rotation to impart rotary motion to the flywheel, depending upon the direction of movement of the target arm.

7. In a mechanical movement for producing ir-

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regular complex motion of a travelled object, a sweep member mounted for oscillatory travel, a driving motor carried by said sweep member; a reciprocating member carried by said sweep member and mounted to reciprocate in a sense approximately radial to the arc of travel of the sweep member; a travelled object and means supporting the same for travel with said sweep member, and also for back and forth movement relative to the sweep member; means providing a driving connection between said travelled object and said reciprocating member to be moved back and forth by the latter responsive to reciprocatory movements thereof; together with irregular-motion mechanism drivingly interconnecting both the sweep member and the reciprocating member severally with said driving motor for actuating the latter in their respective oscillatory and reciprocatory movements whereby to impart a complex resultant motion to the travel of said object, which motion is irregular and a function of both the oscillatory and reciprocatory movements aforesaid.

8. Apparatus as defined in claim 7 and further characterized by the provision of means mounting the sweep member for oscillatory movement and including a pivot for said sweep member, roller means supporting a part of said member for arcuate travel at a point radial of said pivot, and means providing a tracking surface on which said roller means travels.

9. Apparatus according to claim 8 and further characterized by the provision of stabilizing means for said sweep member and including a flywheel and means mounting the same for travel with said sweep member and to rotate about an axis approximately radial to the axis of said pivot; a drive wheel mounted to travel with said sweep member and ride on said tracking surface, gear means drivingly interconnecting said flywheel and drive wheel to produce rotation of the flywheel responsive to the oscillatory travel of the sweep member.

10. In a mechanical movement for actuating a driven member in a complex motion pattern, in combination: a sweep member mounted for back and forth travel; crank means operatively connected to said sweep member for operation to move the latter back and forth; a driven member and means mounting same for reciprocatory movement on the sweep member; lever mechanism carried by said sweep member and including an oscillatory lever and a reciprocatory lever; spring means providing a driving connection between said driven member and said reciprocatory member; rotatable pattern cam means carried by said sweep member and cooperable with said oscillatory lever to move the latter in one direction, said spring means acting to return said oscillatory lever in the opposite direction through the agency of said reciprocatory lever; and motor means having driving connection with said cam means and said crank means for respectively actuating the same.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,061,577	Whitney	May 13, 1913
2,310,085	Hooker	Feb. 2, 1943
2,562,648	Sparrow	July 31, 1951
2,572,146	Henry	Oct. 23, 1951