A. J. OTTO.

THERMOSTAT.

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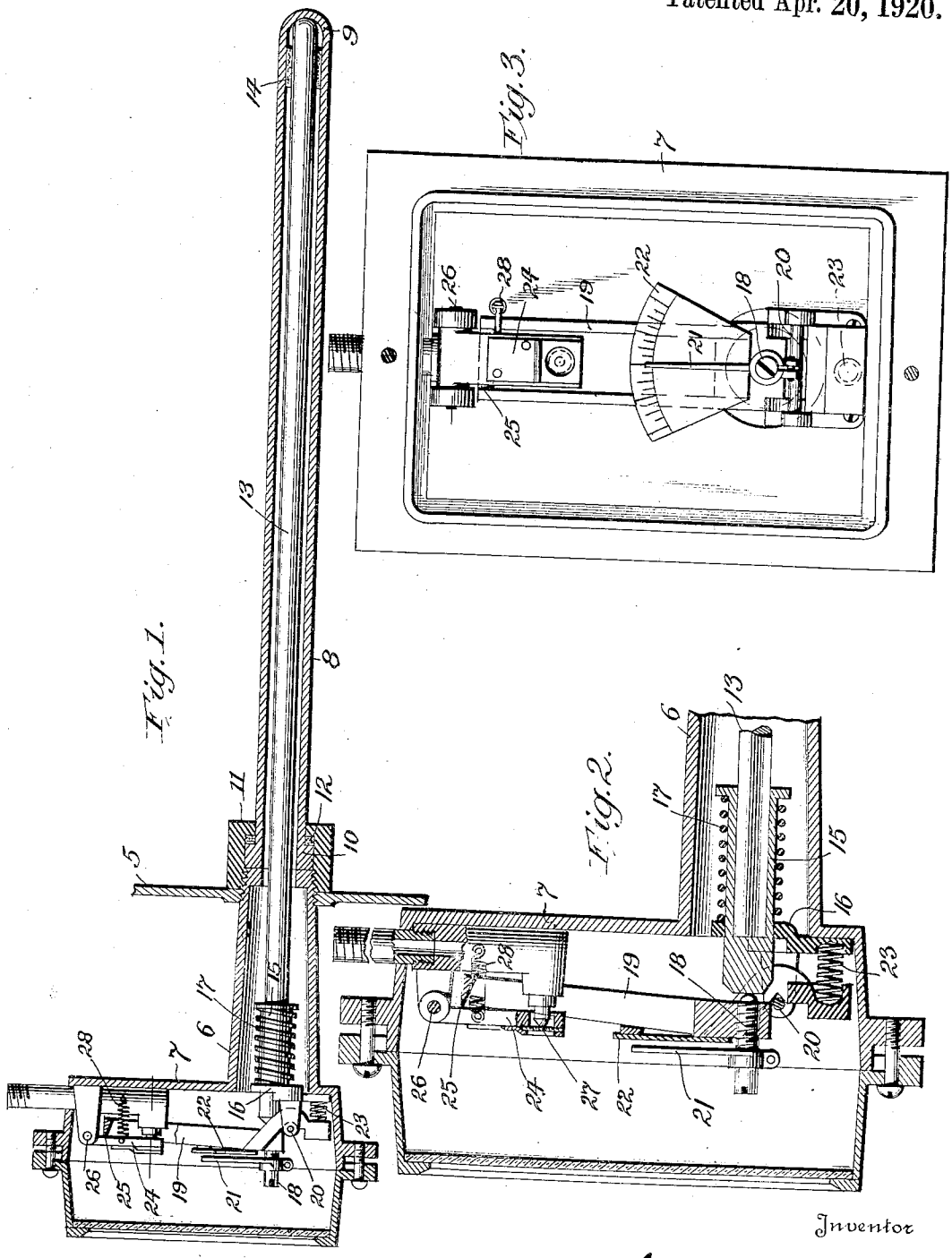
1,337,529.

Patented Apr. 20, 1920.



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THERMOSTAT.

1,337,529. Specification of Letters Patent. **Patented Apr. 20, 1920.**

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To all whom it may concern:

Be it known that I, ARTHUR J. OTTO, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented a certain new and useful Improvement in Thermostats, of which the following is a specification.

This invention relates to thermostatic couples and particularly to those available for use at high temperatures.

When used as the responsive element of a thermostat it secures the close regulation of temperatures up to about 1000° centigrade. Even at such high temperatures the couple is not subject to destructive chemical or physical changes, but maintains a constancy and certainty of action which fully meet all commercial requirements.

The couple consists of a relatively expansible element composed of alundum, and a relatively inexpansible element composed of carborundum. Both are products of the electric furnace.

Alundum is made by fusing bauxite or a pure aluminium oxid, and is a practically pure fused aluminium oxid. The commercial grades vary in purity but are satisfactory for my purpose. Within the limits of temperature contemplated it is almost chemically inert and is a good conductor of heat. The coefficient of linear expansion is about 0.0000071 per degree centigrade. The melting point is about 2050° centigrade.

Carborundum is a compound of carbon and silicon. I commonly make use of a substantially pure grade but absolute purity is not considered essential to the present invention. The coefficient of linear expansion is about 0.0000037 per degree centigrade. The substance is a good conductor of heat and decomposes at 2220° C. without softening or fusing. No oxidation takes place up to the temperature at which I use it.

The two substances may be used in any manner in which their differential expansion may be availed of. In order to place the more expansible element where it will be fully subject to heat variations while securing the simplest construction, I prefer to use an alundum tube closed at one end, inclosing a carborundum rod which bears against the closed end of the tube. The two then act by differential longitudinal expansion.

The couple is available for use in all devices in which thermostatic couples are customarily used, and offers its greatest utility in high temperature work. As an example of its practical application I show it applied to a pneumatic thermostat in the accompanying drawing, in which:—

Figure 1 is an axial section of the complete device;

Fig. 2 is a similar view on an enlarged scale, showing the mechanical structure more fully, and illustrating the mode of connecting the carborundum rod; and

Fig. 3 is a front elevation with the cover removed.

A wall plate 5 receives the threaded tubular shank 6 of the casing 7 and supports the entire device. The alundum tube 8 is closed at its rear end 9 and has a flange 10 at its forward end. The flange 10 is engaged by a nut 11 which holds it in place, some refractory packing being used at 12 to reduce the danger of fracture.

The carborundum rod 13 bears against the closed end 9 of the tube 8 and is centered therein by the asbestos or other refractory ring 14. At its forward end it projects through the tubular shank 6 and terminates in a flanged thimble 15 which is guided and supported by the guide 16 fast to the case 7. A spring 17 is interposed between guide 16 and the flange on thimble 15 and holds the rod 13 in contact with the closed end of tube 8.

The head of thimble 15 bears against an adjustable stop screw 18 threaded in a lever 19 which is fulcrumed at 20. This screw is provided to adjust the action of the thermostat and its position is indicated by a hand 21 on a coacting dial 22. The lever is urged by a spring 23 in such direction as to hold screw 18 against thimble 15.

The upper end of lever 19 actuates a pivoted valve 24 through a knife edge 25 which acts on the valve near its pivot 26, thus securing a multiplying action between the thermostatic couple and the valve. The valve 24 opens and closes a leak port 27, being urged in a closing direction by spring 28, and forced open against such spring by the action of the thermostatic couple. The casing 7 is not air tight, but is vented in any suitable manner to permit the escape of air vented by port 27.

The leak port and valve are characteristic of the Johnson system of regulation, the alternate opening and closing of the port

causing the alternate collapse and distention of a motor diaphragm to which pressure fluid is constantly fed at a rate less than its rate of outflow through the leak port when open. The motor diaphragm may operate control mechanism of any suitable sort.

The themostatic couple is available for use with pneumatic control devices other than the one illustrated and with electric, mechanical and other control devices of known types, and in pyrometers and similar devices. My invention relates broadly to the couple for producing motion by differential expansion irrespective of its particular field of use.

Having thus described my invention, what I claim is:—

1. A thermostatic couple comprising in combination two mechanically related elements, one of said elements being composed of alundum, and the other of carborundum.

2. A thermostatic couple comprising in combination two mechanically related elements, one of said elements being composed of aluminium oxid and the other of carborundum.

3. A thermostatic couple comprising in combination a rod element and an inclosing tube element arranged to operate by differential longitudinal expansion, one of said elements being composed of aluminium oxid and the other of carborundum.

4. A thermostatic couple comprising in combination a carborundum rod and a surrounding tube composed of aluminium oxid, said tube and rod being adapted to operate by differential longitudinal expansion.

5. A thermostatic couple comprising in combination a tube closed at one end and composed of aluminium oxid, and a carborundum rod mounted in said tube and bearing against the closed end thereof.

In testimony whereof I have signed my name to this specification.

ARTHUR J. OTTO.