(No Model.) 2 Sheets—Sheet 1.

W. CALVER.

METHOD OF AND MEANS FOR UTILIZING THE RAYS OF THE SUN.

No. 260,657. Patented July 4, 1882.

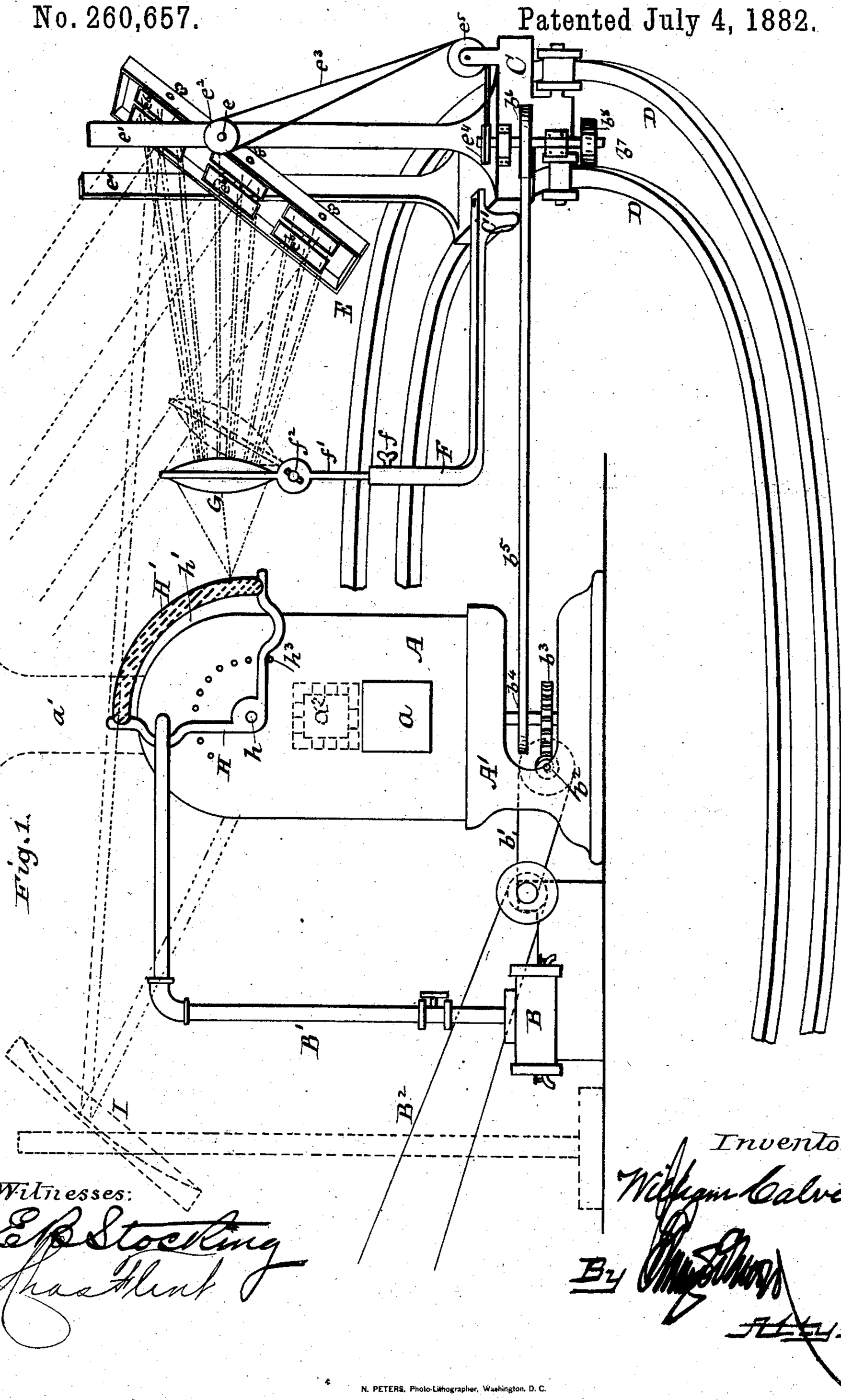


Fig. 1.

Witnesses:
E. B. Stocking
Chas. Hunt

Inventor
William Calver
By Thos. G. Orwig
Atty.

(No Model.) 2 Sheets—Sheet 2

W. CALVER.

METHOD OF AND MEANS FOR UTILIZING THE RAYS OF THE SUN.

No. 260,657. Patented July 4, 1882.

Fig. 2.

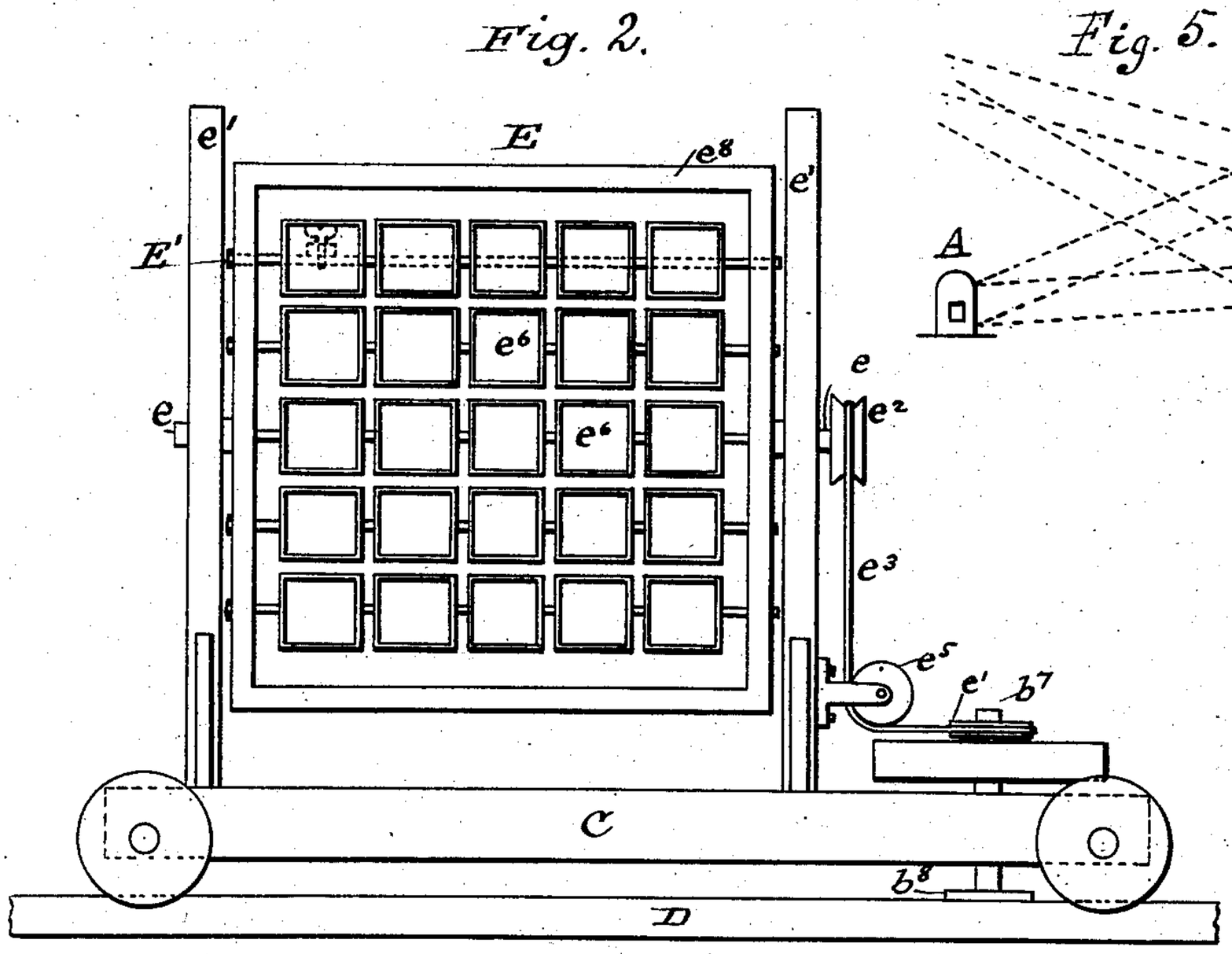


Fig. 5.

Fig. 3.

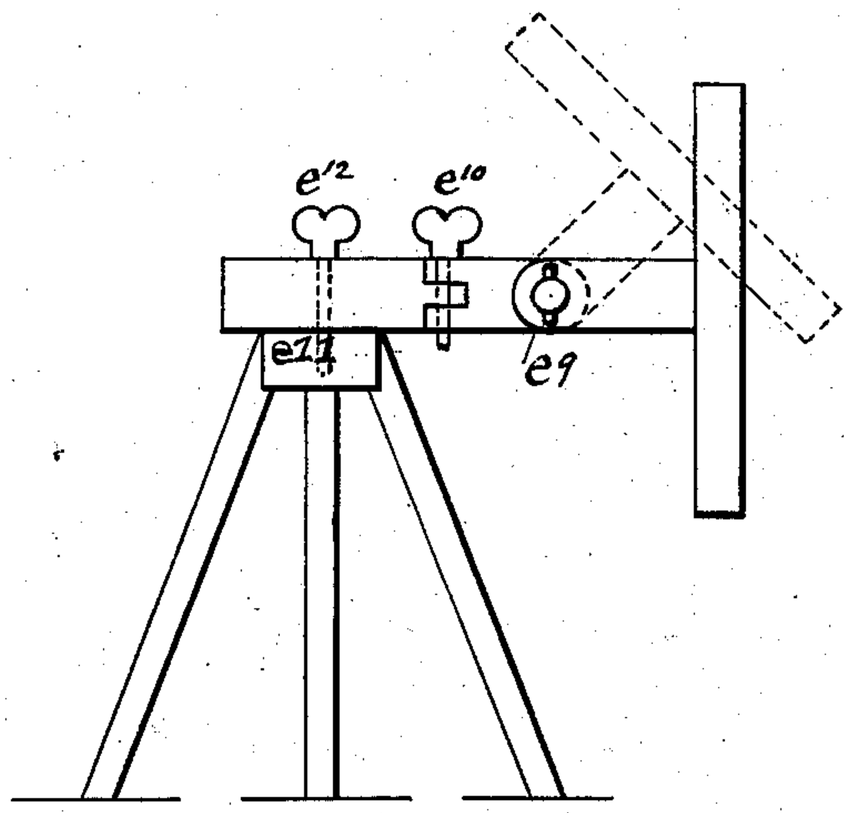
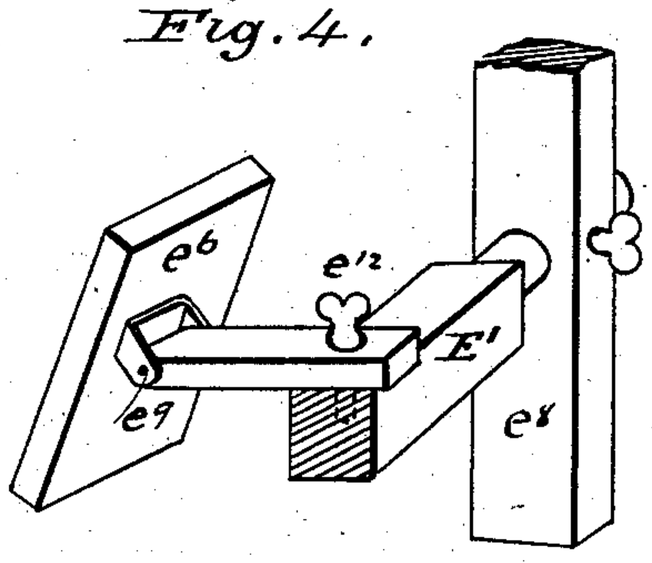


Fig. 4.



Witnesses:
E. B. Stocking
Chas. H. Hunt

Inventor
William Calver
By Munn & Co
Atty

UNITED STATES PATENT OFFICE.

WILLIAM CALVER, OF WASHINGTON, DISTRICT OF COLUMBIA.

METHOD OF AND MEANS FOR UTILIZING THE RAYS OF THE SUN.

SPECIFICATION forming part of Letters Patent No. 260,657, dated July 4, 1882.

Application filed May 18, 1882. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM CALVER, a citizen of the United States of America, residing at Washington, in the District of Columbia, have invented a certain new and useful Method of and Means for Utilizing the Rays of the Sun; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

My invention has reference to a certain method and means for reflecting, directing, and concentrating the rays of the sun and utilizing the same for heating or other purposes and as a source of power; and it consists in the method and mechanism hereinafter described, and specifically pointed out in the claims.

Figure 1 is a perspective of means constructed for and adapted to the purpose in view in accordance with my invention. For convenience of illustration the reflected rays at the right of this figure are slightly concentrated. Fig. 2 is a front elevation of a portion of said means; and Figs. 3 and 4 are details in perspective of a reflector mounted for portable or hand use and operation, and Fig. 5 a further detail.

Like letters of reference indicate like parts in all the figures.

A represents a boiler somewhat similar to an ordinary steam-boiler, in that it may be provided with a fire-place, a, and smoke-stack a', in order that the usual means of producing steam therein—that is, by the combustion of fuel—may be used in connection with the means hereinafter described, if desired, in which case I introduce, construct, or locate within the boiler a flue, a^2, which is located in such position as to receive from the fuel in the fire-box the resultant gases of combustion and conduct them, when not otherwise influenced, as hereinafter described, directly or indirectly to the smoke-stack a'.

I prefer to construct the flue of fire-brick or other material adapted to resist a very high degree of heat, and to so locate said flue that in a portion at least of its path through the boiler it shall be surrounded with the water from which steam is to be produced.

At B, I have illustrated a steam-engine, which is supplied with steam through the pipe B′, and is adapted by means of the belt B^2 to operate desired machinery, and by the belt b' to rotate the worm-shaft b^2, which meshes with the worm-gear b^3, on the shaft of which is a belt-pulley, b^4, which, by means of a belt, b^5, operates a pulley, b^6, mounted on a car, C, the lower end of the shaft b^7 of pulley b^6 being provided with a friction-wheel, b^8, that bears against the rail D of a circular track, as shown.

Mounted upon the car C is a reflector, E, which is supported pivotally at e in uprights e', and one of the pivots of the reflector is provided with a pulley, e^2, which is connected by means of a belt, e^3, to a pulley, e^4, upon the upper end of the shaft b^7, the belt e^3 being turned by means of two pulleys, e^5, supported on the car or on one of the uprights, as shown in Fig. 2, one of said pulleys only being shown.

The base A′ of the boiler is cut away to permit the unobstructed operation of belt b^5 throughout the entire extent of the movement of the car C upon the track D.

The reflector E may be a single plain, or corrugated, or concave, or convex, or any other reflecting-surface—that is, it may be constructed of any suitable material with a reflecting-surface; or, as shown clearly in Fig. 2, it may be composed of numerous reflecting-surfaces, e^6, each of which is adjustably secured to bars E′, secured, it may be pivotally, in a frame, e^8, which is pivotally supported in the uprights, as described.

Any well-known means of adjustment may be employed; but I have illustrated in detail, Fig. 3, one manner, which consists in providing each reflector with a projection at or upon the rear side, which is so jointed to a supporting rod or piece that it may be adjusted by a thumb-screw, e^9, to desired positions in a vertical direction, and by means of a similar screw and joint at e^{10} its position horizontally may be adjustably determined; and, further, when mounted upon a tripod, e^{11}, or other portable support, as shown in this figure, it may be bodily rotated about the central attaching-bolt, e^{12}, either by hand or by suitable portable mechanism attached thereto.

At F, Fig. 1, I have shown a standard which

may be secured to the base of the boiler or engine, or supported and carried by the car, as shown at C′; or it may be set in or upon the ground and at a proper distance from the reflector, and within the standard is a rod, f', adjustably held by set-screw f at desired heights.

To the upper end of rod f' is adjustably secured a lens, G, which can be held in upright or inclined position, as indicated by dotted lines, by means of the thumb-screw f^2.

At the end of the boiler I have shown a sector, H, pivotally attached to the boiler at h, and adapted to support a shield, H′, which is constructed of glass, mica, or any other substance which serves to form a space, h', between itself and the outer surface of the boiler, and which permits the passage therethrough of the heat-rays of the sun and prevents the escape of heat from the boiler. With this end in view the boiler may be coated or covered with glass or mica, as described with reference to the material of the shield.

The shield may be provided with means for adjustably supporting it over different portions of the boiler, as a pin, h^3, shown; or it may be suitably connected to the operative parts described, to be automatically changed in position, as hereinafter described with reference to other parts.

At I is shown in dotted lines a second reflector, which may be used to receive the rays from the reflector E, and to direct them against the boiler, either with or without further concentration, by a lens, G.

The joint e^{10}, Fig. 3, instead of being at a right angle to the joints e^9 and e^{12}, may be at any other angle than right, in order to permit of a diagonal adjustment of a reflector without changing its horizontal or vertical plane of presentation—that is to say, a reflector could be tilted or inclined, and yet remain in the same vertical plane. By thus supporting the reflector every possible presentation can be accomplished, and the rays of light and heat reflected by several independent reflectors may be concentrated upon a desired point or surface, either in independent separate foci, or in a focus common to all the reflectors.

The operation of my invention is as follows: The reflector E directs the rays of the sun against the boiler and heats the water to produce the steam which operates the engine B, and this (or, if desired, an independent engine or motor may be used) operates the worm-gear, which is located at the center of the circle in which the reflector is moved, and through the operation of the mechanism described said reflector is automatically carried about the boiler in such time and with such a presentation or inclination as to constantly and directly receive the rays of the sun from sunrise to sunset. For this purpose the timing of the various gears and pulleys with relation to the revolutions of the engine-shaft is accomplished by a proper determination of their sizes relative to each other, which is a matter within the province of the mechanician, and requires no further specific description herein.

It is readily seen that shafting and gearing may be substituted for the belting and pulleys, and that the boiler need not necessarily be located at the center of the circle in which the reflector moves, as a slight change in the adjustment thereof could be made, so as to direct or concentrate the rays at any other point than said center. Furthermore, the rays directed or concentrated by the reflector may or may not be again concentrated by the lens; or they may or may not be directly reflected against the boiler, as a second or a third reflector may be used to direct and concentrate said reflected rays against the boiler.

It is intended that the car C shall be ample in size to carry several reflectors, if desired. As previously stated, the boiler is constructed to be heated by means of the combustion of fuel, and also by means of the reflectors shown. The rays of the sun may be directed either into the fire-box, or directed and concentrated in the fire-brick flue to highly heat the same, so that when fuel is used the unconsumed products of combustion are therein completely utilized for the production of steam; and hence the very large percentage of waste in coal or other fuel energy is largely reduced, if not entirely overcome. The direction and concentration of the rays may be accomplished separately or jointly, and upon one or more parts of the boiler or receiver, or upon the whole of it.

It will readily be seen that the extent of the movement of the reflector is substantially a half-circle, as with the sun in the east it stands at the end of the circular or curved track which is in the west. With the sun at the west its position is at the opposite end; and as to its inclination to and from a vertical line it approaches it nearest at sunrise and sunset, it being necessary at meridian, when substantially half the track has been traversed by the car, to cross the belt e^3, in order that the automatic tilting of the reflector may be reversed in direction.

In using the term "vertical" to qualify the position of the reflector, the base of the car may be considered as a relative horizontal, but when the heat-receiver or boiler is much elevated the relative horizontal line may or would be actually inclined.

In using the term "circular" with reference to the track D or the course traversed by the reflector, it is intended to indicate either a curved line or an arc of a circle which may or may not equal or exceed a semicircle, as at the equator said movement or course would at times be theoretically exactly a semicircle in extent if not in direction, and at all places even a straight track can be used by adjusting the reflector on vertical pivots.

At points north and south of the equator with a curved track the course would exceed a semicircle.

Instead of a steam-boiler, I may use any re-

ceiver for the reflected or reflected and concentrated rays, and said receiver may serve the function to retain or to deliver the heat directly to practical uses without first converting it into power.

By constructing a reflector of separately-adjustable reflecting-surfaces the rays can be directed in such a manner that the effect at the field may be augmented to almost any degree, and thus practical results may be accomplished. When a reflector is constructed of an integral surface the size required to produce practical results renders its cost exceedingly great, and when constructed of numerous plane fixed surfaces a very large percentage of the effectiveness of the rays is lost by diffusion; but by my constructing a reflector of numerous separate disconnected individually and independently adjustable surfaces the effect of each of said surfaces is augmented, re-enforced, increased, and greatly heightened by directing upon the same field the rays from each of its companions, as shown in Fig. 5. The heated field of one reflector is adapted to be increasingly heated by the rays from a second similar simultaneously-acting reflector, and this without concentrating the reflected rays, and herein lies the peculiarity of my method of utilizing the rays of the sun for all practical purposes wherein heat is an element employed; and it is also fully applicable for the practical application of other rays of the sun than the heat-rays. The light-giving quality of the rays and those known as the "actinic" rays may be manipulated according to my method and by my means to produce practical results.

The use of a concentrator or lens, G, as herein shown and described, is not in the least an essential feature of my method. It of itself serves its well-known purpose of concentrating rays to a focus, while in my method and the means for its practice, as herein illustrated, there is absolutely no concentration, and therefore no "focus" in the true sense of the term. There is no point in or at which the rays meet. The proof of this is seen in that if a lens, say, two inches in diameter be held in close proximity to my "common field," say, ten by twelve inches in area, there will be disclosed just as many distinct images of reflectors as there are reflecting-surfaces employed, and the relative positions of the images will be the same as that of the reflectors, and, furthermore, the "field" of a reflector is in area, if anything, slightly in excess of that of the reflector. By referring to Fig. 5 the rays of the sun from a common source are reflected in separate portions in parallel lines (that is, each portion of said rays do not converge) upon a common field. One portion heats that field to a certain temperature, a second, separate, independent portion is reflected in parallel lines upon the same field, and it, being already heated to said certain temperature, is adapted to be increasingly heated by said second portion, and thus a third, fourth, and so on up to thousands of separately and parallelly reflected portions, are piled on the common field, and excessive heat is produced, insomuch that wrought-iron has been melted in the open air and shade.

By the use of concentrating-reflectors any simple non-concentrating or concentrating reflector may be fully exposed to the direct rays of the sun at any point in its course, and the rays thus fully reflected may be directed to a desired point and concentrated there, while without the concentrating-reflector in such case the simple plane reflector would be necessarily inclined to such an extent as to present less than its full area to the sun. Hence the second reflection serves to save a large loss of the resultant effect.

I would observe that the heat-receiver may rotate with or without the reflector.

Among the many uses to which my invention may be applied that of smelting ores is readily apparent, in which case the smelting-furnace would in reality be the heat-receiver, and the substitution thereof for the boiler herein shown and described as the "heat-receiver" I should deem as within my invention.

Having described my invention and its operation, what I claim as new, and desire to secure by Letters Patent, is—

1. In a solar heater, a reflector provided with means whereby it may be automatically moved in a circular direction, substantially as and for the purpose set forth.

2. In a solar heater, a reflector provided with means whereby it may be automatically moved bodily in a circle and inclined, substantially as and for the purpose set forth.

3. The combination of a reflector, a heat-receiver, and means for automatically moving the former about the latter, substantially as and for the purpose set forth.

4. The combination of a reflector adapted to automatically move in the arc of a circle, and a heat-receiver located at the center of said circle, substantially as and for the purpose set forth.

5. The combination of a heat-receiver, a circular track about the same, and a reflector adapted to be moved upon the track, substantially as shown and described.

6. The combination of a reflector, a heat-receiver, a motor, and connecting mechanism adapted to automatically move the reflector about the heater, substantially as shown and described.

7. The combination of a reflector and concentrator, means whereby they are adapted to move in an arc of a circle, and a heat-receiver located at the center of said circle, substantially as and for the purpose set forth.

8. The combination of a reflector adapted to move in a circle, a steam-boiler located at the center of said circle, and an engine adapted by suitable connecting-pipes to be operated by the steam produced in said boiler, substantially as shown and described.

9. A heat-receiver provided with a movable glass shield, substantially as and for the purpose set forth.

10. The combination of a reflector, a heat-receiver, and a movable shield, substantially as shown and described.

11. The combination of a reflector, an adjustable concentrator, an adjustable shield, and a heat-receiver, substantially as shown and described.

12. The reflector consisting of the frame e^8 and pivotally-supported reflector-sections e^6, pivotally secured to pivotal bars E′, substantially as shown and described.

13. The combination of the reflector E, car C, shaft b^7, friction-wheel b^8, and track D, substantially as shown and described.

14. The combination of the reflector E, pulleys e^2, and belts e^3 b^5 with the car C, shaft b^7, friction-wheel b^8, and track D, substantially as shown and described.

15. The combination of the car C, reflector E, and concentrator G, substantially as shown and described.

16. The combination of the boiler A, the cut-away base A′, the centrally-located belt-wheel b^4, and the car C, substantially as shown and described.

17. The combination of the base A′, centrally-located belt-wheel b^4, worm-gear b^3, and worm b^2, substantially as shown and described.

18. The combination of boiler A, pipe B′, engine B, belt b', worm b^2, worm-gear b^3, belt b^5, and car C, substantially as shown and described.

19. The combination of the reflector E and boiler A, provided with a superheating-flue, as a^2, substantially as and for the purpose set forth.

20. A reflector consisting of independent reflecting-surfaces provided with means for universal adjustment, substantially as shown and described.

21. The method herein shown and described of utilizing the rays of the sun, which consists in solely reflecting separate portions of the same and directing each separate portion at or upon a single field, substantially as and for the purpose set forth.

22. The method of utilizing the sun's rays, which consists solely in reflecting separate portions of the same and directing each of said separately-reflected portions to, at, or upon a single common field, and concentrating them from said field to a common focus or field, substantially as and for the purpose set forth.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM CALVER.

Witnesses:
E. B. STOCKING,
J. H. COONEY.