

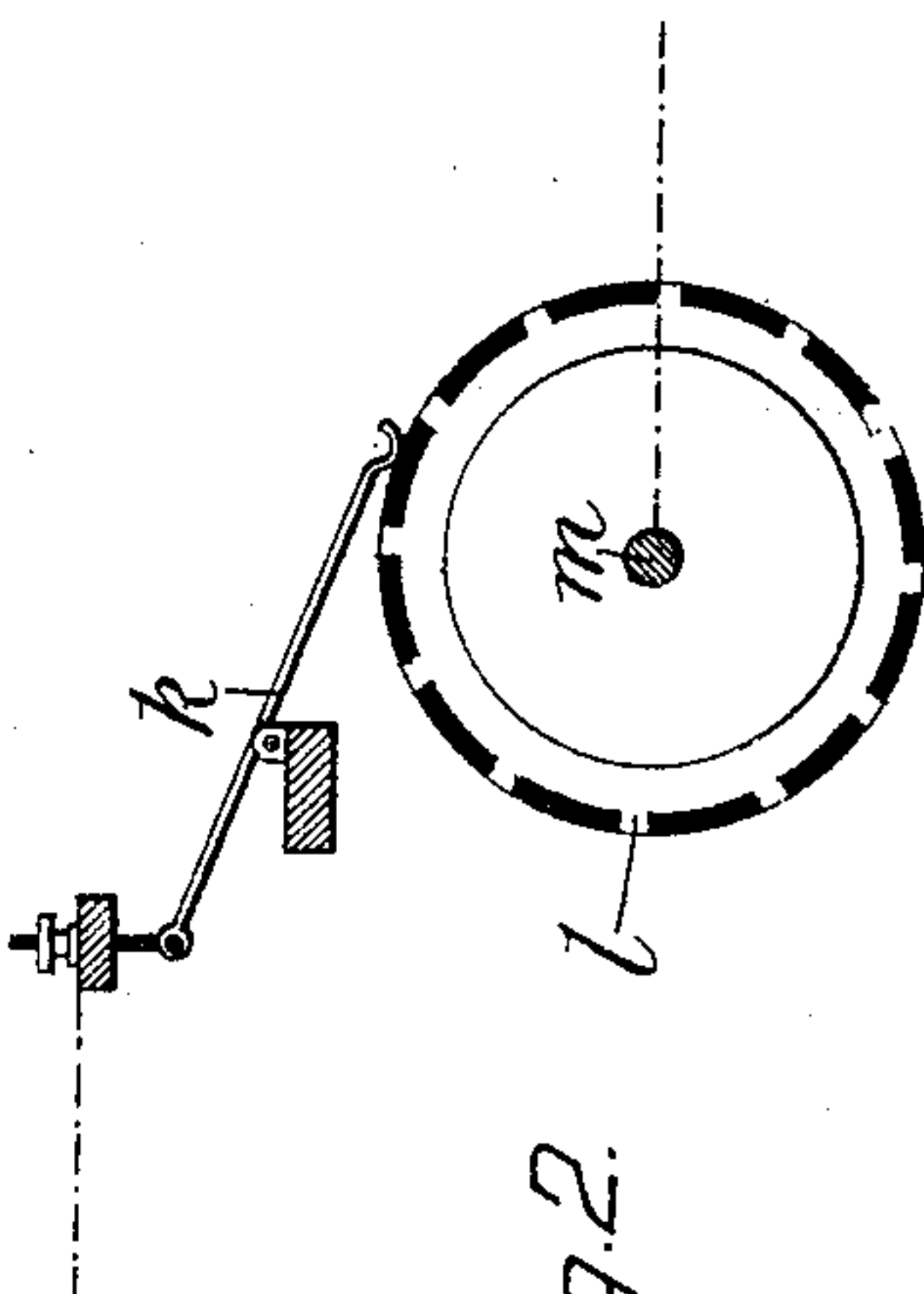
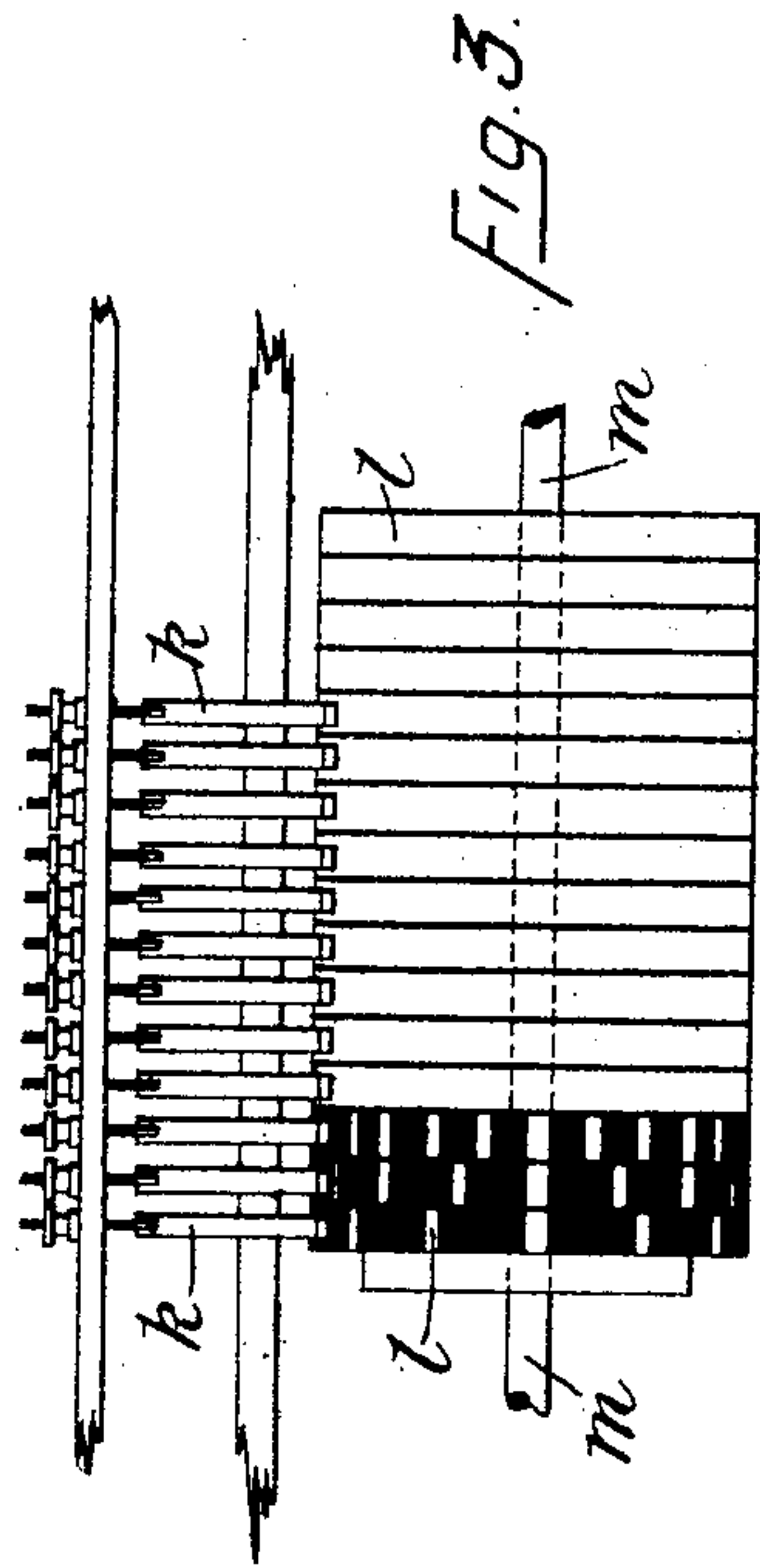
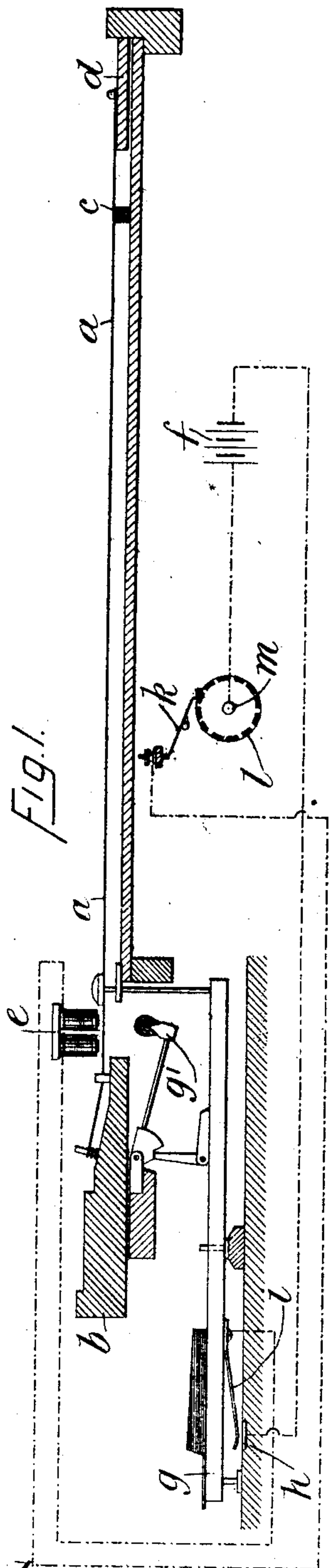
(No Model.)

3 Sheets—Sheet 1.

P. E. SINGER.
ELECTRICAL MUSICAL INSTRUMENT.

No. 501,540.

Patented July 18, 1893.



Attest:
Geo. H. Dotto.
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Inventor:
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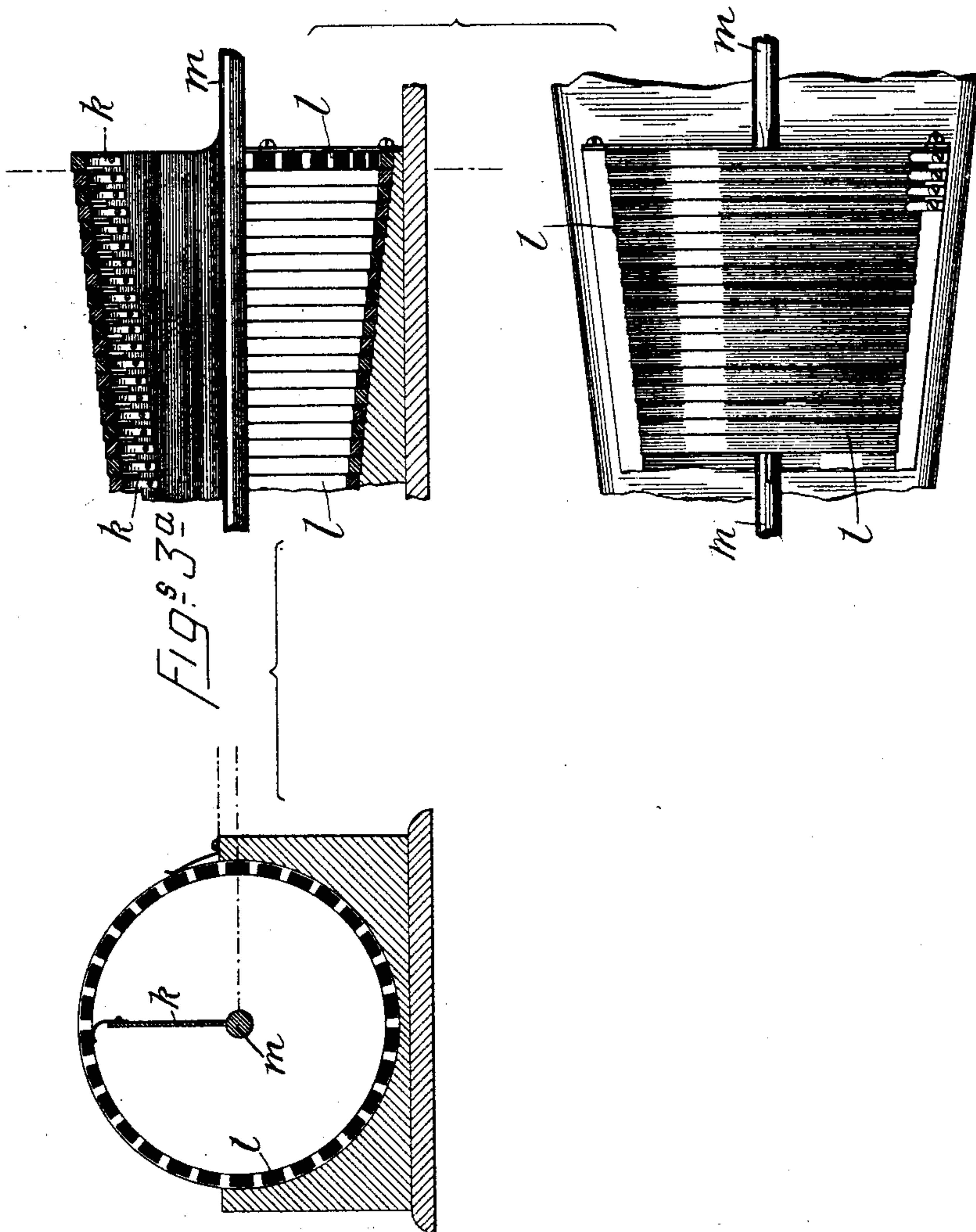
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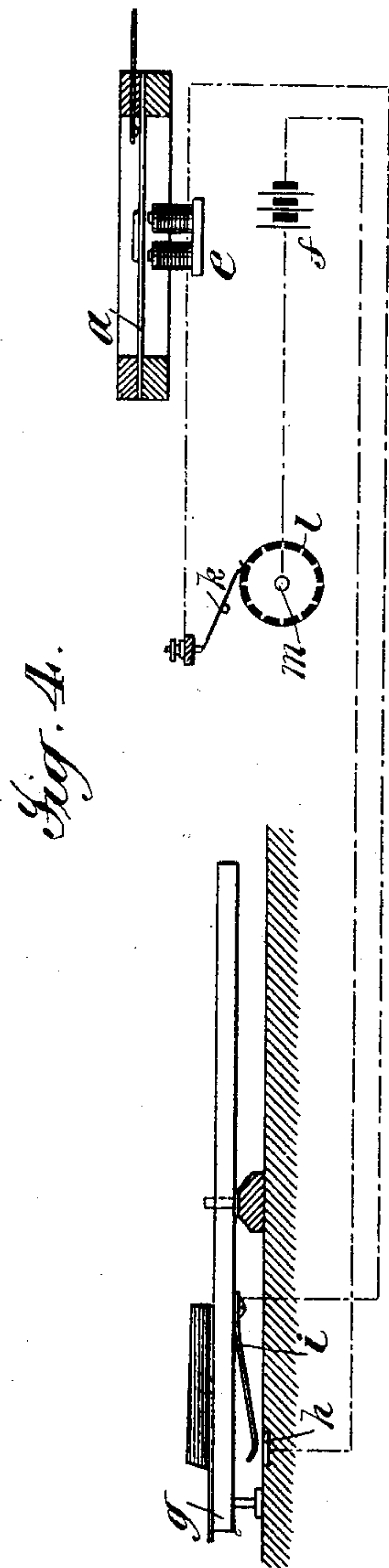
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UNITED STATES PATENT OFFICE.

PARIS E. SINGER, OF LONDON, ENGLAND.

ELECTRICAL MUSICAL INSTRUMENT.

SPECIFICATION forming part of Letters Patent No. 501,540, dated July 18, 1893.

Application filed June 16, 1892, Serial No. 436,907. (No model.)

To all whom it may concern:

Be it known that I, PARIS EUGENE SINGER, of 6 Victoria Road, Kensington, London, in the county of Middlesex, England, have invented certain new and useful Improvements in Musical Instruments Actuated by Electricity, of which the following is a specification.

The object of my invention is to produce a keyed musical instrument, which may be of the pianoforte type, and in which the notes produced by the vibrating bodies employed,—the strings, for example,—may be prolonged by the closing of electric circuits, and also initiated by this means, as well as by the ordinary hammer action. To obtain, and maintain, if desired, the sounds corresponding to the several keys of the instrument, I provide for each note in the scale, a peculiar construction of commutator, which, by breaking and making the electric circuit a given number of times per second, will vibrate, and maintain the vibrations of, the sounding string, or other body, so long as the key corresponding to the note sounded is held down by the player.

In the accompanying drawings,—Figure 1 explains the manner of adapting my invention to a grand pianoforte, the strings being capable of receiving impact from the ordinary hammers, if desired, or actuated solely by electro-magnets put into circuit by the depression of the playing keys, and maintained in vibration by the aid of commutators. Fig. 2 shows, on an enlarged scale, a disk commutator in side view, and Fig. 3 shows a group of such commutators mounted on their common shaft. Fig. 3^a shows a modification of the commutator. Fig. 4 shows the application of a sonorous disk to the production of a musical note. This disk, when not made of magnetic material, is fitted at its center with an iron or steel armature, which, like the string in Fig. 1, will be vibrated by the energized electro-magnet underlying the disk, to produce the sound.

In Fig. 1, *a* represents one of the ordinary steel pianoforte strings, attached, as usual, by a wrest pin to the wrest plank *b*, carried over a bridge *c*, and made fast to the metal plate *d*. Situate above the string, immediately over the part usually struck by the hammer, is an

electro-magnet *e*, pendent from a fixed transverse bar carried by the case.

Each note of the instrument is represented by a magnet *e*, and each magnet is separately connected with a battery *f*, or other source of electricity, in a manner to be presently explained.

g is the playing key, the depression of which is intended to put its magnet into circuit, and keep it excited by the current of the battery, or other source of electricity, so long as it is desired to sustain a note; and *g'* is the hammer, the use of which provides the player with the means for giving suitable expression to the music performed.

Underlying the whole row of keys, is a plate *h*, electrically connected with the battery. Each key is fitted, on its underside, with an electrically conducting spring *i*, connected by a wire to the coil of the electro-magnet which commands the string represented by the key. The other end of the coil of the magnet connects with a brush *k*, of which there is a series, one for each note of the instrument. These brushes severally bear upon a disk commutator *l*, which commutators correspond in number with the notes of the instrument, and are mounted upon one common spindle *m*, electrically connected with the battery. Rotary motion, the speed of which must be carefully regulated, is imparted to this spindle by clockwork or other suitable mechanism, and maintained while the instrument is in use. The commutator disks are so constructed that, say, for one rotation of their shaft, they shall break and make the circuit in which their respective magnets are included, at a rate corresponding to the number of pulsations required to be set up or maintained in their respective sounding strings.

With this preliminary description, my explanation of the action of the apparatus will be readily followed. Supposing the string to represent the note C, which will require, when sounded, to make two hundred and fifty-six vibrations per second, its electro-magnet, when energized, will attract the string toward its poles, and when the electric circuit is broken, it will recede by its own elasticity. Now, supposing the commutator *l* to be so ar-

ranged as to close the circuit two hundred and fifty-six times per second, the result will be a series of attractions of the string corresponding in number to the vibrations pertaining to the note sounded.

Fig. 2 shows, on an enlarged scale, a disk commutator in side view, and Fig. 3 shows a group of such commutators mounted on their common shaft. In place of mounting the commutator disks on a rotary spindle, and providing fixed brushes for making and breaking the circuits, I may use fixed rings and revolving brushes, arranged as shown at Fig. 3^a; the fixed rings carrying the metal contact pieces on their inner face, and the brushes revolving within the rings. The electric connection of these parts with the electro-magnets *e* and the source of electricity, will be the same as above described.

From what has gone before it will be understood that the rate of making and breaking the circuit for each note will vary, and consequently the construction of the commutators, for the respective notes of the instrument, will vary also, with the view of maintaining throughout the instrument, a proper relation between the vibration of the strings or sounding bodies, and the make and break of the current circulating round the respective magnets.

I wish here to observe, that the magnet *e* may, if desired, be made to give a number of impulses less than the absolute speed of vibration of the sounding body. So long as this speed is one half, one fourth, &c., of the absolute speed, the sounding body still gives its normal pitch, but with less intensity, but when the impulses vary in the ratio of, say, one third; one fifth, or one seventh, the sounding wire will give out a note a third, a fifth, or a

seventh of its fundamental,—always, however, with much less power than when the impulses synchronize with the sounding body.

In adapting my invention to other sounding bodies than strings, certain modifications will be requisite, and these I will now describe.

Fig. 4 shows a disk of sonorous material as applied to the production of a musical note. This disk, when not itself magnetic (as shown in the figure) is fitted at its center with an iron or steel armature, which, like the string in Fig. 1, will be vibrated by the energized electro-magnet underlying the disk, to produce the sound. This magnet is connected with a battery, or other source of electricity, through a commutator, as in Fig. 1. Provision, consisting of an adjustable pad, is made for "tuning" the disk, as indicated in the drawings.

Having now particularly described the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

In a keyed musical instrument in which electro-magnets are used to create or maintain the vibration of the strings or other sonorous bodies employed, rotary commutators, one for each note in the gamut, constructed and arranged to make and break the circuits of their respective electro-magnets at a rate synchronous with, or having musical relation to, the vibrations in the strings, or other bodies, requisite to produce and sustain the notes of the keys, when they are depressed, and are putting the magnets in connection with the source of electricity, as set forth.

PARIS E. SINGER.

Witnesses:

H. K. WHITE,

A. W. SPACKMAN.