A.D. 1876, 11*th* OCTOBER. N° 3924.

Apparatus for Synchronising Clocks.

LETTERS PATENT to John Alexander Lund, of the Firm of Barraud and Lunds, of 41, Cornhill, in the City of London, Manufacturers, for the Invention of "IMPROVED MEANS OR APPARATUS FOR SYNCHRONIZING CLOCKS OR OTHER TIMEKEEPERS, AND FOR TRANSMITTING SECONDS OR OTHER TIME, OR INTERMITTENT CURRENTS."

Sealed the 15th December 1876, and dated the 11th October 1876.

PROVISIONAL SPECIFICATION left by the said John Alexander Lund at the Office of the Commissioners of Patents on the 11th October 1876.

JOHN ALEXANDER LUND, of the Firm of Barraud and Lunds, of 41, Cornhill, in the City of London, Manufacturers. "IMPROVED MEANS OR APPARATUS FOR SYNCHRONIZING CLOCKS OR OTHER TIMEKEEPERS, AND FOR TRANSMITTING SECONDS OR OTHER TIME, OR INTERMITTENT CURRENTS."

The object of the first part of my Invention is to enable any number of clocks or other timekeepers in the same establishment or in different establishments to be automatically synchronized, whereby it becomes unnecessary to interfere with the pendulum or with the clock movement, or any other part of the timekeepers. This part of my Invention consists in setting or synchronizing the hands electrically. For this purpose I take any timekeeper which can be depended upon to keep correct time, and I connect this normal or primary timekeeper electrically in a manner well understood with all the other clocks or timekeepers to be synchronized.

The mode in which I prefer to carry out the Invention is as follows:—I fit each of these other clocks with an electro-magnet, the armature of which is carried by a weighted arm, the weight keeping the armature raised clear of the magnet. The end of this arm is forked, and the fork takes into slots in a pair of levers which carry pins passing through the dial at points equidistant from the zero point. The two points through which the pins pass are connected by a curved slot in the dial. At the expiration of every hour the electric circuit from the battery being completed by the movement of the normal clock the armature at each of the other clocks is attracted to its magnet, and the fork on the armature arm is thereby caused to act upon the pair of levers and draw them together, as well as the pins which pass

through the dial, these pins then meeting at zero on the dial. The result of this movement is that should the minute hand of the clock not be exactly at zero the pins act upon it, or upon a block thereon, and set it to zero; all the clocks connected electrically with the normal clock are thus synchronized every hour. When the electric circuit is broken the weight returns the parts to their normal position.

Another part of my Invention relates to means of transmitting seconds currents, or other time or intermittent currents from a normal or primary clock or timekeeper, and it enables me to use a known and unvarying resistance instead of the springs and other means hitherto employed for this purpose. I fix to either of the clock plates a wheel of ebonite or other insulating material concentric with the escapement wheel; I divide the periphery of this wheel into 120 equal parts when intended for second's currents, and in each alternate part I fix teeth or pieces of metal exactly fitting in between the other or ebonite parts. These metal pieces are all connected with a metal ring which in its turn is connected with one pole of the battery, the other pole of the battery being connected with the plates of the clock. Upon the arbor of the escapement pinion I fix a metal brush or metal rubber which as the pinion revolves travels over the periphery of the ebonite wheel; each time it comes in contact with one of the metal pieces, that is to say, every second, it makes electric contact and transmits the current, while each time it comes in contact with an ebonite piece the electric contact is broken.

Where the current is required to be alternately positive and negative I use two ebonite and metal wheels instead of one.

Where instead of second's currents it is required to transmit other time or intermittent currents at regular or varying intervals the arrangement of the ebonite and metal pieces in the wheel will be varied accordingly.

SPECIFICATION in pursuance of the conditions of the Letters Patent filed by the said John Alexander Lund in the Great Seal Patent Office on the 11th April 1877.

JOHN ALEXANDER LUND, of the Firm of Barraud and Lunds, of 41, Cornhill, in the City of London, Manufacturers. "IMPROVED MEANS OR APPARATUS FOR SYNCHRONIZING CLOCKS OR OTHER TIMEKEEPERS, AND FOR TRANSMITTING SECONDS OR OTHER TIME, OR INTERMITTENT CURRENTS."

The object of the first part of my Invention is to enable any number of clocks or other timekeepers in the same establishment or in different establishments to be automatically synchronized without interfering with the pendulum or with the clock movement, or any other part of the works of the timekeepers. This part of my Invention consists in setting or synchronizing the hands electrically. For this purpose I take any timekeeper which can be depended upon to keep correct time, and I connect this normal or primary timekeeper electrically in a manner well understood with all the other clocks or timekeepers to be synchronized.

One mode in which I carry out the Invention is as follows:—I fit each of these other clocks with an electro-magnet, the armature of which is carried by a weighted arm, the weight keeping the armature raised clear of the magnet. The end of this arm is forked, and the fork takes into slots in a pair of levers which carry pins passing through the dial at points equidistant from the zero point. The two points through which the pins pass are connected by a curved slot in the dial. At the expiration of every hour the electric circuit from the battery being completed by the movement of the normal clock the armature at each of the other clocks is attracted to its magnet, and the fork on the armature arm is thereby caused to act upon the pair of levers and draw them together, as well as the pins which pass through the dial, these pins then meeting at zero on the dial. The result of this movement is that should the minute hand of the clock not be exactly at zero the

pins act upon it, or upon a block thereon, and set it to zero; all the clocks connected electrically with the normal clock are thus synchronized every hour. When the electric circuit is broken the weight returns the parts to their normal position.

The manner just described of carrying my Invention into effect will be fully understood by Sheet 1 of the annexed Drawings.

Figure 1 is a front view; Figure 2, a transverse section; and Figure 3, a plan of the dial of a clock with my Invention applied thereto.

Figure 4 is a front view and Figure 5 a plan of the pair of levers herein-before described in their normal position.

Figure 6 is a front view and Figure 7 a side view of the same levers in the position they occupy when acted upon by the electric current.

a is the case and *b* the dial of the clock; *c* is the hour hand and *d* the minute hand; *e*, *e*, are a pair of electro-magnets connected by wires *f*, *f*, with the primary or normal clock in the manner well understood; *g* is the armature of the magnet *e*, it is carried by an arm *h* which is centred at *i* and carries a weight *j* which keeps it raised clear of the magnets; the front end of the arm *h* is forked, and the prongs *k*, *k*, of the fork take into slots *l*, *l*, in a pair of levers *m*, *m*, which are centred at *n*, *n*, and carry pins *o*, *o*. These pins pass through the dial at the two ends respectively of a slot *p*; *q* is a block at the back of the hand *d*.

The action is as follows:—At the expiration of every hour, the electric circuit from the battery being completed by the movement of the normal clock, the armature *g* is attracted by the magnets *e* overcoming the power of the weight *j*, and thereby giving a downward movement to the fork *k*. The fork *k* acting in its downward movement upon the levers *m*, *m*, moves them from the position seen in Figure 4 to that shewn in Figure 6, as well as in Figures 1, 2, and 3, so that the pins *o* are drawn together. Thus, if the minute hand *d* is not exactly at zero the pins acting upon the block *q* set it to zero; the electric circuit being then broken at the normal clock the weight *j* returns the parts to their normal position.

Figure 8 (Sheet 2) is a side elevation, and Figure 9 a plan of a modified arrangement. Here the armature *g* is hung on horizontal pivots or centres *i*, *i*, and carries a vertical fork or prongs *k*, *k*, which take into slots *l*, *l*, in the tails of the pins *o*, *o*. These pins are centred at *n*, *n*, and pass through a slot in the dial, as in the arrangement represented in Sheet 1; *j* is a spring connected to the armature *g*, so as to keep it clear of the magnets *e*, the pins *o*, *o*, being then in the position seen in full lines in Figure 9. But when at the expiration of every hour the circuit from the battery is completed by the movement of the normal clock the armature *g* is attracted by the magnets, and thus causes the prongs *k*, *k*, to move inwards; the prongs in this motion acting in the slots *l*, *l*, move the pins *o* into the position shewn in dotted lines, so that the hands of the clock to which the apparatus is connected are set to zero.

It will be readily understood that the mechanism, herein-before described, which connects the armature *g* with the pins *o* or analogous devices for acting upon the minute hand may be modified in various ways, but I have found the arrangements above described to answer well.

If it be desired to avoid making the slot *p* in the dial I use a false hand behind the dial on the same centre as and moving with the hand *d*. Instead of acting upon the hands every hour, as herein-before described, they may be acted upon at any other desired times; for instance, there may be another pair of the pins *o*, *o*, at the half hour of the dial worked from the same electro-magnet, and in this case the clock would be set or synchronized by a current sent every half hour.

Figures 10, 11, and 12, (Sheet 3), represent a modification of my Invention suitable for turret and other large clockwork, in which the setting of the hands would be effected, not immediately by the electric current itself, but by an intermediate weight discharged by the electric current; *a* represents a false minute hand at the back of the dial, or if more convenient the counterpoise of the minute hand may be used, or the hand on the set dial might with equal convenience be utilized if

suitably prolonged, in fact the said false hand a can be placed upon any such part of the clockwork as might most conveniently control the hand work; b is a lever substantially corresponding with the lever h, in Figures 2 and 3; c is substantially the same as one of the levers m, m, in Figures 2 to 7; d, d^1, are substantially the same as the pins o, o, in the levers m, m, in the Figures just mentioned; the pin d^1 is cut back as shown in the Drawing to its semi-diameter, in order that the hand a may proceed upon its way immediately after the discharge of the electric current; e is a weight affixed to the lever b. To this lever is fixed an arm j which carries the pin d^1, and in the said lever is a slot k in which works the other pin d on the lever c. The lever c is centred at the fixed point c^1; the weighted lever b and parts connected therewith can be raised by any convenient means, say, by the clock itself between five minutes past the hour and five minutes to the hour, supposing the electric current to be sent hourly; f is a flange rivetted to the under side of the false hand a, commencing level with the bottom of the hand, and terminating at such a point as would free the pin d in the arm c as the hand was coming round to the succeeding hour.

The action is as follows:—The lever rests at the hour upon the detent g ready to be discharged on the arrival of the electric current from the normal clock, which discharge may be effected by any well known method. Upon the arrival of the electric current the detent g being made to revolve slightly on its axis liberates the lever b, which is instantly caused by the weight e to descend to the stop h. This stop h must be so arranged that when the lever b is depressed and the weight resting upon its stop, the end of the hand a must be just safely free of the semi-diameter of the pin d^1.

In its passage the lever b carries down the lever c carrying the pin d, and also the other pin d^1 affixed to the arm j. Should the clock be, say, one minute or any portion of a minute slow, and therefore the hand a in the position represented for example at a^1, the pin d on the lever c will act upon the flange f on the false hand a, and in its passage force the hand a to its central or true time position. Should on the other hand the clock be one minute or any portion of a minute fast, and therefore the hand a in the position represented for example at a^2 the pin d^1 on the arm j acting upon the edge of the hand a will bring the said hand back to its central or true time position.

Another part of my Invention relates to means of transmitting seconds currents or other time or intermittent currents from a normal or primary clock or timekeeper, and it enables me to use a known and unvarying resistance instead of the springs and other means hitherto employed for this purpose. I fix to either of the clock plates a wheel of ebonite or other insulating material concentric with the escapement wheel; I divide the periphery of this wheel into 120 equal parts when intended for seconds currents, and in each alternate part I fix teeth or pieces of metal exactly fitting in between the other or ebonite parts. These metal pieces are all connected with a metal ring, which in its turn is connected with one pole of the battery, the other pole of the battery being connected with the plates of the clock. Upon the arbor of the escapement pinion I fix a metal brush or metal rubber, which as the pinion revolves travels over the periphery of the ebonite wheel. Each time it comes in contact with one of the metal pieces, that is to say, every second, it makes electric contact and transmits the current, while each time it comes in contact with an ebonite piece the electric contact is broken. When the current is required to be alternately positive and negative I use two ebonite and metal wheels instead of one and separate them by any suitable non-conducting substance such as ebonite or talc.

Where instead of seconds currents it is required to transmit other time or intermittent currents at regular or varying intervals, the arrangement of the ebonite and metal pieces in the wheel will be varied accordingly.

The means herein-before described of transmitting time currents will be fully understood on reference to Figures 13 and 14 (Sheet 2), which are respectively a front elevation and a side elevation partly in section; a is one of the clock plates;

b, the escapement wheel; *c*, the escapement pinion; and *d*, the arbor of the same; *e* is a wheel of ebonite or other insulating material fixed to the plate *a*, and concentric with the wheel *b*. The inner periphery of the wheel *e* is shewn divided into 60 equal parts, the number required for transmitting a current every alternate second. Every alternate part *x* of the periphery is of brass or other metal, while the other parts *y* are of ebonite. The metal parts *x* are all connected with a metal ring *f*, which in its turn is connected with one pole of the battery, the other pole being connected with the plates of the clock, as has already been stated; *g* is a metal brush on the arbor *d*, and travelling over the periphery of the wheel *e*. It will be readily understood that every time this brush comes in contact with one of the metal parts *x*, that is to say, every second or alternate second (or such intervals of seconds as may have been arranged for) it makes electric contact and transmits the current, while every time it comes in contact with one of the ebonite pieces *y* the electric contact is broken.

And having now described the nature of my said Invention, and in what manner the same is to be performed, I declare that I claim,—

First. Synchronizing clocks or other timekeepers by acting upon the minute hand at every hour or other stated time, substantially as herein-before described.

Second. Constructing or arranging mechanism, substantially as herein-before described and represented respectively in Figures 1 to 7, Figures 8 and 9, and Figures 10, 11, and 12 of the accompanying Drawings for acting upon the minute hands of clocks or other timekeepers for the purpose of synchronizing the same.

Third. The means or apparatus, substantially as herein-before described and represented in Figures 13 and 14 of the accompanying Drawings for transmitting seconds or other time or intermittent currents.

In witness whereof, I, the said John Alexander Lund have hereunto set my hand and seal, this Eleventh day of April, One thousand eight hundred and seventy-seven.

JOHN ALEX^{DER} LUND. (L.S.)

LONDON: Printed by George Edward Eyre and William Spottiswoode,
Printers to the Queen's most Excellent Majesty. 1877.

A.D. 1876, Oct. 11 N° 3824
LUND'S SPECIFICATION.

FIG. 1

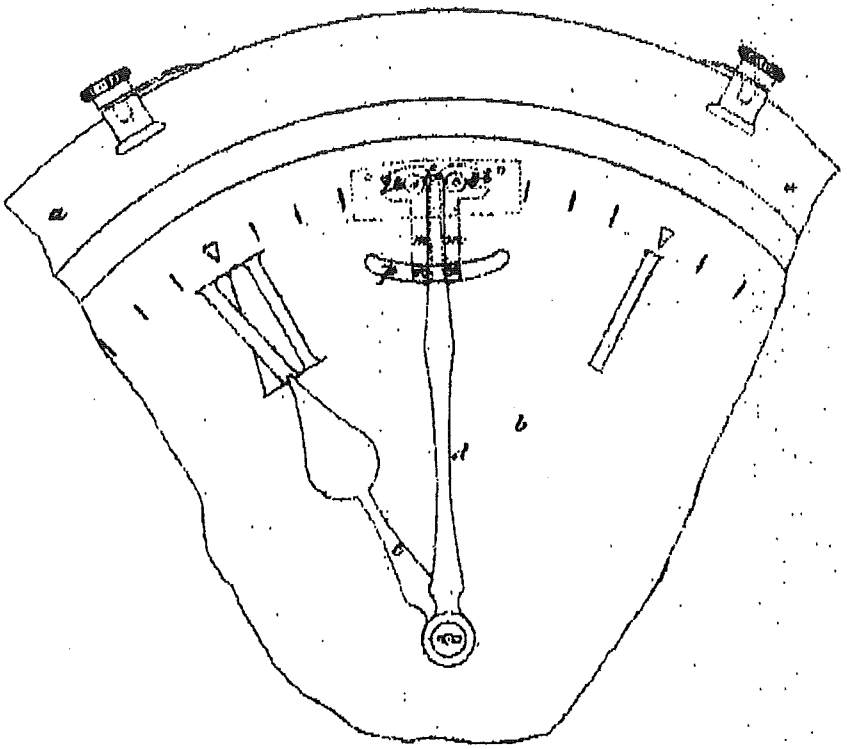

FIG. 3

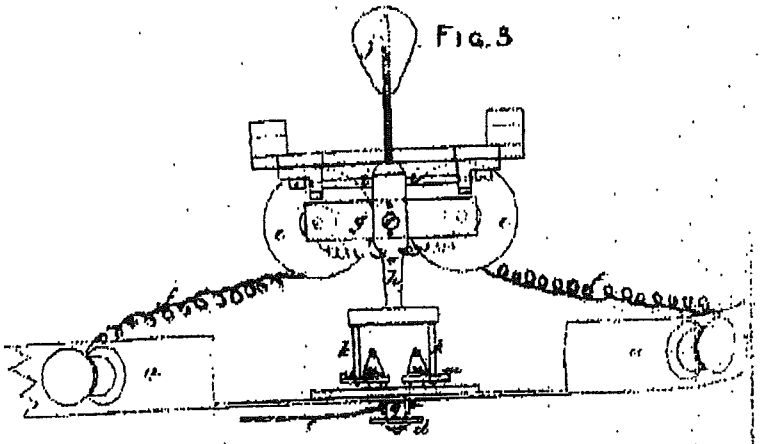

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Fig. 2

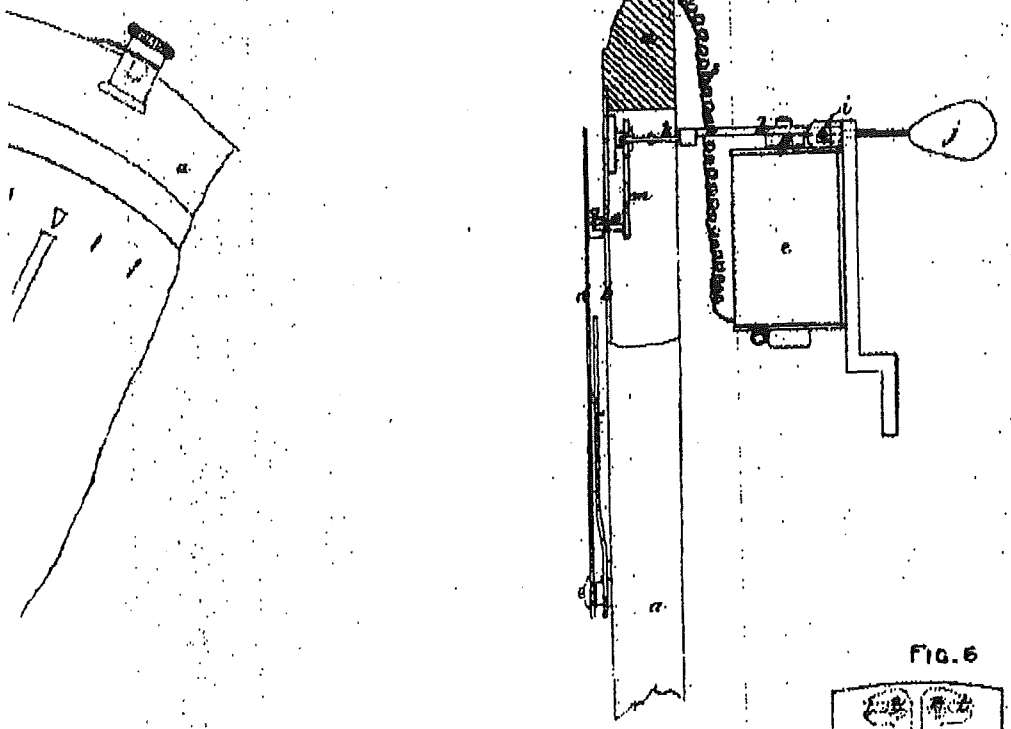


Fig. 6

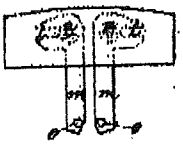
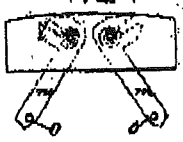
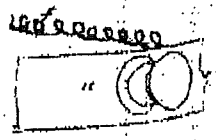


Fig. 7

Fig. 5

Fig. 4





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LUND'S SPECIFICATION.

(3 SHEETS)
SHEET 2.

FIG. 8

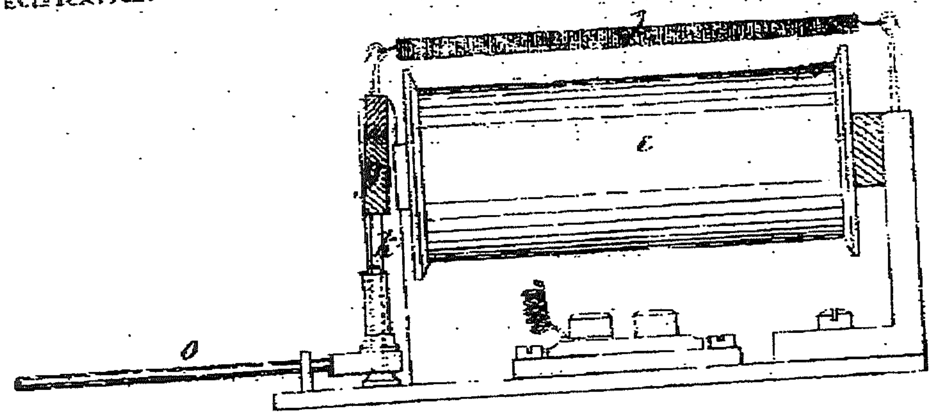
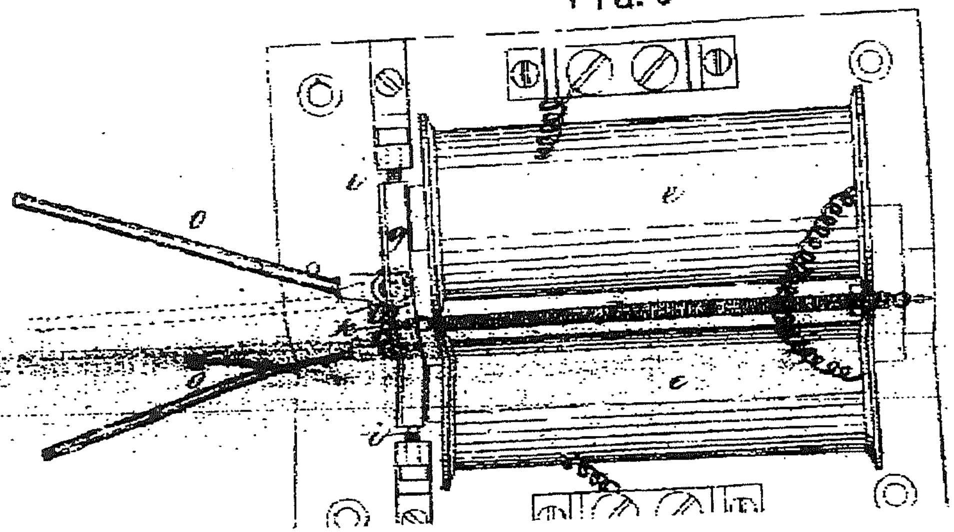


FIG. 9



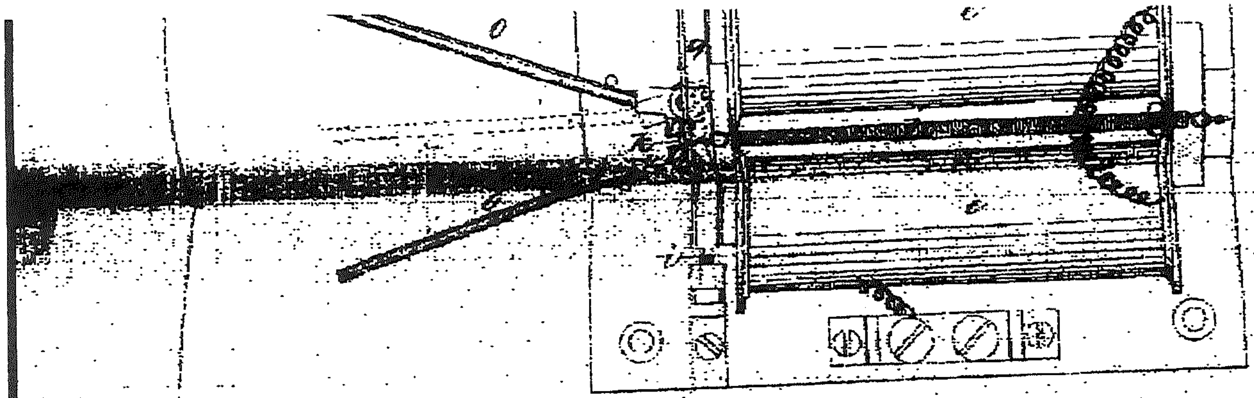


FIG. 13.

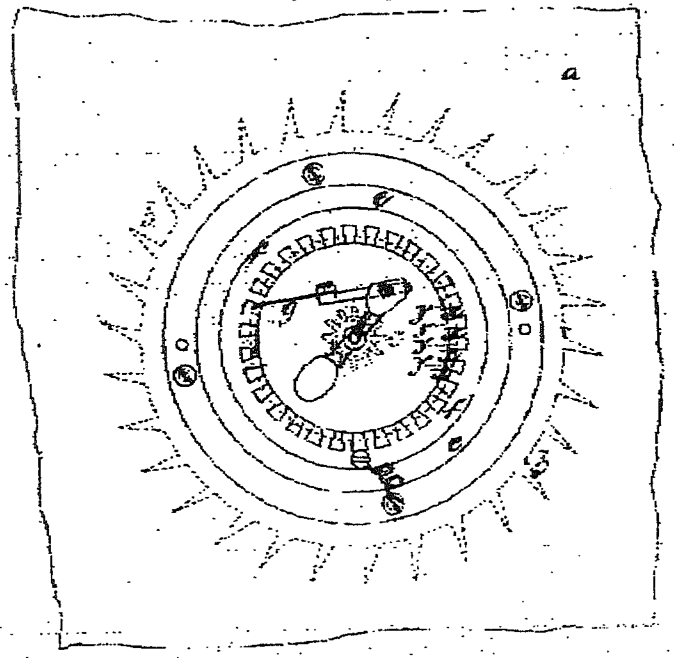
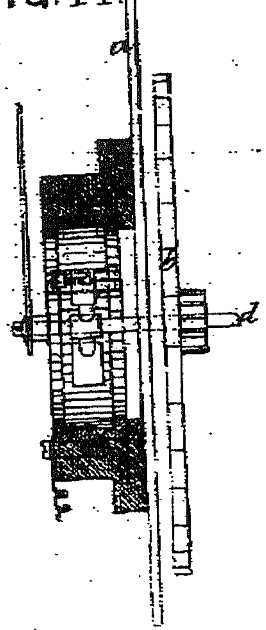


FIG. 14.



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A.D. 1876. Oct. 31. N° 3924.
LUND'S SPECIFICATION.

3 SHEETS
SHEET 3

FIG. 10.

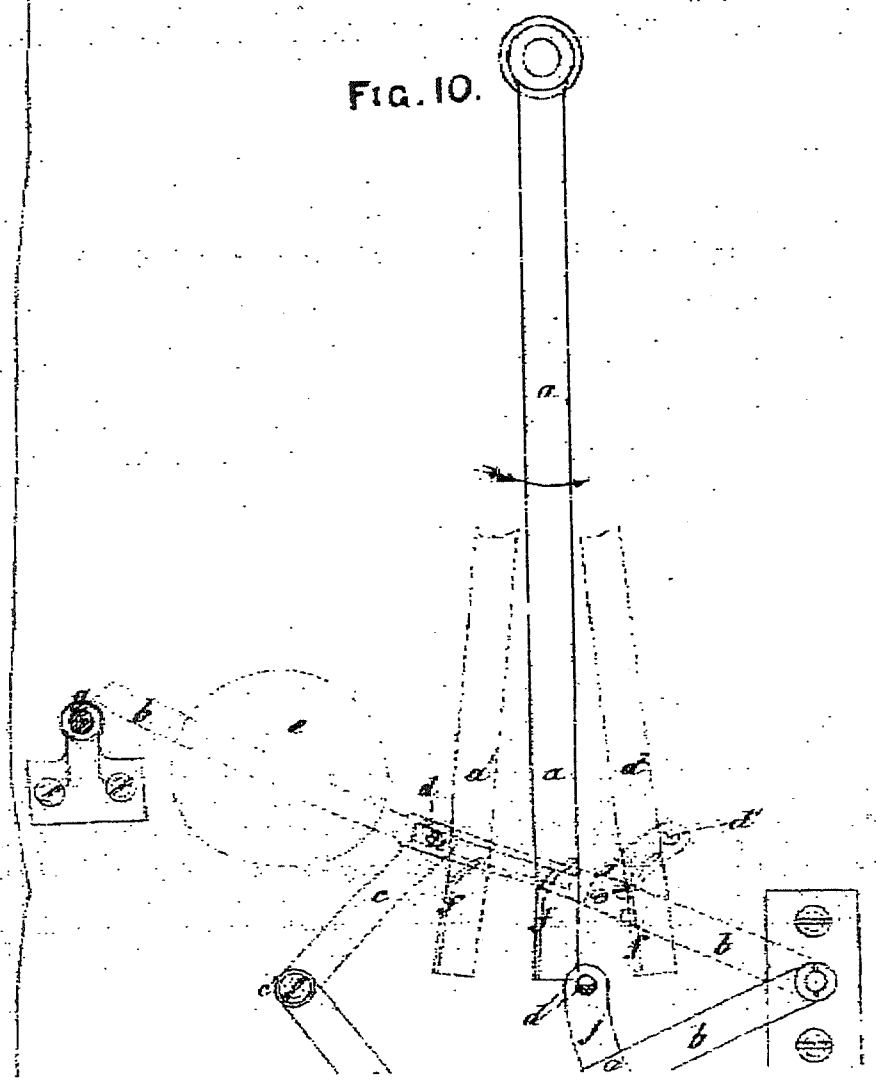
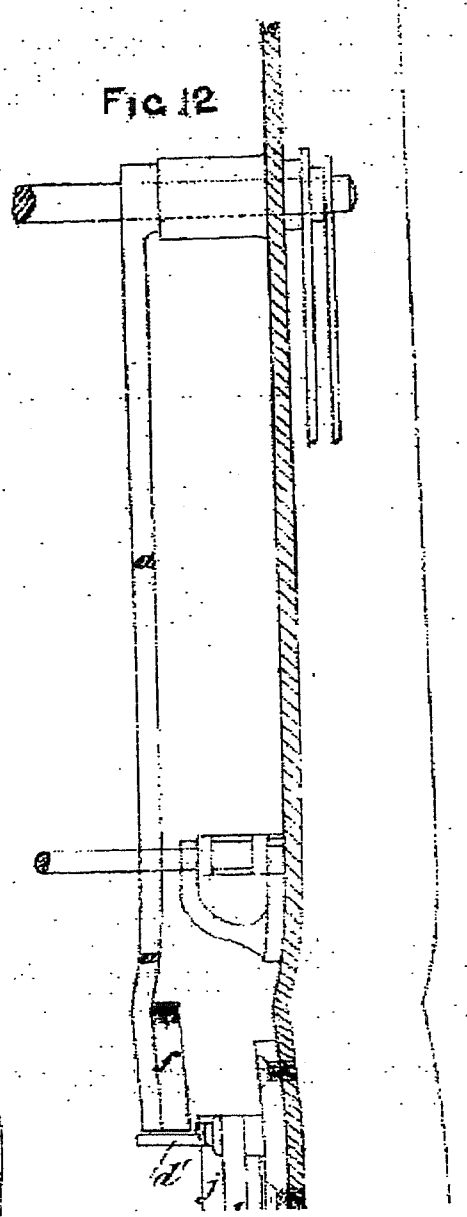


FIG. 12



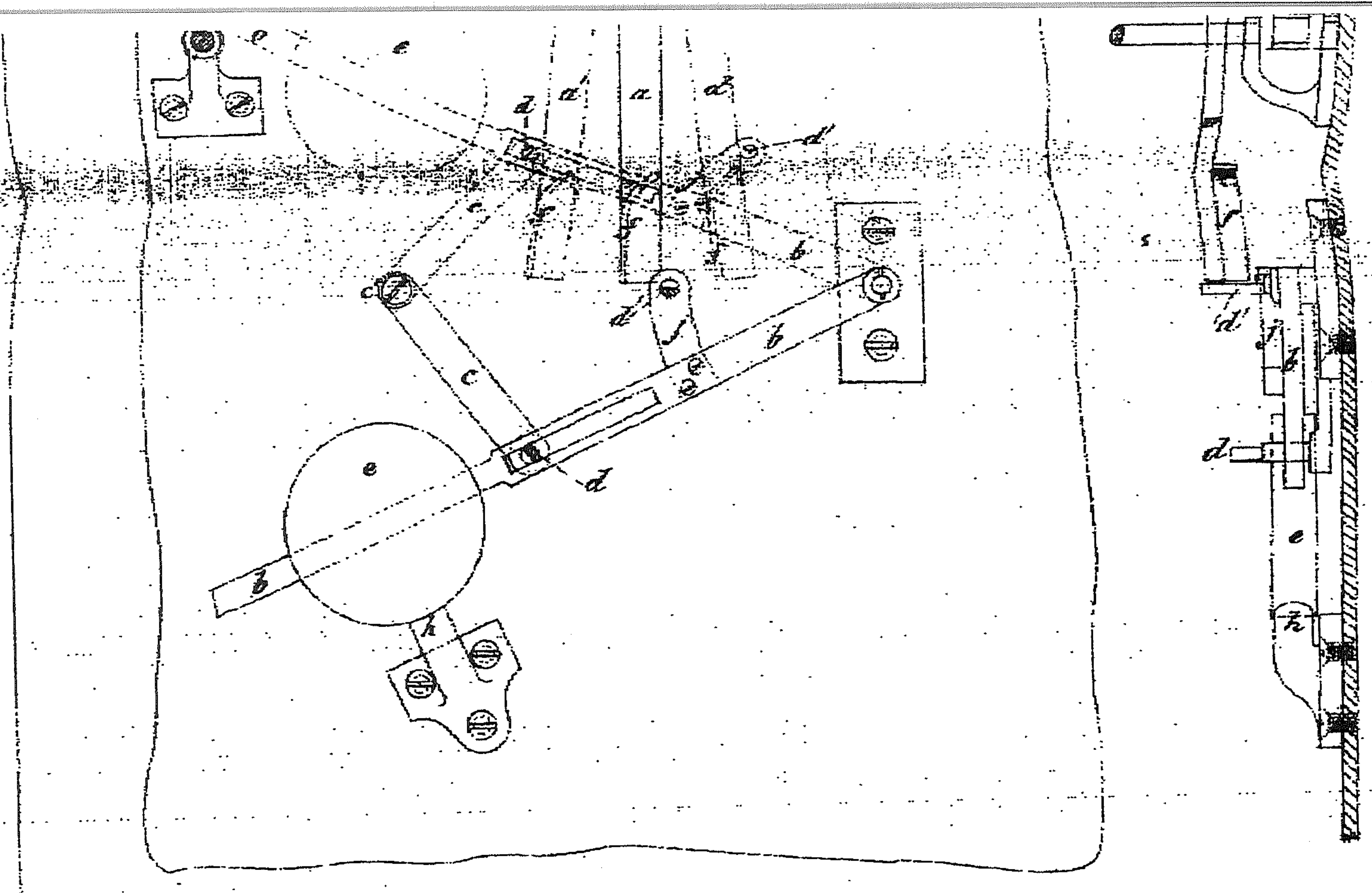
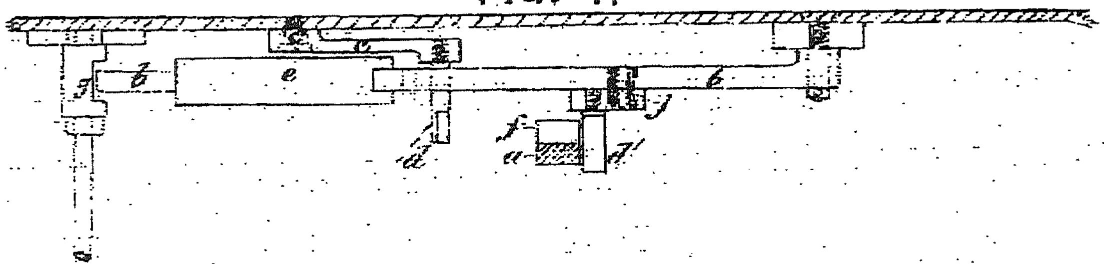


FIG. 11



The original drawing is not coloured.

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