No. 700,536. Patented May 20, 1902.

G. J. & D. C. MOORE.

APPARATUS FOR DEMONSTRATING THE PHENOMENA OF ELECTRICAL STORMS.

(Application filed Nov. 20, 1901.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

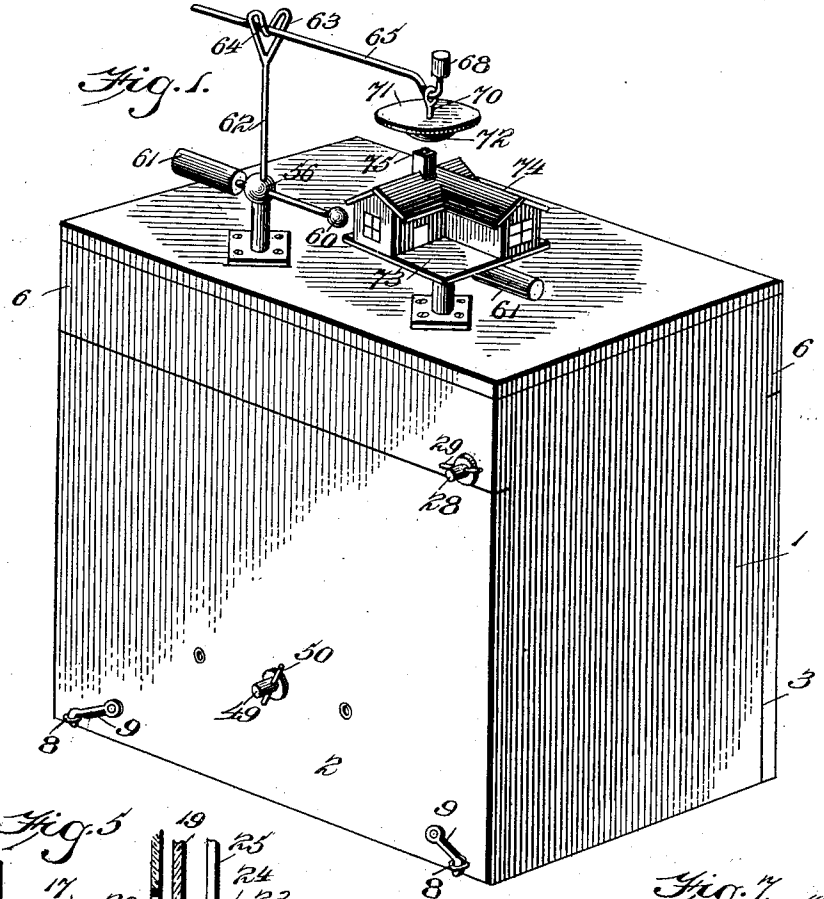


Fig. 5

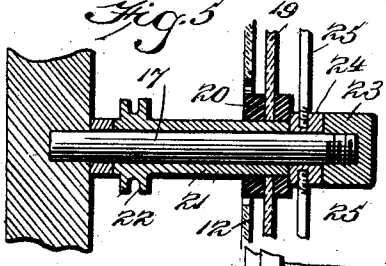


Fig. 6.

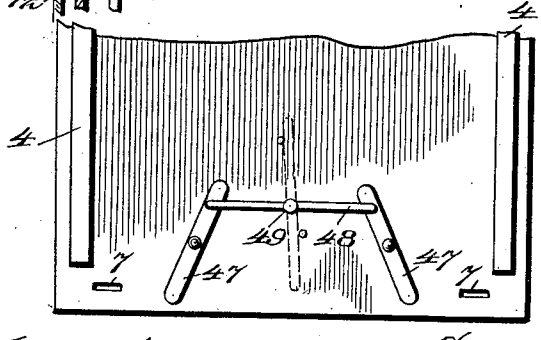
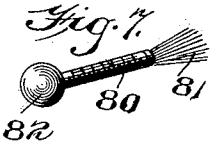


Fig. 7.



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(No Model.) 2 Sheets—Sheet 2.

Fig. 2.

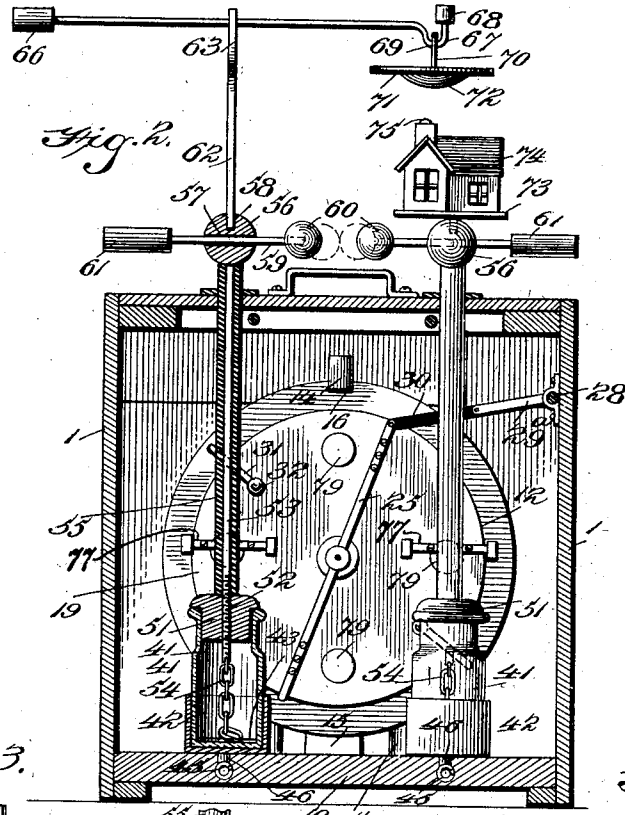


Fig. 3.

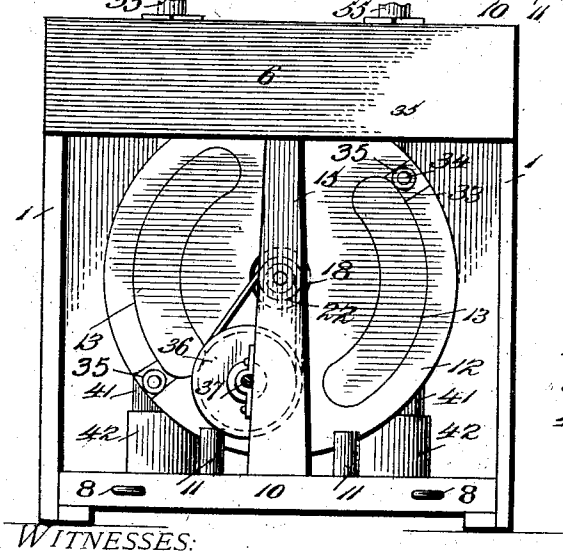
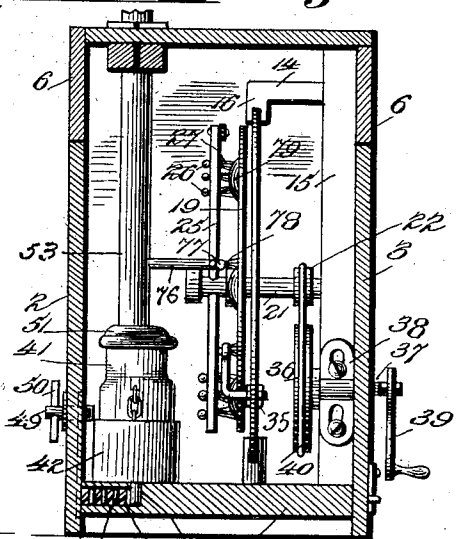


Fig. 4.



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APPARATUS FOR DEMONSTRATING THE PHENOMENA OF ELECTRICAL STORMS.

SPECIFICATION forming part of Letters Patent No. 700,536, dated May 20, 1902.

(Application filed November 20, 1901. Serial No. 83,048. (No model.)

To all whom it may concern:

Be it known that we, GEORGE J. MOORE and DAVID C. MOORE, citizens of the United States, residing at Graham, in the county of Nodaway and State of Missouri, have invented new and useful Improvements in Apparatus for Demonstrating the Phenomena of Electrical Storms, of which the following is a specification.

This invention relates to an apparatus for demonstrating the phenomena of electrical storms or the destructive tendencies of lightning to life and property; and the intent and purpose of the same is to provide a compact apparatus which is mainly inclosed and provided with controlling devices, whereby a direct or induced current may be set up or be caused to proceed from accumulators or storage devices and fed with electricity frictionally generated by a static mechanism, the latter being protected from the generating influences of moisture and also capable of operation when desired without depending upon a supply through a feeder from a source of electrical generation at a distance from the improved apparatus.

The invention consists in the construction and arrangement of the several parts, which will be more fully hereinafter described and claimed.

In the drawings, Figure 1 is a perspective view of the improved apparatus arranged for demonstrating the effect of lightning or a representation of lightning on a miniature house supported by a part of the apparatus. Fig. 2 is a longitudinal vertical section of the apparatus, showing part of the interior organization in elevation. Fig. 3 is a rear elevation of the casing and apparatus, the casing being shown partially open. Fig. 4 is a transverse vertical section through the apparatus, the exterior upper part of the latter being broken away. Fig. 5 is an enlarged longitudinal sectional view through the shaft mechanism for the plates of the apparatus. Fig. 6 is an elevation of the lower portion of one of the closures for the casing of the apparatus, showing the circuit-breaker located on the inner side of said closure. Fig. 7 is a detail perspective view of one of the brushes.

Similar numerals of reference are employed to indicate corresponding parts in the several views.

The reference-numeral 1 designates a casing or box for holding the apparatus and preferably constructed of some non-conducting material, such as wood. The casing or box is normally completely closed on all sides and at the top and bottom, and the front and rear sides have removable closures 2 and 3, which are formed by cutting out a portion of the said sides of the box. Each of the closures has cleats 4 secured to the inner side thereof and projecting above the upper end of the same to catch or bear against the inner surface of the upper stationary strips 6 of the front and rear sides of the casing or box, and at the bottom each closure also has horizontally-disposed slots 7 for the passage therethrough of staples 8, secured to the lower portion of the casing, the said staples being adapted for engagement by locking-hooks 9 to hold each closure in immovable applied position. The closures are made removable to render the mechanism, or that portion of the apparatus within the casing or box, easily accessible for the purpose of adjustment or repair. Rising from the bottom 10 of the casing or box are insulating-posts 11, having their upper extremities secured to a vertically-disposed glass plate 12 of circular form and serving as an induction-plate. On the rear side of the plate 12, as clearly shown by Fig. 3, are segmental accumulators 13 of tinfoil for obvious reasons, and to hold the plate 13 steady or in immovable or erect position an arm 14 projects forwardly in a horizontal plane from the upper portion of a rear interiorly-located upright 15, the said arm having a depending post 16 at its front extremity, which engages the said plate. Extending forwardly in a horizontal plane from the upright 15 is a stationary shaft 17, which is projected through an enlarged opening 18 in the center of the plate 12, and in front of the latter a second glass plate 19 is arranged and secured to the sleeve 21 for rotation in front of the plate 12, it being understood that the two plates are spaced apart from each other a suitable distance, as will be readily appreciated by those acquainted with static electrical machines. The upright 15 is formed of

wood, and therefore serves as a non-conductor, and where the plate 19 is secured to the sleeve an insulating-collar 20 is interposed and mounted on the sleeve 21, having a rear cord or analogous pulley 22, the collar 20 extending through the opening 18, so as to thoroughly insulate the plate 12. The rear end of the shaft 17 is embedded in the upright 15, and the forward end is screw-threaded to receive an insulating-cap 23, a collar 24 being interposed between the cap 23 and the front end of the sleeve 21 and having a rod or rods 25 secured thereto at diametrically opposite points and carrying equalizing-combs 26 with intermediate brushes 27, the said equalizing-combs when brought opposite to the accumulators 13 on the back of the plate 12 causing the machine to have greater freedom in generation. The equalizing-combs are adjusted through the medium of a crank-rod 28, secured to the upper inner portion of one end of the casing or box and projected rearwardly through the strip 6 above the removable closure 2, as clearly shown in Fig. 1, and supplied with a cross-pin or analogous device 29, by which the said crank-rod may be exteriorly operated. Projecting inwardly from the crank-rod 28 is a crank-arm 29^a, which is movably attached to a non-conducting or hard-rubber link 30, also attached to the upper extremity of the uppermost rod 25. When the cross-pin 29 is disposed vertically, the equalizing-combs, carried by the rods 25, will be brought opposite to the accumulators 13 on the back of the plate 12, and when said cross-pin is disposed horizontally the said combs will be thrown away from positions opposite the said accumulators, and hence the generation of frictional electricity in the machine may be controlled in a very simple and effective manner. The plate 19 is less in diameter than the plate 12, and hence the peripheral portion of said latter plate projects beyond the circumferential edge of the former plate, and extending rearwardly from the rear plate 12 and over the front plate 19 are angular brush-arms 31, carrying brushes 32 at their inner free ends, which are held in operative proximity to the said front plate. These arms connect with tin-foil conductors 33, leading from the reverse terminals of the opposite accumulators 13 on the plate 12, and are held by insulating-caps 34 and collars 35 and respectively bearing against the conductors 33 and the front side of the plate 12. These arms 31 and brushes 32 operate as transferrers or conveyers from the rear plate to the forward plate and also as means for exciting the front plate and causing electrical generation. The sleeve 21 is operated through the medium of a pulley 36 on an operating-shaft 37, held on the upright 15 below the plane of said shaft 17 and mounted in an adjustable bearing 38, the said shaft having an end projecting rearwardly through the closure 3 and formed with an angular terminal for the reception of a crank-handle 39. The pulley 36 is of insulating material and engaged by a cord or analogous belt 40, which also surrounds the pulley 22, the adjustable bearing 38 being employed to control the tension of the belt.

In the front portion of the casing or box in advance of the plates 19 and 12 are a pair of Leyden jars 41, spaced apart from each other and having, as usual, outer metallic coverings 42 and inner metallic contacts or linings 43. These jars are held in stationary position, and connecting with the lower metallic coverings 42 are springs 44, located in bores 45 in the front edge of the bottom 10 of the casing or box, the front terminals of the said springs being normally projected beyond or in advance of the plane of the said edge. The rear terminals of the springs 44 have bearing against metallic leads 46, depending from the metallic coverings 42 of the Leyden jars. On the inner side of the lower portion of the closure 2 are a pair of spaced contact-strips 47, which are maintained in fixed position and diverge toward the lower edge of the said closure, the lower ends of the strips 47 reliably contacting with the outer extremities of the springs 44 when the closure 2 is applied to the casing or box 1. The upper extremities of the strips 47 are adapted to be connected by a switch-bar 48, having a central stud or post 49 extending through the adjacent portion of the closure 2 and supplied with a cross-pin 50 for convenience in operating the said stud or post. These strips 47 and switch-bar 48 constitute a circuit-breaker, and the function of the same is to incidentally change the current of the apparatus from a direct to an induced current or to couple up the two jars shown. The jars 41 have upper non-conducting closures 51, which are tightly held therein and have central screw-threaded bores 52, in which the lower screw-threaded extremities of vertically-disposed rods 53 are inserted, the rods having portions of the lower extremities thereof depending below the closures 51 and extend fully through the top of the casing or box. To the lower projecting face of the rods conducting-chains 54 or like devices are attached and depend downwardly to and loosely contact with the inner linings 43 of the jars. The rods 53 are surrounded by hard-rubber or other insulating-tubes 55, which also extend upwardly through the top of the casing or box, and on the upper end of these tubes and attached to the rods 53 are conducting or transmitting spherical heads 56, having horizontal bores 57 and vertical sockets 58. Within the bores 57 are sliding electrodes 59 in the form of metallic rods of suitable stiffness, having inner opposing spherical terminals 60 and outer grips 61, of suitable insulating material. The rods 59 are freely slidable in the bores 57 to bring the terminals 60 into adjacency in relation to each other or to support the same any distance desired, and in view of the screw-threaded extremities of the rods 53 the latter rods may

be turned so as to swing the terminals 60 in horizontal planes to bring the said terminals close together or separate them, as may be desired, the rods being loose in the tubes 55 for this purpose. This capability of adjustment of the rods 53 may also frequently serve as convenient means for raising the rods in the tubes and breaking the contact of the connecting devices therefor with the interior linings of the Leyden jars, and by this means the apparatus can be arranged with safety for storage or when not in use without liability of serious results when tampered with by those unacquainted with the function of the machine or the possible shock that might result seriously to those in ignorance of the strength of the apparatus.

The apparatus which is thus far described is complete in itself as a frictional generating and transmitting medium and will serve in many useful capacities, and at times it may be desired to use the improved apparatus as thus far explained independently of any other attachments. As previously stated, however, the apparatus has been devised for demonstrating the phenomena of lightning and the destructive influences of the same, and for this purpose conventional means or attachments are supplied to represent a house or other structure and a cloud. This means comprises a wire upright 62, having an upper forked head 63, with frictional gripping-jaws 64, that serve as a fulcrum for a horizontally-disposed balance-rod 65, supplied with an outer weighted end 66 and an inner hooked extremity 67, with a smaller upstanding counterpoise-weight 68. The hook 67 is engaged by an eye 69 in the upper end of a hanger 70, secured to the center of a metallic disk 71, having a depending bulbous extension 72, the said disk conventionally representing a cloud. The upright 62 is removably fitted in the socket 58 of one of the heads 56, and the parts are so arranged that the disk 71 will extend over to a point approximately above the other head 56, and on this head is arranged a metal plate 73, on which is disposed a house or other structure 74 in diminutive, having at some point at the upper portion thereof a conductor 75.

Metallic arms 76 extend rearwardly from the rods 53 above the plane of the tops of the Leyden jars and have cross-heads 77, with brushes 78 held thereby and in operative proximity to the plate 19, so as to gather the current and permit it to enter the jars to charge the latter from the said plate. At regular intervals the plate 19 is provided with bulbous or convex contacts 79, disposed in circular alinement and adapted to be engaged by all the brushes, the said contacts being of metal and serving as concentrators from which the current or the electricity generated is translated to the jars 41.

All the brushes will be constructed similarly to that shown by Fig. 7 and comprise a screw-shank 80, with metallic strands 81 to contact with the plate 19, the end of each brush also having a spherical head 82, by means of which the screw-shank may be adjusted in its bearing to regulate the pressure of the strands 81 against the plate 19, and thereby compensate for wear as well as permit the establishment of the necessary proximity of the strands 81 in relation to the plate 19.

In the operation of the device the plate 19 is rapidly revolved through the medium of the actuation of the crank-handle 39 and the intermediate operating mechanism between said handle and the plate. This rotation of the plate generates frictional electricity, as will be understood, and from said plate electricity is translated to the Leyden jars 41, the casing or box 1 being disposed in such relation that the operator may readily adjust the switch-bar 48, as well as the equalizing-combs, when necessary. During the charging operation the adjustable electrodes carried in the heads 56 have their terminals turned away from each other, and the balance-rod 65 is not adjusted in position until after the jars are charged sufficiently to display the electrical phenomena that is proposed to be exhibited by the use of the disk 71 and the diminutive house or the like of the metal plate 73. It will be seen that the current may be used direct from the jars by adjusting the balance-rod 65 and its disk 71 over the house, as shown by Fig. 2, the house becoming charged from one jar and the disk 71 from the other jar. When the disk 71 is swung around over the contact or conducting device 75, the current jumping from one part to the other will produce a streak of light simulating lightning and illustrate the action of lightning in striking a house or the like. By throwing the switch-bar 48 into engagement with the strips 47 an induced current will be set up with a similar result in the electrical display in a slightly-varied manner. Instead of the house any other object may be substituted, and the disk 71 may be formed to represent a cloud. As before stated, the apparatus may be discharged through the medium of the terminals 60 of the sliding electrodes by bringing said terminals in such proximity as to form an arc.

The inclosure of the apparatus in the casing or box 1 will prevent moisture affecting the plates, and thereby always maintain the said plates in condition for generative operation, and, moreover, the use of the plate 12 with the appurtenances or attachments thereon, as specified, will greatly aid in the generation of electricity.

The apparatus may be increased or decreased in proportions and general dimensions; but for ordinary demonstrating purposes it will be of such size and weight that it can be easily transported from one place to another.

Having thus fully described the invention, what is claimed as new is—

1. In an apparatus of the class set forth, the

combination of frictional electrical generating devices, Leyden jars provided with upwardly-extending adjustable insulated rods and having contact devices engaging the inner linings thereof, translating attachments between the rods and the frictional generating devices, a disk held in suspended relation to one of the said rods, and an object supported by the other rod under the said disk.

2. In an apparatus of the class set forth, the combination of electrical generating means, accumulators having translating devices therefor in operative proximity to portions of said generating means, contacting devices extending upwardly from said accumulators, a casing inclosing the apparatus and having a removable slide with contact-strips thereon, a switch-bar for connecting said contact-strips and operative from the exterior of the casing, resilient conductors in the bottom of the casing having the opposite terminals respectively in contact with said strips and with devices extending downwardly from the bottom portions of the accumulators, a disk held in suspended relation to one of the accumulators, and an object supported by a portion of the other accumulator and located under the disk.

3. In an apparatus of the class set forth, the combination of static electrical generating devices, one part of which has accumulators thereon, exteriorly-adjustable equalizing-combs, Leyden jars having translating devices in operative proximity to the generating devices, a disk adjustably supported by a portion of one of the Leyden jars, and an object adjustably supported by the other Leyden jar under said disk.

4. In an apparatus of the class set forth, the combination of static electrical generating devices, Leyden jars having translating attachments in operative proximity to the said generating devices, conductors adjustably extending upwardly from the Leyden jar and having upper terminal heads, electrodes slidable through and rotatable with the said heads, a disk suspended by one head, and an object held by the opposite head under the disk.

5. In an apparatus of the class set forth, the combination of static electrical generating devices, a pair of Leyden jars having translating devices in operative proximity to said generating devices, insulating-tubes extending upwardly from the top portions of the said jars, conducting-rods adjustable in the said tubes and having heads at their upper ends, the said rods being rotatable, electrodes horizontally disposed and slidably mounted in the said heads, and devices supported by the said heads in such relation that an electrical spark will be caused to pass from one to the other.

6. In an apparatus of the class set forth, the combination with static electrical generating and storage devices, of members projecting upwardly from the said storage devices, an upright held by one of said members, a weighted balance-rod suspended in the upper portion of said upright, a disk held by one end of the balance-rod, a metal plate mounted on the other member, and an object disposed on the metal plate under the said disk and having a conductor in the upper portion thereof.

In testimony whereof we affix our signatures in presence of two witnesses.

GEORGE J. MOORE.
DAVID C. MOORE.

Witnesses:
J. M. WILSON,
WM. T. BLACK.