W. E. IRISH.

THERMALLY OPERATED DEVICE.

APPLICATION FILED NOV. 14, 1919.

1,393,376. Patented Oct. 11, 1921.

2 SHEETS—SHEET 1.

Fig. 1

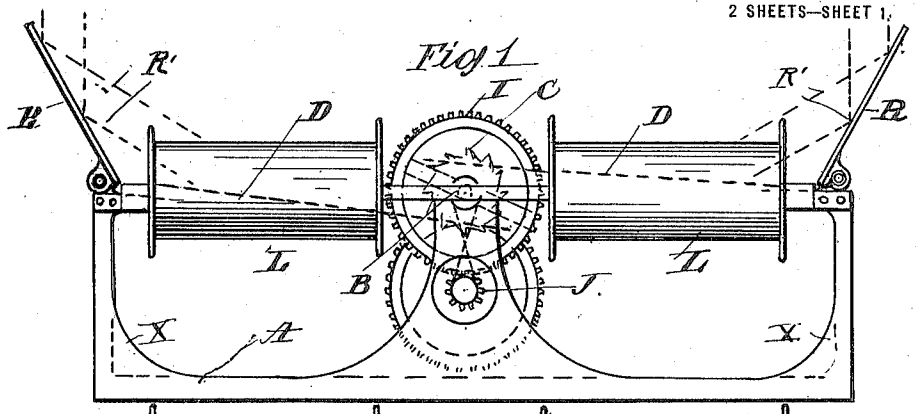


Fig. 2.

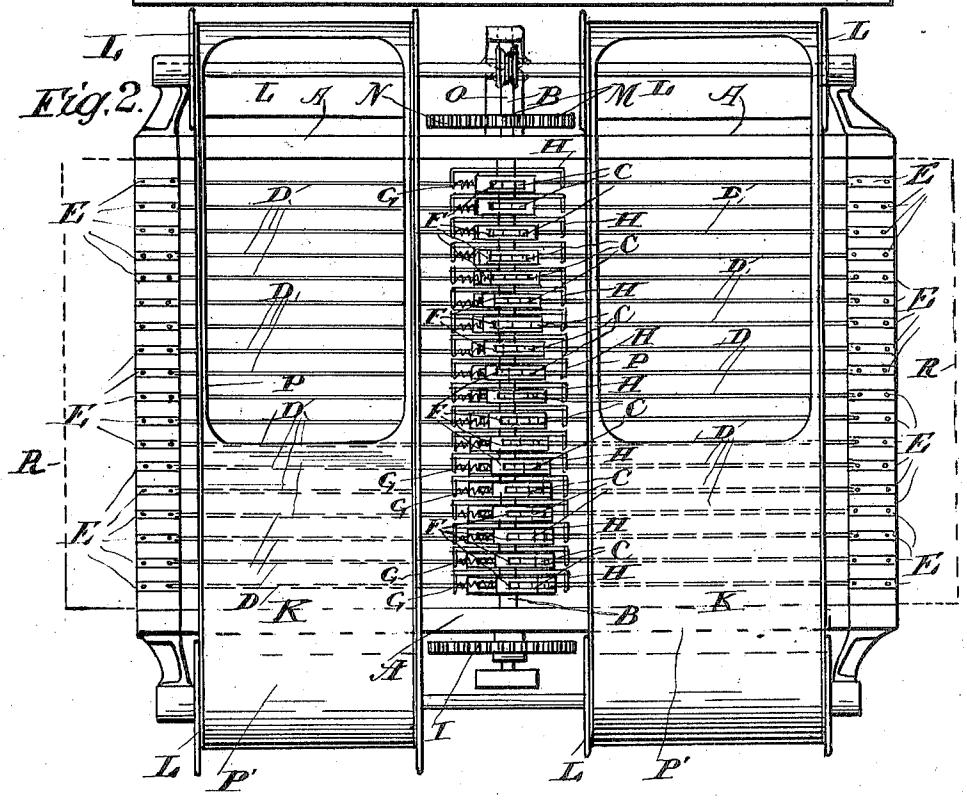


Fig. 4

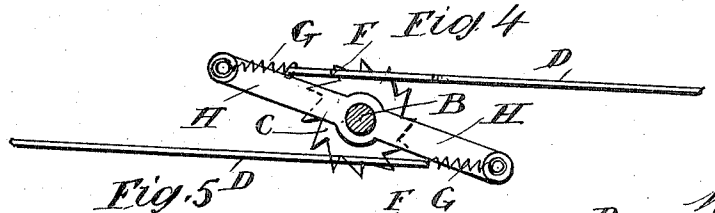
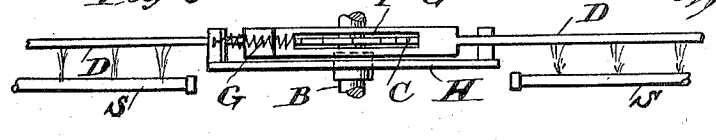


Fig. 5



Inventor
William E. Irish
by Wm. H. Thorne
Attorney

W. E. IRISH.

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2 SHEETS—SHEET 2.

Fig. 3

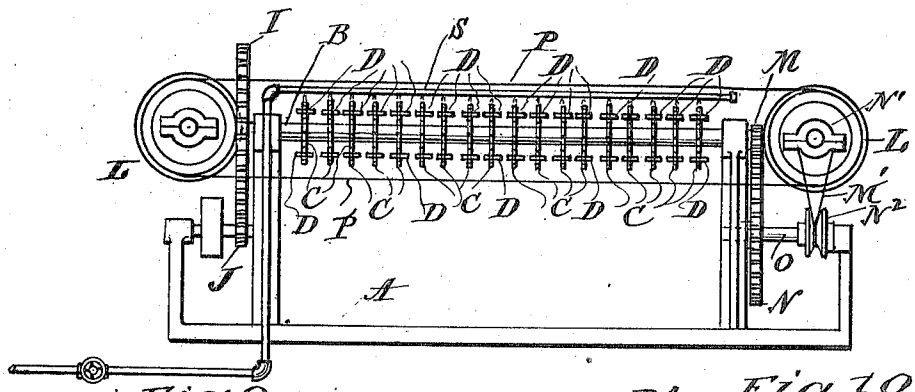


Fig. 9

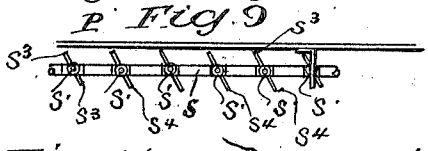


Fig. 10

Fig. 8

Fig. 11

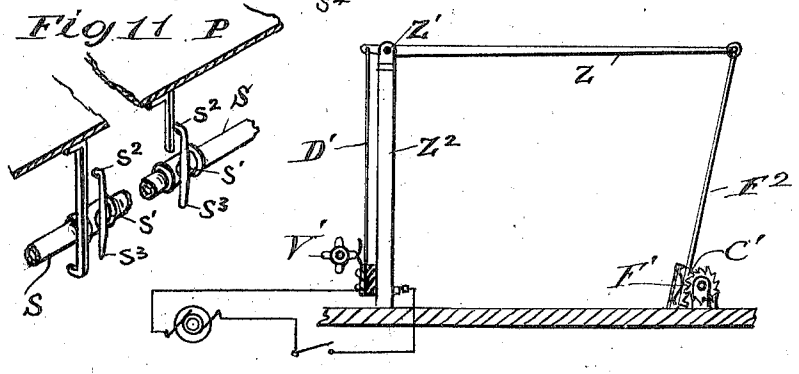


Fig. 6

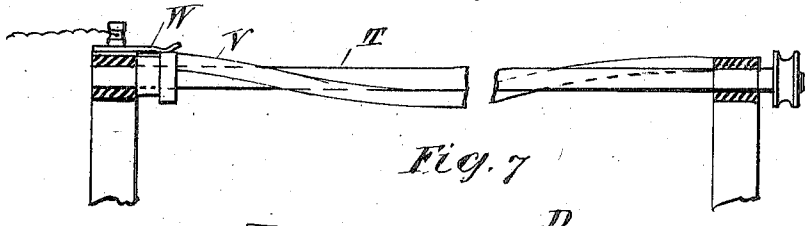
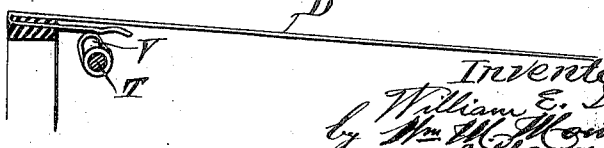


Fig. 7



Inventor
William E. Irish
by Wm. H. Monroe
Attorney

UNITED STATES PATENT OFFICE.

WILLIAM E. IRISH, OF CLEVELAND, OHIO.

THERMALLY-OPERATED DEVICE.

1,393,376. Specification of Letters Patent. Patented Oct. 11, 1921.

Application filed November 14, 1919. Serial No. 338,135.

To all whom it may concern:

Be it known that I, WILLIAM E. IRISH, a subject of Great Britain, and resident of Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Thermally-Operated Devices, of which I hereby declare the following to be a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

The objects of the invention are to provide thermally operated means for actuating power driven mechanism and the invention is particularly applied to operating means which utilize the alternate expansion and contraction of metal under the application of high and low temperatures alternately applied thereto, the said metals being operatively connected with said mechanism in such a manner as to communicate their movements thereto.

The movements of the metal parts being limited in extent are further amplified by intervening mechanism so that the rate of speed of travel of the said mechanism may be increased to any amount relatively to the speed of the movement of the metal parts as may be requisite in the character of the work required.

In this invention the thermal effect in expanding and constructing metal parts is transmitted to other mechanism in the form of rotary motion.

The invention is particularly applicable to use in localities where the thermal effects can be obtained from solar power, but it is applicable for use in connection with heat generated by the electric current, or gas or other sources of heat.

The invention is exemplified in the employment of a multiple number of metallic strips which may be heated by the sun's action or by any artificial means and which are operatively connected with any suitable means for converting rectilinear reciprocating movement, into rotary movement.

The invention is applicable for use in propelling, pumping, mining or other machinery in arid countries, since it requires no fuel or water, or explosives and will require no expert attention or skilled operatives to install or maintain it.

The invention is illustrated in the accompanying drawings, hereinafter more fully described and specifically pointed out in the claims.

In the accompanying drawings, Figure 1 is an end elevation of the device adapted for solar power; Fig. 2 is a plan thereof. Fig. 3 is a central transverse section; Fig. 4 is a transverse section of a ratchet shaft showing one of the actuating ratchets and the extremities of two of the thermal strips, enlarged; Fig. 5 is a plan thereof; Fig. 6 is a transverse section showing a commutator spirally aranged upon a shaft and adapted to convey an electric surrent successively to a multiple number of thermal strips; Fig. 7 is a side elevation thereof. Fig. 8 is a side elevation of a modified form in which the action of the thermal strip is increased by leverage; Fig. 9 is a side elevation showing valves, for turning on the gas before action. Fig. 10 is a similar view of the same after action. Fig. 11, is a perspective of two valves.

In these views A is a frame centrally through which is supported the shaft B, upon which are spaced a multiple number of ratchets C.

From opposite sides of the machine extend an equal number of thermal strips D, D, which are fixed at their outer ends in the frame at E, E, and are provided with slots, or other engaging means F, F, at their inner ends, the walls of which engage with the teeth of the ratchets on opposite sides thereof.

Springs G, G, connect the inner extermities of these strips with arms H, H, loose upon the shaft B, and draw the strips forward as they expand, over the teeth of the ratchets, while permitting them to expand and contract at will. When the strips contract they draw the teeth forward and rotate the ratchets.

The strips preferably expand and contract in succession and any suitable heating means can be employed to heat them periodically, the heat being alternately applied and removed, permitting the strips to automat-

ically contract after the heat has ceased to have its expansive effect.

The power is obtained by means of the contraction of the thermal strips and their tensile strength is sufficient to rotate the ratchet shaft and mechanism connected therewith.

The movement of the strips are comparatively slow and the rate of speed is augmented by means of gears I and J or other suitable speed accelerating devices. The strips on the opposite sides of the frame contract in opposite directions and hence the frame is braced at X, X accordingly to endure the strain. In Figs. 1 and 2, the device is illustrated as applicable to solar power.

Here a moving screen K mounted upon rollers L, L, is kept in constant motion over each set of thermal strips by means of an operative connection with the ratchet shaft B.

This connection is shown as gears M and N belt and pulleys M′ and N′, N^2 and shaft O.

The screens K, K, are provided with openings P through which the sun's rays can strike against the thermal strips to expand them, these openings alternate with closed portions P′ through which the rays can not pass.

The relative speeds of movements of the ratchet shaft and screen should be such that the thermal strips are successively heated by the sun and have a period of time in which to cool and contract and operate the ratchets before they are again subjected to the sun's rays.

In Fig. 2 the openings in the screen are passing over the upper portion of the figure where the thermal units are shown fully expanded, while in the lower portion of the figure they are shown fully contracted and under shadow and between these points they are shown in intermediate stages the expansion and contraction being a gradual one.

In Figs. 6 and 7 means for electrically heating the thermal strips in a successive manner is shown.

Here T is a commutator shaft provided with a spirally wound contact member V designed to engage successively with the several strips and conduct the current to them. One of the conducting communicators is employed for each set of strips.

These commutators engage preferably with spring contacts W, W, so as not to lift the strips out of contact with the ratchets.

An alternating or direct current low in voltage is employed and the current after traversing the strips emerges through the conductor and ratchet shaft to ground or is led away from the strips in any convenient manner.

In Fig. 8 is shown a lever Z having its pivot or fulcrum at Z′, upon a pillar Z^2. D′ is the thermal strip, the action, or range of movement of which, is much increased by means of the leverage. A ratchet C′ is operated by means of a pawl or pawls, F′, F′ upon the rod F^2.

V′ is a commutator or switch for successively closing and opening an electric circuit through a multiple number of thermal strips.

To hasten the action of the solar rays in their effect upon the thermal strips amplifying means such as mirrors for lenses for concentrating the rays upon them are preferably employed since they will collect the rays from a larger area and cause them to impinge upon the thermal strips such mirrors are shown in Figs. 1 and 2 also a cooling device is employed to hasten the contraction of the strips.

In Figs. 3, 9 and 10 and 11 this is shown to comprise a series of pipes S controlled by means of valves S′, which are opened and closed by means of levers S^2 S^3 engaged alternately by lugs S^4, S^5 depending from the curtain or screen P, so that the jets S^6 will be closed when the strips are subjected to the rays of the sun and will open to cool the strips when they are shaded by the closed portions of the screen.

The movements of the curtain will alternately open and close the valves. Any suitable cooling liquid can be employed for this purpose.

Having described the invention what I claim as new and desire to secure by Letters Patent is:—

1. In thermally operated mechanism, a frame, a multiple number of thermal strips, secured at one extremity to said frame, a common ratchet shaft with which the opposite extremities of the said strips engage, means for periodically applying heat to said thermal strips, and means for alternately cutting off the supply of heat thereto.

2. In a thermally operated machine, a support, a multiple number of thermal strips fixed to said support, and free to expand under the influence of solar heat, and to contract when said heat is removed, and means operatively connected with said strips for converting the rectilinear reciprocating movement of said strips into rotary movement, a shield and means for alternately applying said shield thereover and for withdrawing said shield therefrom.

3. In a thermally operated device, in combination, a support, a multiple number of thermal strips, each secured at one end thereto, a common shaft adjacent to the other ends of said strips, a corresponding number of ratchets on said shaft, and engaging means for said ratchets on said strips.

4. In a thermally operated device, in combination, a support, a multiple number of thermal strips, each secured at one end there-

to, a common shaft adjacent to the other ends of said strips, a corresponding number of ratchets on said shaft, and engaging means for said ratchets on said strips, and means for holding said engaging means in operative relation to said ratchets.

5. In a thermally operated device, a support, a multiple number of parallel thermal strips, each secured at one end to said support, and free to expand longitudinally therefrom, a common rotatable shaft adjacent to the outer ends of said strips, and coöperating means on said shaft and strips for converting the reciprocating rectilinear movements of said strips into rotary movement of said shaft.

6. In a thermally operated device, a support, a multiple number of parallel thermal strips, each secured at one end to said support, and free to expand longitudinally therefrom, a common rotatable shaft adjacent to the outer ends of said strips, and cooperating means on said shaft and strips for converting the reciprocating rectilinear movements of said strips into rotary movement of said shaft.

7. In a thermally operated mechanism, a multiple number of thermal strips, a common support therefor, to which each strip is attached at one end and free to expand and contract at the other end, a common ratchet bearing shaft, rotatable on said support adjacent to the outer ends of said strips, separate means on each of said strips for engaging said ratchet bearing shaft, and acting in turn to rotate said shaft when said strips contract, and means for alternately applying heat to said strips and withdrawing the heat therefrom.

8. In a thermally operated mechanism, a multiple number of thermal strips, a common support therefor, to which each strip is attached at one end and free to expand and contract at the other end, a common ratchet bearing shaft, rotatable on said support adjacent to the outer ends of said strips, separate means on each of said strips for engaging said ratchet bearing shaft, and acting in turn to rotate said shaft when said strips contract, and means for alternately applying heat to said strips and withdrawing the heat therefrom; said heating means successively applied to said strips.

9. In a thermally operated mechanism, a multiple number of thermal strips, a common support therefor, to which each strip is secured at one end, the other end being free to expand and contract, a common rotatable ratchet bearing shaft, engaged by said strips, and rotated by the contraction of said strips, and speed accelerating mechanism operatively connected with said shaft.

10. In a thermally operated mechanism, a multiple number of thermal strips, a common support therefor, to which each strip is secured at one end, the other end being free to expand and contract, a common rotatable ratchet bearing shaft, engaged by said strips, and rotated by the contraction of said strips, and speed accelerating mechanism operatively connected with said shaft, and means for periodically applying heat to said thermal strips.

11. In a thermally operated machine, a support a multiple number of thermal strips, each secured at one end thereto and adapted to expand and contract therefrom, a rotatable shaft engaged successively by said strips and operated by the contraction thereof, a protecting screen passing successively said strips, said screen operatively connected with said shaft.

12. In a thermally operated machine, a support a multiple number of thermal strips, each secured at one end thereto and adapted to expand and contract therefrom, a rotatable shaft engaged successively by said strips and operated by the contraction thereof, a protecting screen passing successively said strips, said screen operatively connected with said shaft and speed reducing mechanism operatively connecting said shaft and screen.

13. In a thermally operated machine, a frame, a multiple number of thermal strips rigidly secured thereto at one end, and free to expand and contract at the other end engaging means at the free ends of said strips operatively connected with rotatable mechanism means for successively exposing said strips to solar power and means for successively cooling said strips.

14. In a thermally operated machine, a frame, a multiple number of thermal strips rigidly secured thereto at one end, and free to expand and contract at the other end engaging means at the free ends of said strips operatively connected with rotatable mechanism means for successively exposing said strips to solar power and means for successively cooling said strips and subsequently acting means for applying a cooling agency to said strips.

15. In a thermally operated machine, a frame, a multiple number of thermal strips rigidly secured thereto at one end and free to expand and contract at the other end, engaging means at the free extremities of said strips, rotatable mechanism operatively connected with said engaging means, means for alternately exposing said strips to the sun's rays and for cutting off the same therefrom and means for concentrating the sun's rays upon said strips.

In testimony whereof, I hereunto set my hand this 29th day of September, 1919.

WILLIAM E. IRISH.

In presence of—
WM. M. MUNROE,
S. W. SANGSTER.