(No Model.)

E. A. SPERRY.

ELECTRIC MINING MACHINE.

No. 497,832. Patented May 23, 1893.

Fig. 1.

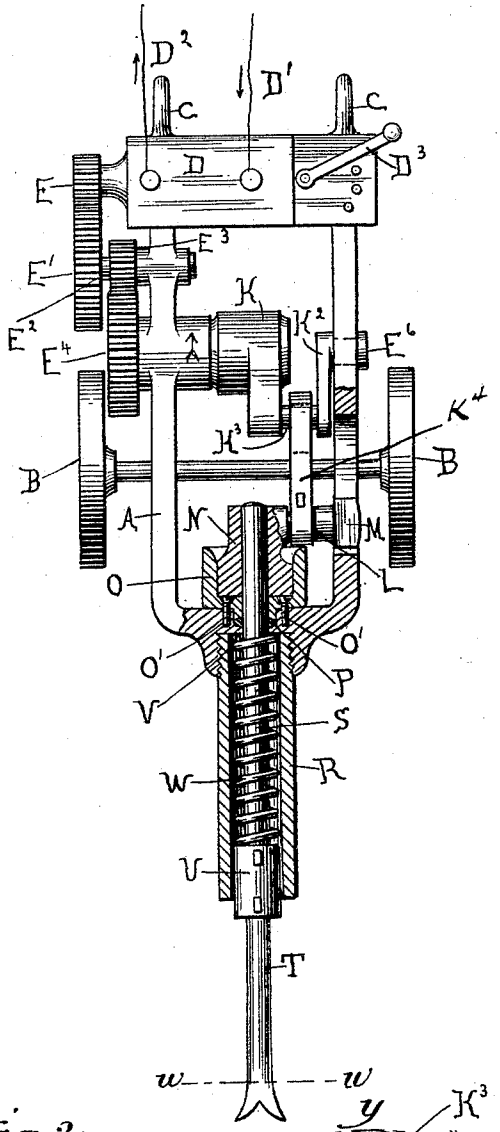
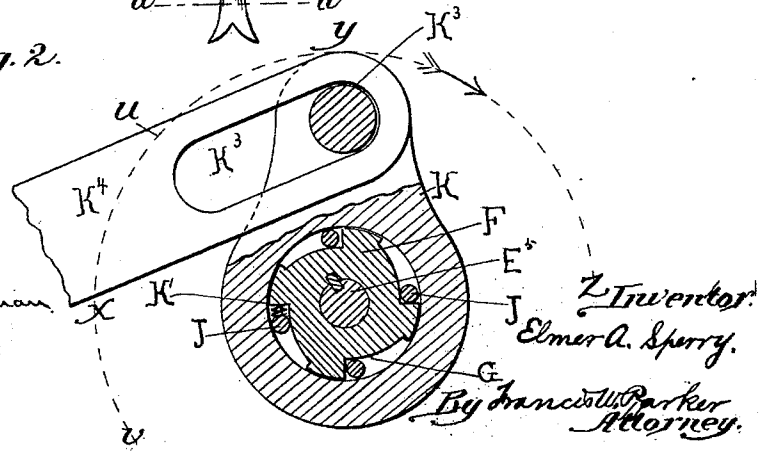


Fig. 2.



Witnesses:
Celeste P. Chapman
Francis M. Ireland

Inventor:
Elmer A. Sperry.
By Francis W. Parker
Attorney.

UNITED STATES PATENT OFFICE.

ELMER A. SPERRY, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE THOMSON-HOUSTON ELECTRIC COMPANY, OF CONNECTICUT.

ELECTRIC MINING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 497,832, dated May 23, 1893.

Application filed October 8, 1888. Serial No. 287,481. (No model.)

To all whom it may concern:

Be it known that I, ELMER A. SPERRY, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Electric Mining-Machine, of which the following is a specification.

My invention relates to mining machines and has for its object to provide a cheap and simple automatic mining machine or pick.

My invention is illustrated in the accompanying drawings, wherein—

Figure 1 is a plan view of my machine with parts in section, and Fig. 2 is a detail view of the crank automatic releasing mechanism and lost motion device.

Like parts are indicated by the same letter in both the figures.

A is the frame; B B the trucks and C C the handles.

D is an electric motor mounted on the frame and supplied by means of the conductors D′ D^2 and controlled by the switch D^3. This motor operates the pinion E which meshes with the gear E′ mounted on the shaft E^2. This shaft carries the pinion E^3 which meshes with the gear wheel E^4 on the shaft E^5. All shafts are mounted on the frame, and, on the same axial line with the shaft E^5, is journaled the gudgeon E^6. On the shaft E^5 is keyed the compound cam F which with its eccentric curves G and rollers J constitutes a clutch whereby the shaft E^5 is at certain times locked to the crank K. Back of these rollers may be placed springs as K′. On the gudgeon is a crank K^2 and continuous with the cranks K and K^2 is the crank pin K^3. A pitman K^4 with an elongated slot K^5 which receives the crank pin K^3 is at its other end secured to the cross head L, which slides in the guide M on the frame and carries at its other end a plunger N adapted to reciprocate within the dash pot O. The dash pot is secured by the screws O′ O′ to the frame and both are shaped so as to form the stuffing box P. Projecting from the frame is the guide cylinder R in which reciprocates the drill shaft S which is secured to the cross head at its upper end and carries the drill point T at its other end.

U is a sleeve which reciprocates within the cylinder R and together with the portion V of the frame forms guides for the drill and bearings for the spring W which encircles it.

The use and operation of my invention are as follows: When the machine constructed substantially as shown in the drawings is connected with the power supplying dynamo it is moved on the trucks and guided by the operator by means of the handles against the substance to be cut. The operation of cutting is performed by rapid and continuous striking of the drill against the substance. The operation of the motor by means of the several gears, pinions and shafts rotates the double crank in the direction indicated by the arrows in Figs. 1 and 2. This operation of the crank retracts the drill and compresses the spring thus storing up energy until it reaches the point *z*. The crank up to this point in the operation has been locked to the shaft with which it is concentric by means of the rollers which pass between the eccentric curves on the compound cam and the concentric curves on the bore of the crank toward the point where said curves approach each other and away from their points of greatest separation. All this is indicated by Fig. 2 and the retracting action of the crank upon the drill is accomplished by the crank pin bearing against the outer end of the slot in the pitman. When the crank pin has reached the point *z* the energy stored in the compressed spring imparts to the drill a velocity greater than that of the moving crank and thereby the crank moves about its shaft in the direction of the arrow more rapidly than the shaft itself moves. Instantly the rollers move toward the point of greatest separation of the curves between which they lie and thus the crank is freed from its shaft and the drill is forced with great velocity against the substance to be cut by the direct action of the spring which is first compressed and then instantly released as above described. The dash pot O and plunger N co-operate to form an air cushion to relieve the parts from the concussion which might occur in case the drill meets with little or no resistance. When the crank and pitman are thus released the stroke of the drill if it meets with no resistance would terminate

at the point x but when the drill meets with ordinary resistance the effective stroke or blow terminates when the crank pin has reached the point v or some other point between x and z. If now the connection between the pitman and crank pin were positive and unyielding the remainder of the stroke would be completed by the action of the shaft upon the crank. For the drill having once been retarded or arrested the crank would in like manner be retarded or arrested so that its velocity would no longer be greater but less than that of the shaft and instantly the clutch would lock the crank and shaft together. If the drill were thus retarded or arrested at v the stroke would continue until the crank thus aided had passed over the arc from v to x during which portion of the stroke the energy of the machine is exhausted in pushing itself back and away from the work. This tends to interfere with the effective control and operation of the machine. If now the connection between the cross head and the crank be made by a yielding, loose or lost motion connection as for instance that shown in Fig. 2 the operation will be as follows:— As soon as the crank pin has reached say the point v at which the drill is for example retarded or arrested the yielding loose or lost motion device will permit the crank pin to pass through an arc equal to twice the arc $v\,x$ without imparting any further motion to the drill and this action is instantaneous, whereupon the action of the clutch instantly locks the crank and shaft together and the operation of recompressing the spring proceeds before a sufficient period of time has elapsed to permit the inertia of the machine to be overcome and thus forced backward. The velocity of the crank and drill after the pin leaves the point z is so great that the crank moves through the arc double the length $z\,x$ by the momentum required and thus the drill is given time while unretarded to do its full and most effective work while the momentum of the crank itself, in being arrested at the end of the double arc, gives up its energy in recompressing the spring itself for the next stroke. The process of storing energy, as above referred to, is important also for it permits the use of an energizing motor which would not be practicable for direct application to the work of drilling. Thus for example a rapidly rotating electric motor may be made to store up the energy of many revolutions in a device which delivers such stored energy in a single blow.

It will be seen from the foregoing that with a constant speed of revolution of the energizing or electric motor the number of revolutions of the crank, and therefore the number of compressions of the spring or driving motor may be different. For instance with one hundred and fifty-six revolutions per minute of the wheel E^4 and its shaft the crank will in practice make two hundred and five revolutions per minute. When the stroke is of full length and the drill is arrested only by its cushion in the front end of the frame; whereas when it is held to its work in such a way that the length of the effective stroke of the drill is materially shortened, the pick, in this case engaging the work before the end of its stroke, will make as many as two hundred and forty-seven blows per minute, the wheel E^4 and its shaft maintaining its speed of one hundred and fifty-six revolutions per minute, which shows that the number of effective strokes of the drill may not only be different but irregular with respect to the number of revolutions of the energizing motor. This regularity of number between the revolutions of the energizing motor and the strokes of the driving motor is brought about by the mechanism by which they are intermittently locked and released from each other. This mechanism I term my irregularly acting catch, no such irregularly acting catch having heretofore been used in connection to this art.

It is obvious that the main features of my invention are equally applicable to the drilling of rock, coal or other similar substances.

One of the objects of placing the shaft of the motor parallel with the axle of the truck is to keep the two in proper relation to each other so that, no matter what the position of the machine at work may be, the shaft of the motor will have play parallel to the axis of the machine. This greatly facilitates the operation and extends the life of the commutators and brushes.

The class of mining apparatus to which my invention particularly extends is that in which the machine is constantly moving, being manually directible as a part of its operation. It is therefore more in line of an "excavator" or "digger" than a "drill," the distinction being that in the latter case while the parts may be heavy and never require the direction of its operation to be manually controlled while in action, but only after its work has been performed, in contra-distinction to this in the present case the machine should be as light as possible, for if it is not light the operator cannot easily control its operation. My invention therefore extends to the use of a moving machine which has upon it or within it a comparatively small motor, and a device whereby the power continuously exerted by such motor over a space of time is collected or stored and suddenly imparted to the tool, whereby a series of powerful actions of the tool or cutter are obtained. This combination is new and novel, and is enabled to perform a new and useful result from the fact that the machine, by being made in this manner, may be constructed sufficiently light in weight that a single operator can use it for the purpose of digging or excavating as with a hand pick, and with results which are almost in direct proportion to the enormous difference in the strength of the blows attending their use respectively. If the motor were required to operate the cutter by direct

connection thereto with equal force, and without the intervention of power storage, the machine would require a motor of great size, so heavy in fact as to render it impossible of control by a single operator. A machine of this character, to be of practical utility, must be sufficiently light that a single operator may continuously and without over-exertion direct all of the operations of the cutter both up and down laterally in each direction, and also follow in as the cutter penetrates the material upon which the work is performed. Such moving machine is supplied with a flexible connection to the source of power supply, which in this case may be a flexible electrical conductor or wire.

The clause "continuously acting motor" used in the following claims is hereby defined as follows: The motor, which may be comparatively small, acting through or by means of the speed reducing gearing E, E′, E^3, and E^4 or the substantial equivalents thereof, together with other co-operating devices upon the machine, is enabled to gather, accumulate or store the energy or power derived from more than a single, or several revolutions or unit impulses into one great impulse or work-doing stroke of the drill bar.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is as follows:

1. In an excavating machine, the combination of a movable manually directible truck and a supporting frame, a continuously acting motor mounted thereon, flexible conductors for conveying energy to the motor from a separate source, a cutter-holder or bar reciprocating longitudinally in a line passing practically through the center of inertia of the machine, and a power storing device, as a spring receiving and accumulating tension from the continuously acting motor and discharging the same at regular intervals through the reciprocating cutter bar, whereby relatively powerful intermittent blows are delivered upon the material operated upon, substantially as shown and described.

2. In an excavating machine, the combination of a movable supporting frame, with a continuously acting motor mounted thereon, flexible conductors for conveying energy to the motor, a cutter holder or bar reciprocating longitudinally in a line passing practically through the center of inertia of the machine; a power storing device receiving and accumulating tension from the continuously acting motor and discharging the same at regular intervals through the reciprocating cutter bar, whereby relatively powerful intermittent blows are delivered upon the material operated upon, and an intermittent connection and release between the motor shaft and the power storing device whereby the power is alternately accumulated and antomatically released, substantially as shown and described.

3. In an excavating machine, the combination of a movable supporting frame, with a continuously acting motor mounted thereon, flexible conductors for conveying energy to the motor a cutter-holder or bar reciprocating longitudinally in a line passing practically through the center of inertia of the machine, a power storing device receiving and accumulating tension from the continuously acting motor through a speed reducing gear or gears, and discharging the same at regular intervals through the reciprocating cutter-bar, whereby relatively powerful intermittent blows are delivered upon the material operated upon, and an intermittent connection and release between the motor shaft and the power storing device, whereby the power is alternately accumulated and automatically released, substantially as shown and described.

4. In an excavating machine the combination of a movable supporting frame, with a continuously acting electric motor mounted thereon, a cutter-holder or bar reciprocating longitudinally in a line passing practically through the center of inertia of the machine, a power storing spring receiving and accumulating tension from the continuously acting motor through a speed-reducing gear or gears and discharging the same at regular intervals through the reciprocating cutter-bar, and a catch to intermittently connect and release the motor and the spring, substantially as and for the purpose shown and described.

5. In an excavating machine, the combination of a movable supporting frame, with a continuously acting electric motor mounted thereon, a cutter-holder or bar reciprocating longitudinally in a line passing practically through the center of inertia of the machine, a power storing and delivering spring, operating the cutter-bar, a speed-reducing gear or gears between the motor and the spring, a catch to intermittently connect and release the motor and the spring and a cushion device as N O to relieve the machine from the shock of the drill bar when the same is not encountering resistance, substantially as and for the purpose shown and described.

6. A moving manually directible bi-wheeled excavating machine, consisting in part of a power motor having the axis of the shaft of the motor parallel with the axis of its supporting wheels, combined with a flexible connection to the source of power supply.

ELMER A. SPERRY.

Witnesses:
FRANCIS W. PARKER,
FRANCIS M. IRELAND.