No. 735,425. PATENTED AUG. 4, 1903.

F. W. TAYLOR & H. L. GANTT.

PYROMETER.

APPLICATION FILED NOV. 16, 1900.

NO MODEL. 3 SHEETS—SHEET 1.

Fig. 1.

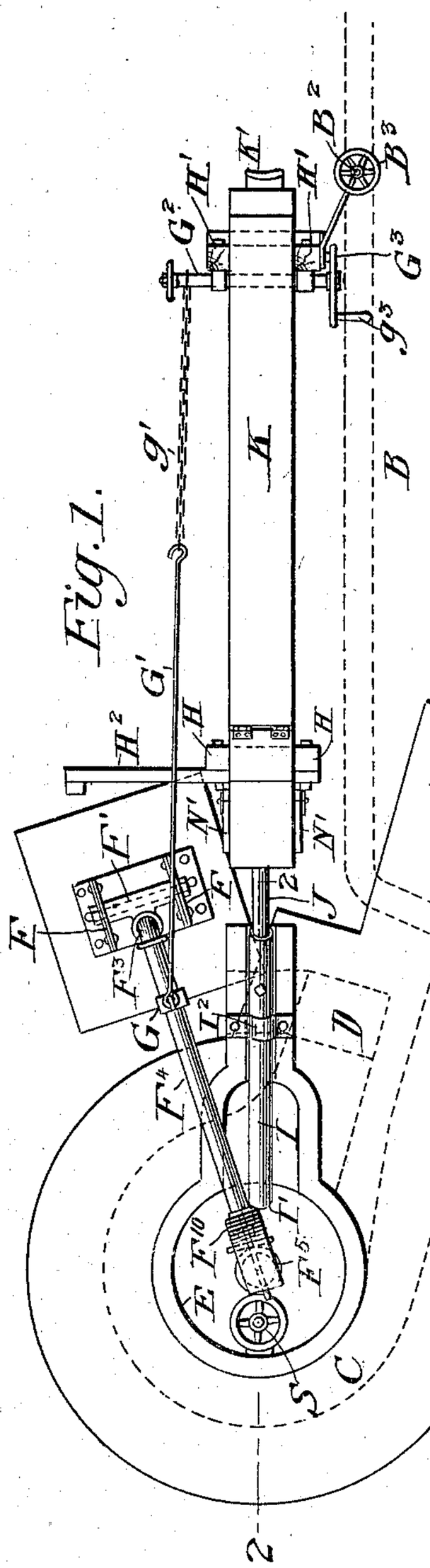
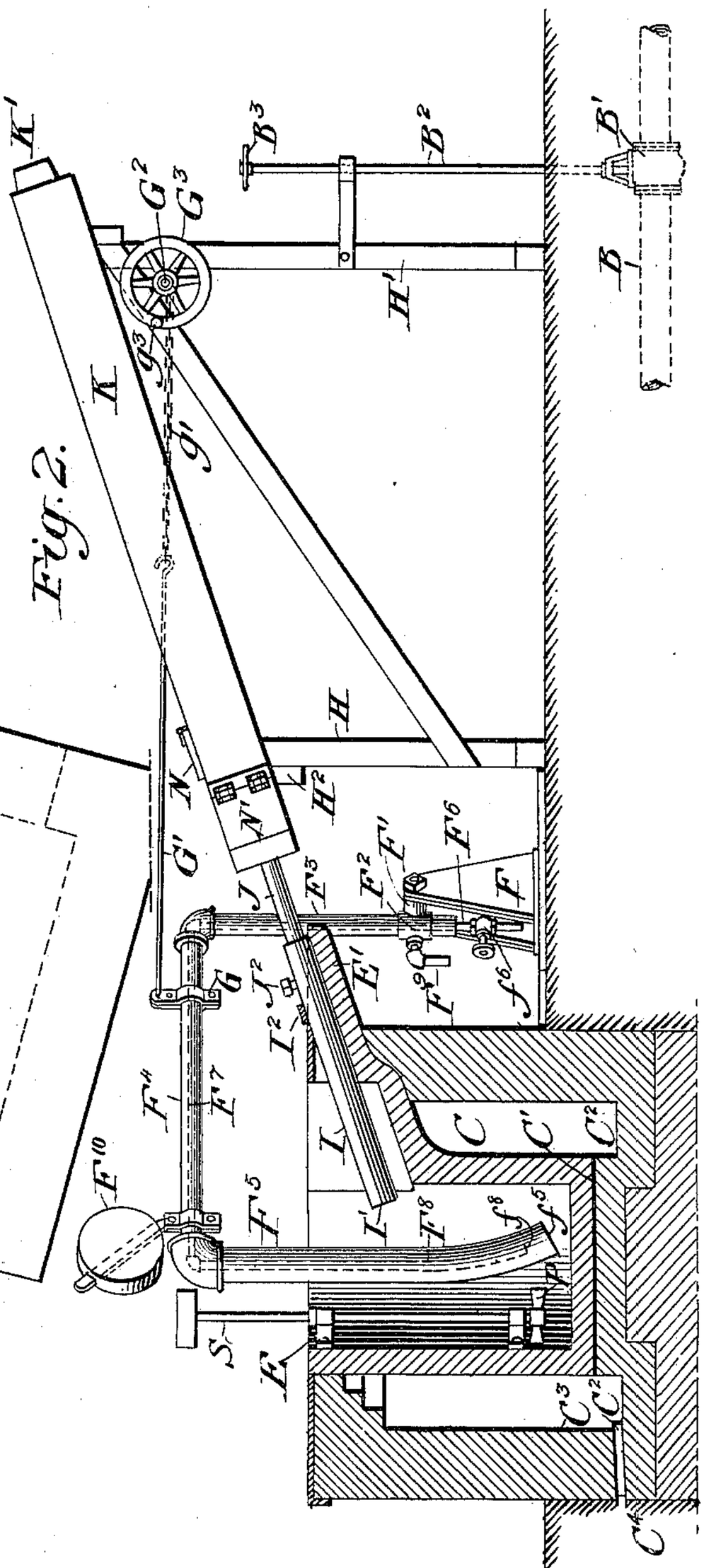


Fig. 2.



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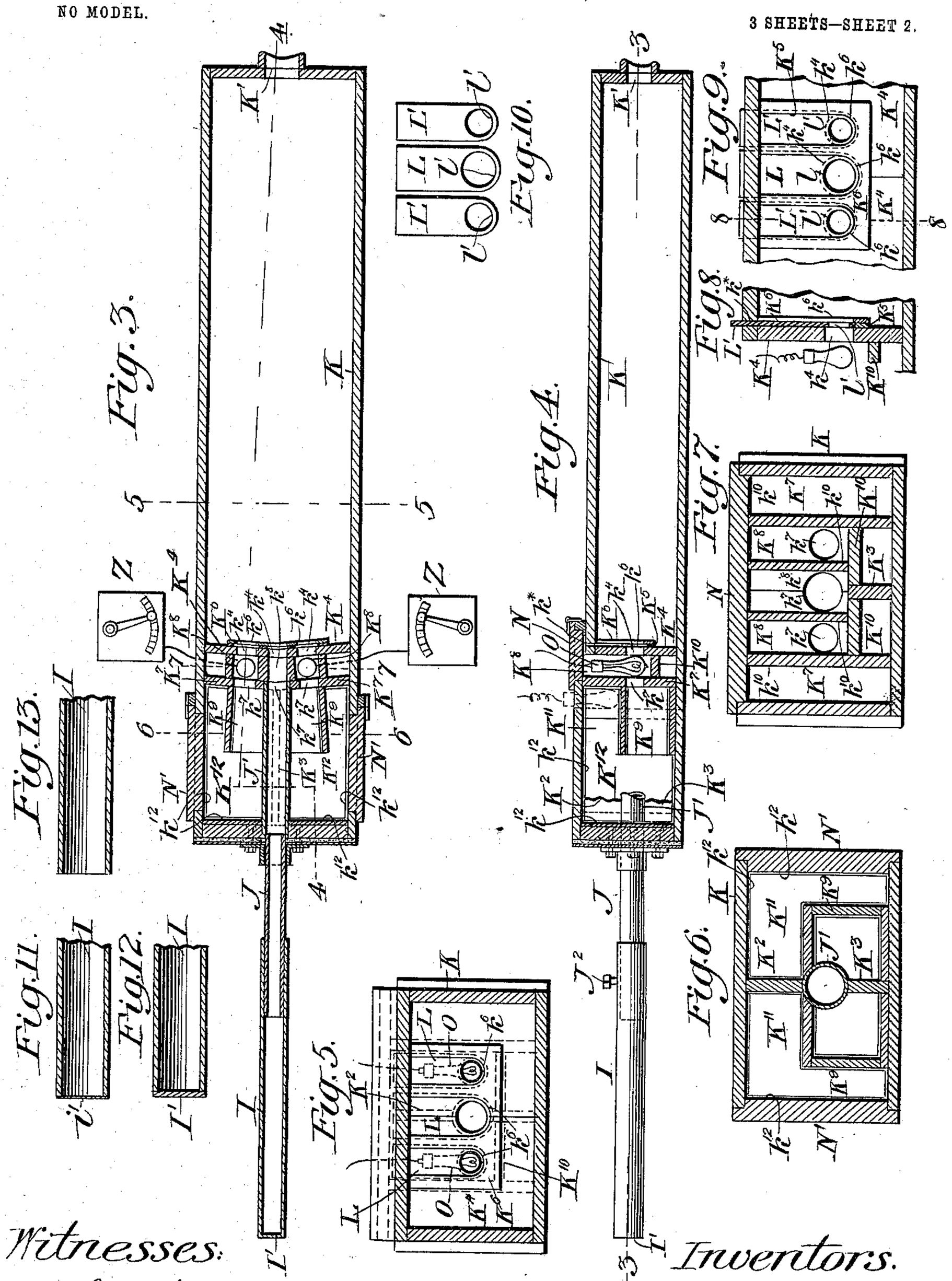
NO MODEL. 3 SHEETS—SHEET 2.



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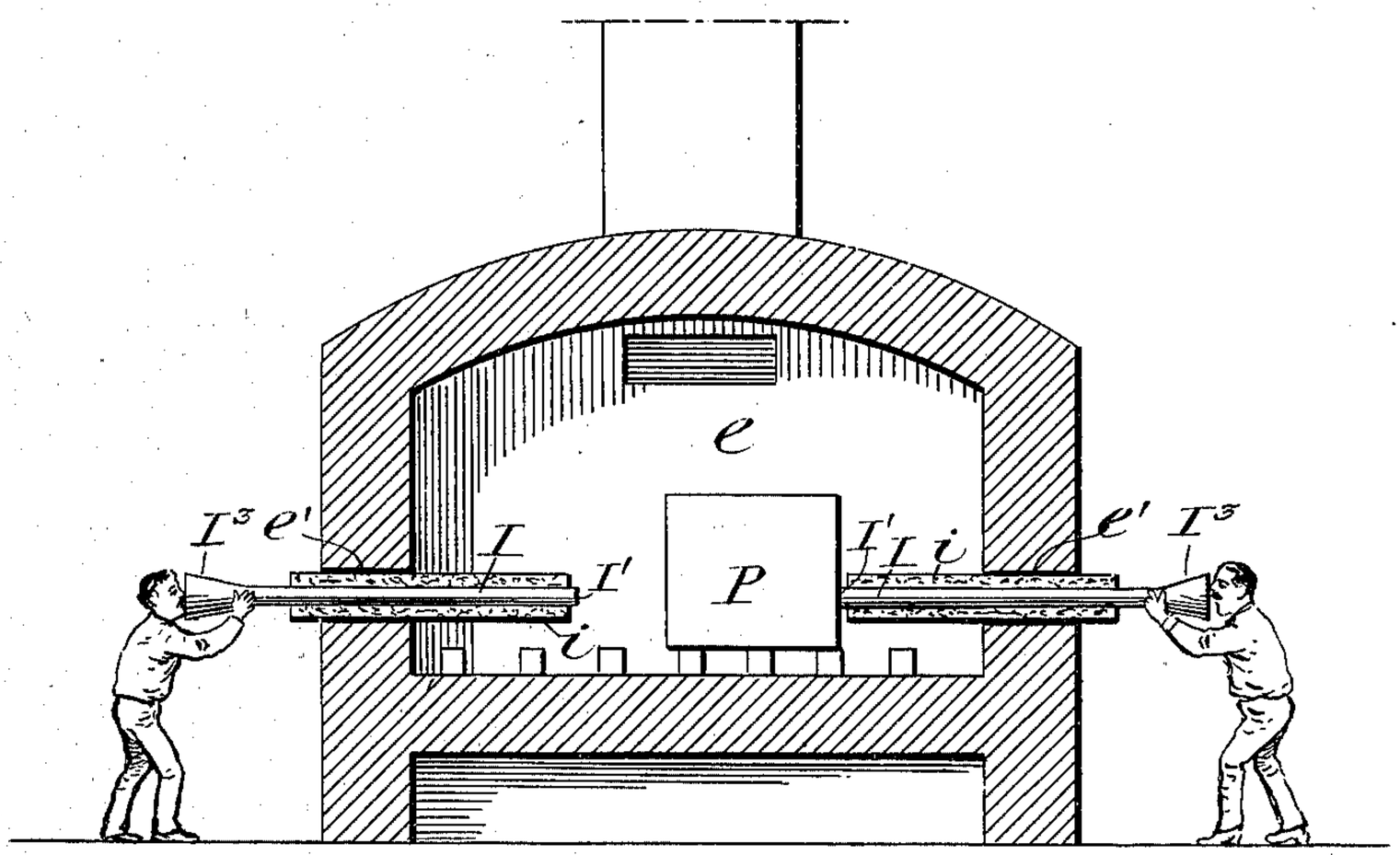
NO MODEL. 3 SHEETS—SHEET 3.

Fig. 14.



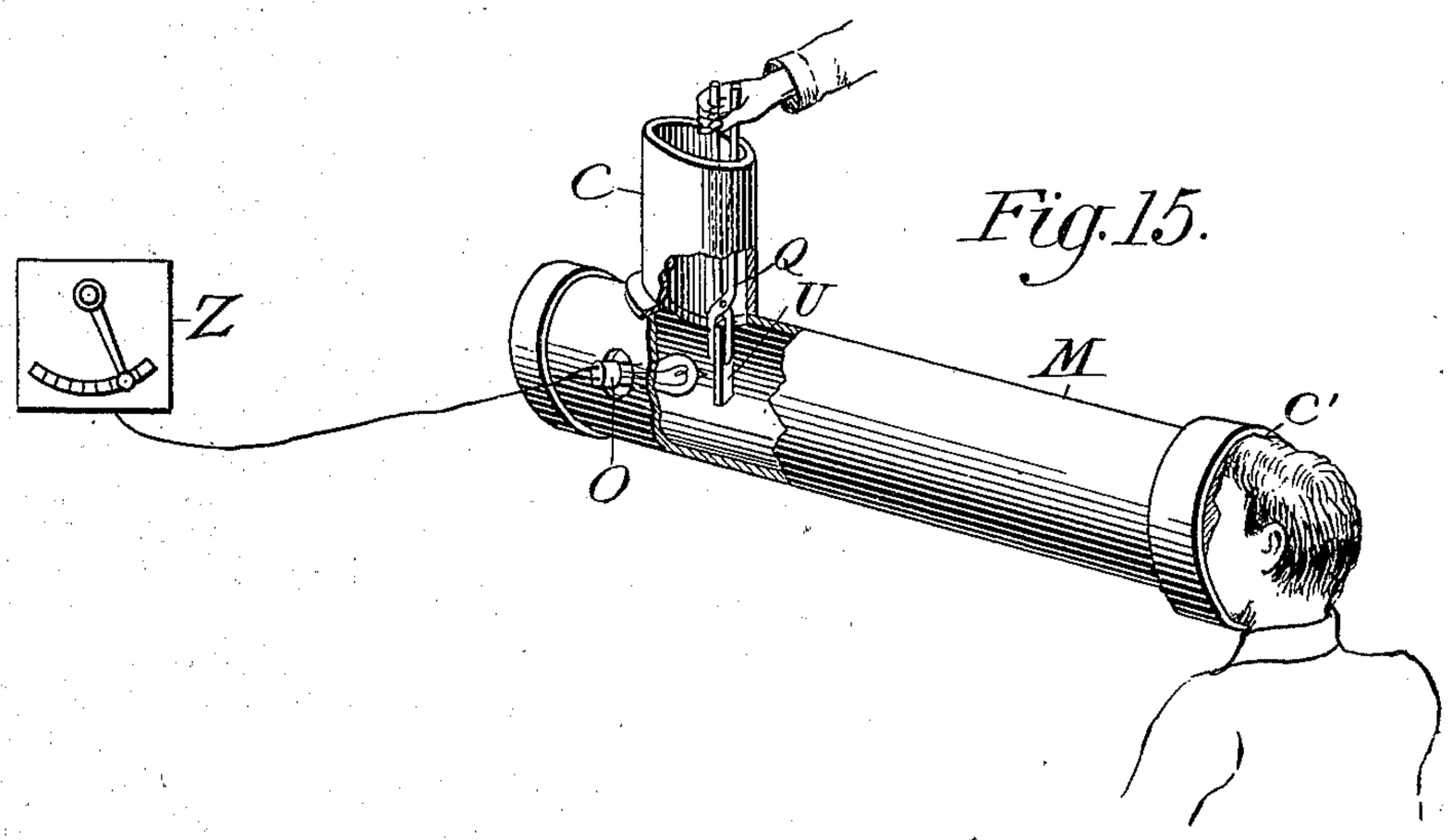


Fig. 15.

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No. 735,425. Patented August 4, 1903.

UNITED STATES PATENT OFFICE.

FREDERICK W. TAYLOR AND HENRY L. GANTT, OF SOUTH BETHLEHEM, PENNSYLVANIA, ASSIGNORS, BY MESNE ASSIGNMENTS, TO MORSE THERMO-GAGE CO., OF TRUMANSBURG, NEW YORK.

PYROMETER.

SPECIFICATION forming part of Letters Patent No. 735,425, dated August 4, 1903.

Application filed November 16, 1900. Serial No. 36,683. (No model.)

To all whom it may concern:

Be it known that we, FREDERICK W. TAYLOR and HENRY L. GANTT, citizens of the United States of America, residing in South Bethlehem, in the county of Northampton, in the State of Pennsylvania, have invented a new and useful Improvement in Pyrometers, of which the following is a true and exact description, reference being had to the accompanying drawings, which form a part thereof.

In an application for Letters Patent of the United States filed by us October 23, 1899, Serial No. 734,456, we have described and claimed certain improvements in optical pyrometers having for their object primarily to provide a simple and efficient construction by means of which the color and the intensity of the light emitted from heated bodies can be compared with the color and intensity of light emitted from a body placed so as to be simultaneously in the line of vision with the object to be observed and the color of which emitted light, with its relationship to the color of the light emitted from the body to be observed at certain temperatures, is known. In the said application and also in our application filed October, 21, 1899, Serial No. 734,289, we have explained that the standard light used in our pyrometer may be that emitted by a body glowing under the influence of heat or that the emitted light used as a standard of comparison may be that colored by transmission and emission from a translucent colored medium.

The present application relates particularly to apparatus involving the employment of light emitted by a glowing or incandescing body as the standard of comparison.

In the accompanying drawings, Figure 1 is a plan view of the pyrometer and its coacting devices. Fig. 2 is a side elevation thereof, partly in section, on the line 2 2 of Fig. 1. Fig. 3 is a longitudinal section through the pyrometer, taken on the line 3 3 of Fig. 4. Fig. 4 is a vertical section taken on the irregular line 4 4 of Fig. 3. Fig. 5 is a cross-section taken on the line 5 5 of Fig. 3. Fig. 6 is a cross-section taken on the line 6 6 of Fig. 3. Fig. 7 is a cross-section taken on the line 7 7 of Fig. 3. Fig. 8 is a vertical section taken on the line 8 8 of Fig. 9. Fig. 9 is a fragmentary view of a portion of the construction shown also in Fig. 5. Fig. 10 is a face view of a slide used in connection with a pyrometer. Fig. 11 is an enlarged view in section of the end of the pipe I, showing the closing of said end by a thin diaphragm. Fig. 12 is a similar view indicating the closing of the end of the pipe by metal substantially as thick as the walls thereof. Fig. 13 is a similar view of the pipe I when open-ended. Fig. 14 is a sectional view of an annealing-furnace, showing a mode of using the closed-ended-tube feature of the invention for observing the temperature of the furnace and of the object treated therein. Fig. 15 is a perspective view, partly broken away, of a modified form of the invention.

A is a furnace; B, a draft-pipe entering the furnace, having in it a regulating valve B′, operated, as indicated in Figs. 1 and 2, by means of a valve-rod B^2 with a hand-wheel B^3.

C is a flue leading from the furnace A and surrounding the pot E, C′ indicating a platform in the center of the flue, and C^2 a gutter surrounding the platform and having, as indicated, an opening C^4 leading through its wall C^3, through which any fluid deposited in the flue can escape.

D indicates a smoke-conduit leading to the stack through which the gases escape from flue C.

E is a pot which, as shown, is especially intended to contain molten lead and is formed with a laterally-projecting extension, as indicated at E′.

F F indicate standards, to the tops of which is pivoted the oscillatable shaft F′, to which in turn is secured, by means of a laterally-projecting annulus F^2, a tube F^3, connecting at top with the second tube F^4, with the other end of which connects a tube F^5, having a closed end, as indicated at f^5.

F^6, F^7, and F^8 indicate a system of interior tubes, the end f^8 of the tube F^8 being opened.

f^6 indicates a valve in the pipe F^6, and F^9 indicates an escape-pipe leading from the bottom of the pipe F^3, F^{10} indicating a weight

[redacted]

kept hot by means of the furnace A and flues C, the end of the pipe I is heated to the same temperature as the lead-bath, and the observer looking into the pyrometer sees the color corresponding to the heated end of the pipe I through the chamber k^8 and compares it with the standard colors of the light transmitted from the chambers K^8. If the temperature of the lead-bath is too high, the operator can lower it by actuating the cooling device, the controlling-wheel G^3 of which is within easy reach from his observing position. He can also control the temperature of the lead-bath by the hand-wheel B^3, controlling the blast-valve B', and by one or both of these devices is able very promptly to bring the temperature of the lead-bath to the desired point, at which the color of the heated pipe will be the same as that of the light emitted from the lamp or lamps. The heated tool can then be plunged into the lead-bath and rapidly cooled to but not below the temperature of said bath. Obviously, also, a tool may be heated in the same way.

In the modified form of apparatus shown in Fig. 15, the pyrometer box or tube is indicated at M, the sight-opening at *c'*, and at the same point the tube is accessible by means of a lateral opening *c*, through which a heated tube or other object, as indicated at U, can be inserted and held by means of tongs Q alongside of the incandescent electric lamp O, by which the light is generated, Z indicating a rheostat, by means of which the current transmitted through the filament of the lamp can be varied at will with a consequent variation in the color and intensity of the light emitted from the filament. As in the other modification of the invention, so, also, in this instance a convenient way of determining the temperature of a heated object is thus furnished by varying the color and intensity of the light emitted from the filament until it coincides with that of the object, the relationship of the current to temperature having been previously determined.

The primary feature of our new pyrometer lies in the construction by means of which emitted colored light is directly compared with the colored light due to the temperature of the object under observation, and it will be clearly understood that in this feature our pyrometer differs radically from previous pyrometers in which temperature has been ascertained by means of a comparison of light intensity as distinguished from colored light, our apparatus depending, primarily, on the comparison of color, though light intensity is also observed and compared.

As already stated, the closed-ended-tube feature of our pyrometer is in itself a valuable means for observing the temperature of heated chambers and receptacles. Thus in Fig. 14, *e* indicates an annealing-furnace having openings *e'*, and P is a metal body under treatment. When it is desired to ascertain roughly the temperature of the furnace, the closed-ended tube I is inserted, as shown at the left of Fig. 14, and the observer placing his eyes in the eyepiece I^3 sees the color corresponding to the heat of the furnace. If the heat of the metal P is to be ascertained, the end of the tube I is brought in contact with it, as shown at the right of Fig. 14. In using the tubes in furnaces it is advisable to cover their sides with non-conducting jackets, as shown at *i*.

In order to secure uniformity throughout the mass of heated lead, it is desirable to keep the molten lead moving inside the pot by artificial means. Therefore an agitator driven by any suitable driving mechanism is shown in Figs. 1 and 2, consisting of a shaft S, extending from the driving mechanism above and outside of the lead-pot down into the lead and having on its lower end a propeller *p*. When this shaft, with its submerged propeller, is rotated at sufficient speed, the lead in the pot is kept moving from one part of the pot to another, and in this way its temperature is equalized throughout the mass.

Having thus described our invention, what we claim is—

1. An optical pyrometer for gaging the temperature of a substance, comprising a light-emitting standard adapted to become incandescent simultaneously with said substance and incandescent to a degree corresponding to the incandescence of said substance when heated to the desired temperature, means for bringing the standard to the said degree of incandescence, in combination with a tube through which the substance and standard may be simultaneously viewed.

2. An optical pyrometer for gaging the temperature of a substance, comprising a light-emitting standard adapted to become incandescent simultaneously with said substance and incandescent to a degree corresponding to the incandescence of said substance when heated to the desired temperature, in combination with a tube through which the color and intensity of the light-rays emitted by the standard and substance are brought simultaneously to the eye of the observer.

3. An optical heat-gage having an optical standard so located with respect to the line of vision through the instrument as to permit of direct comparison of the standard and the substance whose heat is to be determined.

4. An optical heat-gage having an incandescent standard so located with respect to the line of vision through the instrument as to permit of direct comparison of the standard and the substance whose heat is to be determined.

5. A heat-gage consisting of a tube through which an object to be tested may be viewed, an incandescent electric lamp located in said tube, and a rheostat in the circuit of the lamp to change the degree of incandescence of the filament.

6. In a heat-gage, the combination with a

tube, of a filament located directly in said tube, a source of electricity, a circuit therefrom including said filament, and means in said circuit for varying or maintaining the current through the filament, whereby its degree of incandescence may be varied or maintained.

7. An optical heat-gage having an optical standard consisting of a substance whose degree or nature of incandescence is dependent upon the temperature to which it is heated and so located in the apparatus as to permit a direct comparison of its incandescence with the incandescence of the substance to be tested or gaged.

8. An optical heat-gage having an optical standard consisting of a substance whose degree or nature of incandescence is dependent upon the temperature to which it is heated and so located in the apparatus as to permit its incandescence to be viewed in the direct line of vision of the substance whose heat is to be tested or gaged and a direct comparison of the incandescence of said standard and substance to be made.

9. In an apparatus for gaging the temperature of a substance, a standard adapted to become incandescent to a degree corresponding to the incandescence of said substance when heated to the desired temperature, said standard being so located with respect to the line of vision through the apparatus as to permit a direct comparison of its incandescence with the incandescence of the substance to be tested or gaged.

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