A. D. CRANE.

Clock.

No. 1,973. Patented Feb. 10, 1841.

Fig. 1.

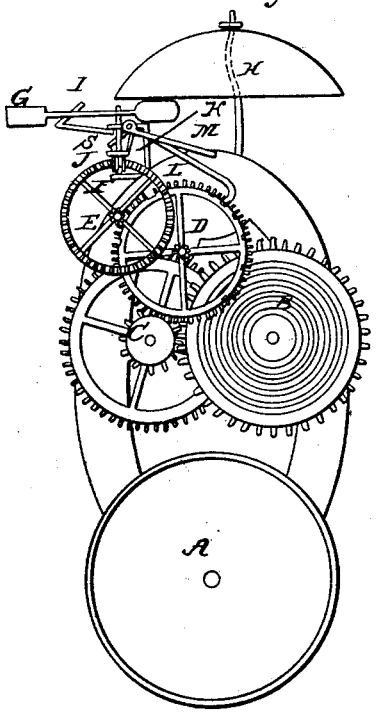


Fig. 2.

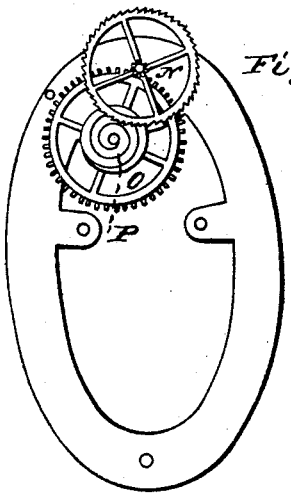
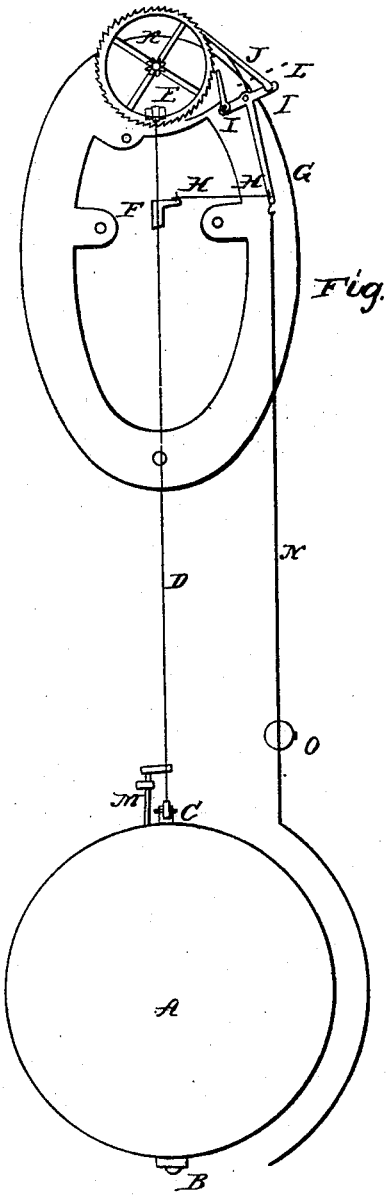


Fig. 3.



Witnesses:

Alfred J. Speer

Jonathan Peskett

Inventor:

Aaron. D. Crane

UNITED STATES PATENT OFFICE.

AARON D. CRANE, OF NEWARK, NEW JERSEY.

METHOD OF CONSTRUCTING CLOCKS.

Specification of Letters Patent No. 1,973, dated February 10, 1841; Antedated December 22, 1840.

To all whom it may concern:

Be it known that I, AARON D. CRANE, of the city of Newark, in the county of Essex and State of New Jersey, have invented new and useful Improvements in Clocks or Timepieces, which is described as follows, reference being had to the annexed drawing of the same, making a part of this specification.

Figure 1 is a plan of the striking part giving an inside view of the back plate, the time part being excluded and represented in Figs. 2 and 3.

The spring barrel A, Fig. 1, is calculated to contain a spring of about seven and a half feet long giving the barrel about nine turns which by means of a cord drives the fusee B, giving it twenty-eight turns, on the same arbor with the fusee is a wheel of thirty-six teeth driving pinion C of twelve leaves giving it eighty-four turns; on the same arbor with pinion C is a wheel of seventy-two teeth, driving pinion D of eight leaves, giving it seven hundred and fifty-six turns; on the same arbor with pinion D, is the count wheel of seventy-eight teeth (twelve being cut deeper than the others to give the proper number of strokes to the hour) driving pinion E of eight leaves, giving it seven thousand three hundred and seventy-one turns, on the same arbor with pinion E, is a contrate wheel of forty-eight teeth, driving the upright arbor and pinion F of six leaves giving it fifty-eight thousand nine hundred and sixty-eight turns, at the upper end of the upright arbor and revolving with it is the hammer G, striking the bell H, once each revolution or turn of the arbor, making fifty-eight thousand nine hundred and sixty-eight turns, or strokes of the hammer, which is two thousand and twenty-eight strokes more than is required in a year. The hammer moves around horizontally until within about half an inch of the bell, when it is thrown up against the bell by passing over the inclined plane I. Immediately after striking it rebounds a little and falls to its former horizontal position passing under the bell. The arm of the hammer is fastened to the arbor by a pin, and working on it in the manner of a joint allowing it to raise no higher than to strike the bell; at the end of the arm opposite the hammer, and so much nearer the axis of its motion as not to strike the inclined plane, is attached a weight nearly counterbalancing the hammer. On the upright arbor above the pinion F, is a small wheel J, with a notch on one side, into which the detent K, drops and locks the striking, whenever the discharging lifter L enters into the deep cut teeth of the count wheel. The detent K and discharging lifter L being connected near their axis. The lifting arm M is raised as is usual in clocks by a pin in one of the dial wheels, and has attached to it a pin which raises the discharging arm and detent. Attached to the lifting arm M near its axis is a small arm S acting as a detainer after the unlocking of the detent, and until the lifting arm falls from the pin in the dial wheels.

Fig. 2 is a plan of the wheel works of the time part giving an inside view of the back plate. The swing wheel N has sixty teeth and revolves once an hour, which carries the minute hand and dial wheels (they being as is generally used in clocks); on its arbor is a pinion of seven leaves, driven by wheel O of eighty-four teeth revolving once in twelve hours, having a socket for its center, to which socket is fastened a small spring barrel P. This wheel and barrel revolve and work on the arbor of the count wheel and pinion D of the striking part Fig. 1, and is driven by a spring being coiled in it as represented in barrel P, one end of which is fastened to the arbor of the aforesaid count wheel the other end being loose in the barrel. This spring is wound up by striking the clock, and kept so by the count wheel D, and arbor to which it is fastened revolving in the same time that the driving wheel O, and spring barrel P of the time part does. The pressure against the inside of the barrel when wound up, gives to it sufficient power to drive the time part.

Fig. 3, is a plan of the escapement and rotary pendulum. The pendulum ball may be made of any convenient shape, but the one found to answer best is of metal, a globular form and hollow, of about three and a half inches diameter and two and a half pounds weight as at A, being made round for the double purpose of a compensator and corrector, and hollow that its weight may be carried farther from the axis of its motion without altering its globular form, thereby lengthening the time in which it makes its revolutions. It is made of two pieces and joined together, through the axis of it is an arbor with a nut B, on

the lower end, on which it rests. At the upper end of this arbor are two hooks which are attached to, and the ball suspended by a small flat metal spring having fastened at its lower end a piece of metal with a pin on two sides, on which the hooks rest forming a point or hinge as at C. The spring D is about seven inches long, narrow and thin, and is attached at the upper end to a stud E. Near the upper end of the spring is fastened an arm F in the form of a crank, if the ball is turned around it will twist the spring, and cause the arm to perform an arch acting upon and receiving the impulse from the connecting lever G, they being connected by a small piece of metal with a hole in each end working on pins as at H, H. At the upper end of the connecting lever G, and on opposite sides of its arbor are two arms I, I, to which the pallet arms, J, J, are attached. At the lower end of the pallet arms are sockets working on a pin the upper end working in and out of the teeth of the swing wheel K. Whenever a tooth of the swing wheel meets with either of the pallets the wheel recoils a little, relieving the other pallet, which is immediately lifted out of the tooth by means of a small spring fastened to each of these arms as at L, L. The impulse given to the arm F, which acts on the spring as a crank is carried through it to the ball and keeps it in motion. The properties of this pendulum are a combination of the balance and pendulum,—of the balance by its having an axis on which it revolves, and of the pendulum by its being suspended and acted upon by the force of gravity. The spring in a quiescent state is longest, upon its being twisted either way from that state it is shortened, and the ball made to rise and fall. All kinds of springs have the same property in a greater or less degree, the wider the spring to the thickness, the more it will be shortened by being twisted, and the greater will be the effect of gravity on the ball. Steel no doubt makes the best spring it being stronger and more elastic than other metals. A lighter spring of the same length, to the same ball, or a larger ball, or a greater weight to the same spring, or the lengthening of the same spring to the same ball, will in either case make the time slower. It is regulated at the lower end near the ball, by a small crutch sliding on the spring having a socket at the end working on the top of the arbor M, Fig. 3, which is a screw running in the top of the ball, and by being turned moves the crutch on the spring, lengthening or shortening the active part of it.

The different degrees of temperature do not affect the time given by the spring, the time it would lose by its expansion in length is accurately counteracted by the time it gains by its expansion in width and thickness. Let the expansibility of the metal of which the ball is made be what it may, the time it would lose by its expansion outward from its axis of motion, is compensated for at the same time, by the time it gains by the regulator rising on the spring, by the expansion of the ball upward from the nut on which it rests, consequently the revolutions or vibrations will be the same and in equal time.

There is an irregularity existing in the common pendulum by a loss of power, arising from an increase of friction, thereby lessening the impulse given to it, and shortening the arc of its vibrations. If it measure true time in an arc of four degrees it will gain eleven and two thirds seconds a day by vibrating in an arc of three degrees, so that by an increase of friction, and loss of power which is always the case it will gain time. In this rotary pendulum, there will be an irregularity, by using a spring more than about three times the width of its thickness, and which is increased in proportion as the width of the spring is increased, but reversed from that of the common pendulum. An increase of friction or loss of power will lessen the revolutions and make a loss of time, which may be counteracted by the application of a corrector as at N Fig. 3, it being a rod of small steel wire, with a small movable weight on it, with a screw to secure it to the rod as at O. This rod is suspended by a hook to the lower end of the connecting lever G, when the lever moves toward the spring D, the rod is carried by it against the ball immediately after the unlocking of the pallet, and remains there during the time of the recoil retarding its motion.

If the adding more weight to the clock make the time faster, the corrector may be adjusted by lowering the weight on it, so as to make it perform its revolutions or vibrations always in equal time. Or the vibrations may be rendered isochronal by a proper adjustment of the width and thickness of the spring, (the length not affecting it in the least degree), a spring of about three times the width of its thickness will be perfectly isochronal, either course may be taken to render its vibrations always in equal time. A spring the width of which is greater than three times its thickness, will by an increase of power or motion make the time faster, and a spring which is of less width, including a square piece of metal, or round like a wire, or a uniform spiral spring, will be the reverse and the time will be slower.

The advantages to be derived from the use of these improvements on the clock, or time piece, are, 1st, that very little care is required in setting up the clock, whether perpendicular or not, in consequence of its not

being liable to be put out of beat like other clocks; 2nd, that the time part is silent; 3rd, that the rotary pendulum makes long vibrations, and is easily adjusted, so that they are performed always in equal time; 4th, that the time part requires fifty two times less maintaining power than other clocks, hence the natural isochronism is less disturbed by the relatively small irregularities of it, the maintaining power being less, the friction of the wheel work will be less, and therefore the motion more regular; 5th, that the time part is driven by the striking part by means of a small spring, left loose at one end for the purpose that it may not interfere so as to stop the striking part or wind up beyond a certain strength without sliding inside the barrel, thereby forming a retaining power and saving the expense of a train of wheels &c.; 6th, that by the application of the rotary hammer it requires fifty-two times less maintaining power for the striking part than other clocks do; 7th, that the striking part with four, and the time part with two wheels, may be made to run a year by once winding up, with a spring seven and a half feet long, and of a strength when wound up equal to thirteen pounds weight, and in the space now generally occupied by the ornamental French clocks.

The invention claimed and desired to be secured by Letters Patent, is:

1. The rotary pendulum.

2. The rotary hammer in the striking part of a clock.

3. The connection between the striking and time part of a clock by which the time part is driven; all as herein described and for the purposes hereinbefore set forth.

December 14th, 1840.

AARON D. CRANE.

Witnesses:

JOHN J. SPEAR,

JONATHAN NESBITT.