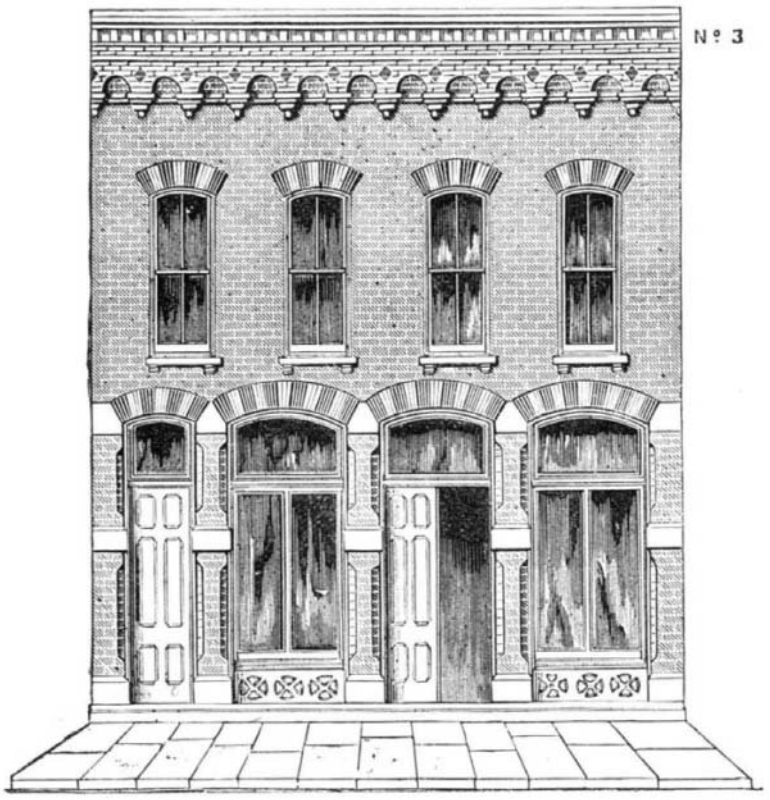
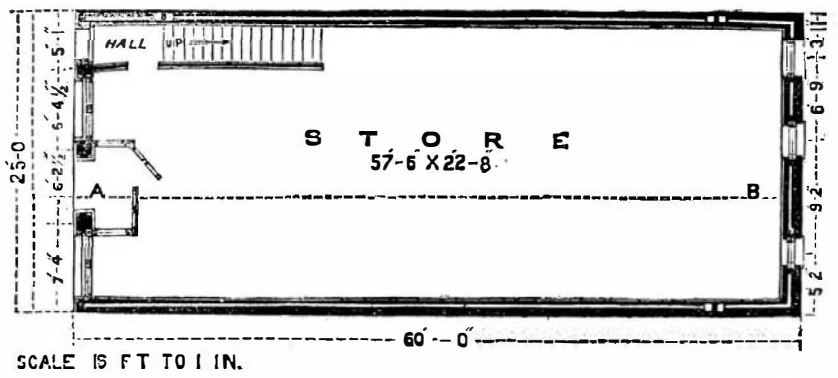
THE HOMES OF THE WORKING CLASSES.

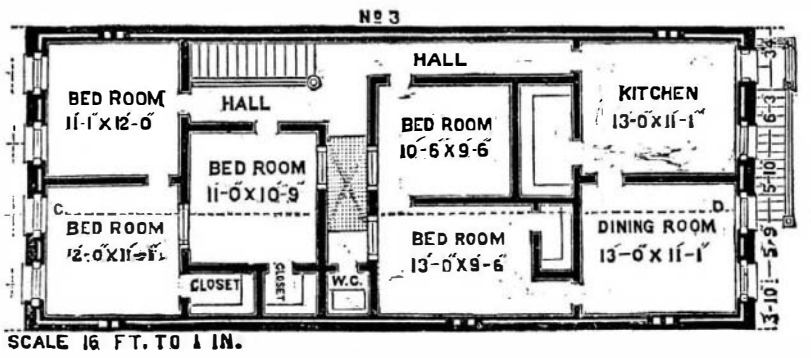
There is little doubt that, in many of our large cities, building houses for the wealthy has been overdone; and it would be fortunate for New York if the capital invested in hundreds of blocks of many-storied mansions, fit only for men of large fortune, could be recovered and devoted to the erection of dwellings for persons of moderate means. It is better to build houses worth $600 or $700 a year, and readily find tenants or purchasers, than to have a square mile of empty palaces on hand, and to mortgage them to pay the taxes. The city of Philadelphia is noticeable for the large number of convenient houses of moderate pretensions which are to be found in all its wards; and the mutual help principle has done much to encourage the development of such investments, the Quaker City having 500 or more building societies and loan associations. In 1874 there were built in Philadelphia 4,439 houses, under the auspices of the loan associations; and during the past four years 19,120 were put up—11,162 being two-story or less, 7,831 three-story, and 127 four-story. Boston, with half the population, erected in the last few years more than one fifth fewer than Philadelphia. But the separate home system, as exhibited in the buildings of the Quaker City, is being extensively copied.



No 3

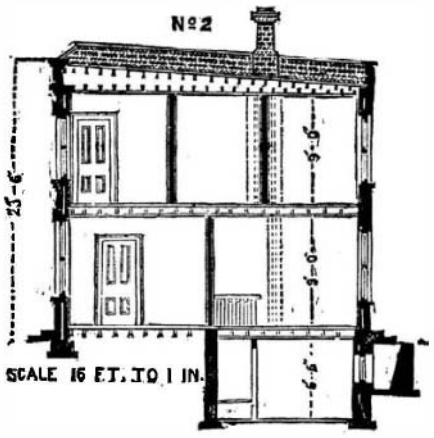


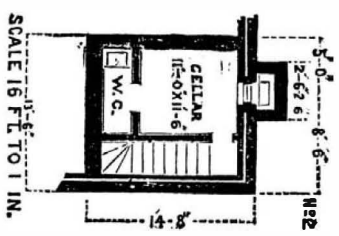
No 3



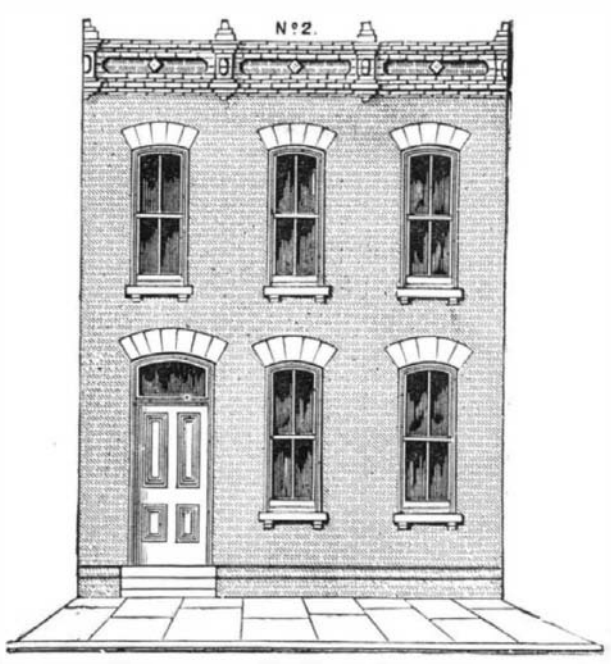
PRIZE PLANS OF A TWO-STORY DOUBLE FIREPROOF HOUSE, WITH STORES, TO COST $3,600.

No 2



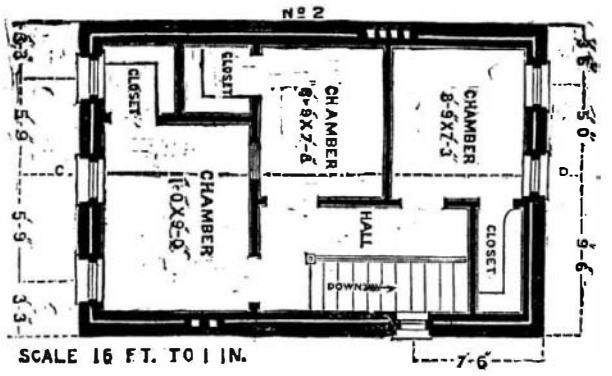


No 2

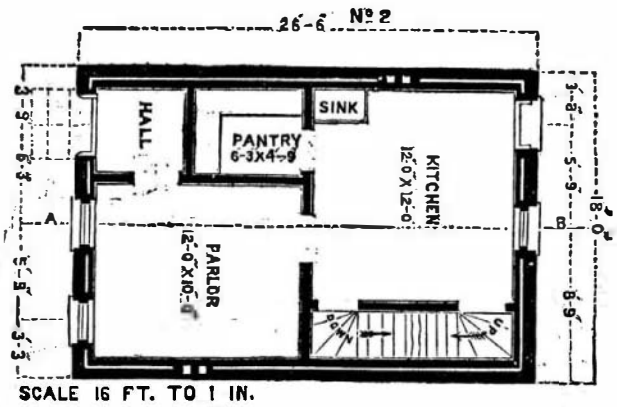


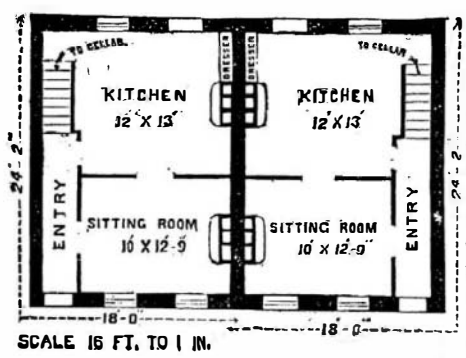
PLAN OF A TWO-STORY BRICK FIREPROOF HOUSE TO COST $1,700.

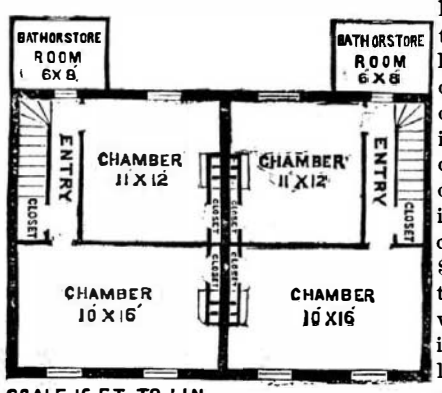
No 2



No 2

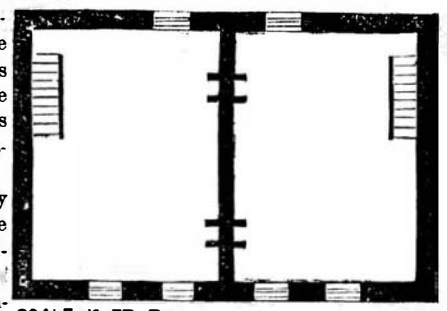




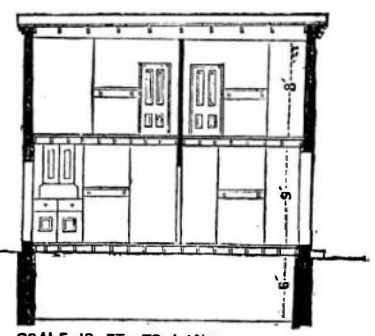


It will be well when every large city is fringed with such residences. During the last ten years the Merchants', Farmers', and Mechanics' Savings Bank of Chicago has had from a quarter to half a million of dollars constantly loaned out on mortgage in the city of Chicago. At the time of the great fire its loans in the city amounted to $240,000. Forty buildings, on which, with lots, it had made loans, were destroyed, but as the lots without the buildings were worth more than the amount loaned on each independent of the buildings, the bank did not lose a dollar. The loans were mostly to depositors in the bank, and the buildings were mostly cottages. After the second fire, a city ordinance was passed, prohibiting the erection of wooden buildings within the limits of the city. Many depositors in the bank found themselves possessed of lots which, by reason of the increased cost of building brick outer walls, they were unable to utilize. The usual proportion of money loaned by the bank on lots was not sufficient to erect buildings of a construction permitted by the fire laws. Yet mere brick walls, without secure roofs, floors, ceilings, etc., were believed to be but little better as security for money loaned than the same buildings with wooden exterior walls. For the purpose of ascertaining how cheaply, approximately, fireproof buildings adapted to various classes could be obtained, the Merchants', Farmers', and Mechanics' Savings Bank, on the 15th of October, 1874, published a circular offering a prize of $1,000 for the best set of plans and specifications for a dwelling of not less than five rooms, and a capacity of not less than 5,500 cubic feet, and of a store and dwelling combined, for use on such thoroughfares as Archer and Milwaukee avenues, to contain not less than 30,000 cubic feet of space, with price and proposals to build one or fifty of either or both buildings. More than thirty sets of plans and communications were received previcus to January 1, 1875. A committee examined these plans and made an award of the prize to A. J. Smith, architect and contractor, of 338 West Randolph street, Chicago, for plans of a one-story house, 20x43, cost $1,200;, a two-story house, 18x26, cost $1,700; and a two-story store and dwelling, 22x57, cost $3,600. We have already described and illustrated some portions of Mr. Smith's system, but the importance of the matter induces us to give here complete details and illustrations.

NEW STYLE PHILADELPHIA FIREPROOF HOUSE.



The one story dwelling house is a brick building, 42x20, five rooms, consisting of parlor, 13x12, dining room, 13 feet 5 inches x 16 feet 6 inches, kitchen, 10x10 feet 6 inches, and two bedrooms, 10x6 feet 6 inches each. The hight of each room will be 10 feet in the clear between floor and ceiling. An important feature in this plan is that,



MODEL FIREPROOF DWELLINGS FOR WORKING MEN

should a fire occur in the front room of the building, the rear portion may be preserved intact, and *vice versâ*. The outside walls are hollow from foundation to roof. The floor, beams, and rafters are wood, protected from fire by concrete one and one half inches on the ceilings and underneath the floors, and the roof is covered with tin on the top of the concrete. Thorough ventilation is provided by flues adjoining the fire flues, and topped out in the chimney. There is an air space ventilated underneath the ground floor, preventing dampness from arising; and there is also an air space ventilated between the ceilings and roof, to prevent the heat of summer from affecting the rooms. The fire flues will be lined with burnt clay pipes, eight inches square, to prevent fires from defective flues. There will be a drain pipe, connected with sinks and closets, and with main sewer, to carry off all surface water, slops, etc.

The two-story dwelling is a building 26 feet 6 inches x 18 feet, with five rooms, two on the ground or principal floor, and three on the upper floor, the sizes of which are: Parlor, 12 x 10; kitchen, 12 x 12. The three upper rooms are for bedrooms, the sizes of which are, respectively, 11 x 9, 8 feet 9 inches x 7 feet 9 inches, and 8 feet 9 inches x 7 feet 9 inches.

This building has a cellar for coal and wood, and fitted up with water closet. The size of cellar within walls will be 12 x12. The upper story will be 9 feet in hight, and the principal story 10 feet; the cellar 6 feet 6 inches.

The building with store and dwelling combined is 25x59. The entire principal story is occupied with store room. The upper story is divided into seven rooms, consisting of two parlors, 11x12 each, bedroom, 11 feet x10 feet 6 inches, bedroom, 13 feet x 9 feet 6 inches, bedroom, 10 feet 6 inches x 9 feet 6 inches, kitcben, 13 feet x 11 feet 1 inch, dining room, 13 feet x 11 feet 1 incb.

Four model brick buildings are now being erected on Sacramento street, and will be known as Sacramento terrace, besides seventeen others in very desirable sections of the city. The exterior walls are hollow, one being eight inches thick, the other four, with a space of three inches between. The shells are tied together with wrought iron bolts. All rafters and floor beams are protected from above and below by artificial stone plastering one and a half inches thick,and no wooden lathing or furring is allowed. Each house is furnished with a bath room, and also a white stone front stoop, stone sills, and terra cotta caps. The façades are painted, and the brick cornices and water pipes are brought into relief by having a darker coating. The purchaser is required to pay down a given sum at the time of purchasing, and can then give a mortgage for one half the entire amount, and pay the remainder in monthly instalments. Over fifty acres of ground have been bought near the West Side Parks, upon which houses of these general plans will be erected.

One of the most striking features of these buildings is the fireproof plastering, which is applied as follows: A twelvepenny nail is driven into bottom of joist, less say three fourths of an inch, every three or four inches; an endless strand of strong wire is then wound once around the head of a nail, and passes from one to the other. A movable platform is then built, the top surface of which is one and a quarter inches from lower line of ceiling joist. This concrete material is then put in from top of joist on to platform, say from one and a half to two inches in thickness. As soon as the plaster sets, the platform is lowered, moved along, and readjusted, etc. A man weighing two hundred pounds has walked and stamped on this plastering in thirty minutes after it has been put on. By a little different method of applying the wire, and arranging the strands half an inch apart, it can be plastered in the ordinary way from the under side.

The composition, when put in from the top, is as follows: About one half cinders, crushed furnace slag, or brick bats; one fourth ordinary good plastering hair mortar; and one fourth coarse, strong plaster of Paris. It will be observed there is no plastering from the underside, except putting on the hard finish—the platform forming the surface to receive the hard finish.

This is considered, to all intents and purposes, a fireproof plastering, and would, in all ordinary cases, prevent fire from communicating with the joist.

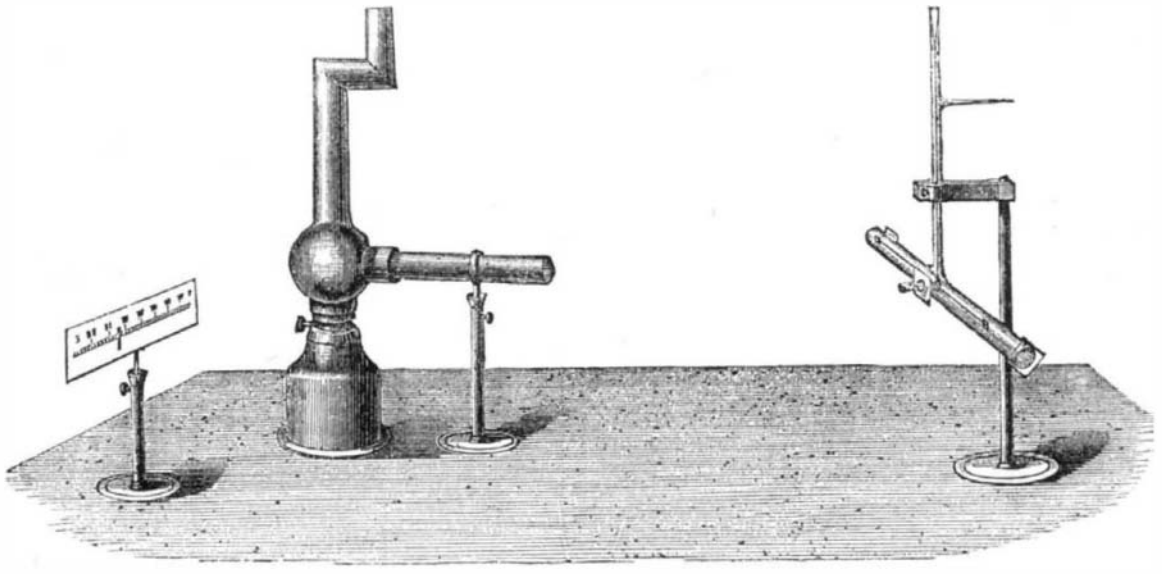
Lining Boilers with Copper.

M. F. Pupka, a Viennese engineer, gives the following facts regarding experiments in lining steam boilers with sheets of copper in order to hinder incrustation: Of the three plates which formed the bottom of a locomotive boiler, the two at the ends were covered with a sheet of copper 0·04 inch in thickness, the middle one being left bare. The machine was used steadily for two years and in districts where the water is of excessively bad quality. On removing the tubes recently a layer of incrustation 4 inches thick was found on the iron surface, while a deposit varying from only 0.08 to 0.12 inch thick appeared on the copper. The iron also was corroded in many places to a depth of 0·02 inch, but the copper had remained perfectly clean and bright. The texture of the incrustations showed larger grains on the iron than on the copper.

THE RADIOMETER.

We have already mentioned the important invention, by Professor Crookes, of a motor actuated by solar light radiation, exhibited at a recent *soirée* of the Royal Society, London. We give herewith illustrations of this wonderfully sensitive machine.

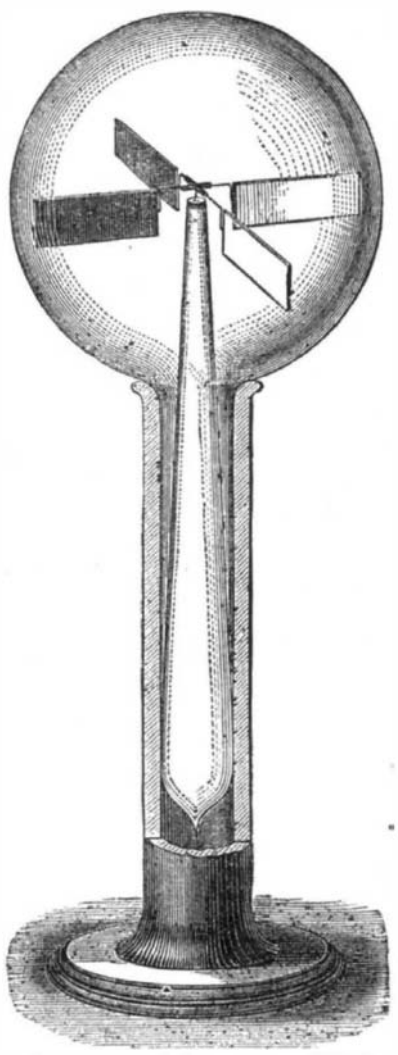
Mr. Crookes began by stating that, in the paper which he had previously read to the society, he had made known how a lever arm of pith, delicately suspended in a very perfect vacuum, was repelled by the impact of light or radiant heat. A great condition of success in the experiments was to work with the highest possible rarefication; consequently the lever arms were suspended in glass bulbs from which the air had been exhausted by means of the Sprengel pump, which gives a far more perfect vacuum than can be obtained by the use of any other apparatus. Until these experiments were made it was supposed that light had no action upon a lever arm of small ponderosity suspended in vacuo. Indeed, the circumstance that light could not turn a lever arm so suspended has been quoted in standard scientific text books, by Dr. Balfour Stewart and others, as one point in the long chain of evidence against the truth of Newton's emission theory of light.



PROFESSOR CROOKES' RADIOMETER.—Fig. 1.

Mr. Crookes has since exhibited a bar of pith suspended by a cocoon fiber in a large glass bulb very well exhausted. When a lighted candle was placed about 2 inches from this bulb, the pith bar began to swing to and fro, the swing gradually increasing in amplitude until the dead center was passed over, when several complete revolutions were made. The torsion of the suspended fiber then offered resistance to the revolutions, after which the bar began to turn in the opposite direction, and so on alternately. These movements were kept up with energy and regularity so long as the candle continued to burn. When instead of a candle a piece of ice was placed near the bulb, one end of the lever arm came toward it as if attracted; but the truth was, as explained by Mr. Crookes, that radiant heat was acting upon the pith bar from all parts of the room, and that the presentation of the piece of ice lowered the radiation on one side; consequently the movement was really caused by repulsion from the opposite direction.

Fig. 2.



In order to measure some of these effects, Mr. Crookes uses a piece of tubular glass apparatus in the shape of an inverted T, Fig. 1, containing a horizontal glass beam, suspended by a very fine glass thread. At the extremities of the beam were attached the substances to be subjected to experiment. In the center of the beam was a small mirror, from which a ray of light was reflected on to a graduated scale, just as in Sir William Thomson's reflecting galvanometer. Thus the amount of repulsion produced could be measured. The advantage which a glass thread possesses over a cocoon fiber is that the index always goes back to zero. The fiber used to suspend the arms are so excessively fine that, when the end of one of them is held in the hand, the fiber usually curves upwards like a cobweb until the other end of it floats almost vertically in the air.

As the vacuum becomes less perfect, the repulsion grows less, until at last the neutral point is reached, where there is no action at all. If still more air be then admitted, attraction instead of repulsion sets in. The barometric pressure of the neutral point varies with the density of the suspended substance on which the radiation falls; it varies also with the ratio of its mass to its surface, and with several other conditions. Thus the neutral point for a thin surface of pith being low, while that for a moderately thick piece of platinum is high, it follows that, with a rarefication intermediate between these two points, pith will be repelled while platinum will be attracted by the same power of radiation. Mr. Crookes proved this experimentally, by showing simultaneous attraction and repulsion by the same ray of light.

When these experiments were first made known, some of the observers tried to account for the effects by the assumed action of feeble air currents or of electricity, but both these hypotheses were considered by Mr. Crookes to be abundantly disproved. Professor Osborne Reynolds suggested that the movement might be due to evaporation and condensation at the surface of the suspended body. Mr. Crookes had a thick and strong bulb blown at the end of a piece of difficultly fusible green glass, specially made for boiler gages. In it he supported a thin bar of aluminum at the end of a long platinum wire, the upper end of which wire was passed through the top of the tube and well sealed, for electrical purposes. The apparatus was sealed by fusion to the Sprengel pump, and the exhaustion was kept going on for two days, until an induction spark refused to pass across the vacuum. During this time the bulb and its contents were several times raised to a dull red heat. At the end of the two days' exhaustion, the aluminum bar was found to behave in the same manner as, but in a stronger degree than, it would in a less perfectly exhausted apparatus, namely, it was repelled by heat of low intensity and attracted by cold.

The most remarkable of all the facts made known by Mr. Crookes was an apparent difference between the action of radiant light and radiant heat. At the highest exhaustions, dark heat appeared to act almost equally on white pith and on pith coated with lampblack, repelling either with about the same force; but strange to say, the luminous rays repelled the black surface with more energy than the white one. This is all the more remarkable because, light being reflected from a white surface, it might have been supposed that the consequent rebound would have repelled the white surface more than the black one.

The apparatus is shown in Fig. 2, and consists of four arms suspended on a steel point resting on a cap, so that the arms are able to revolve horizontally upon their central pivot, just the same, in fact, as the arms of an anemometer revolve. To the extremity of each arm of straw, in the apparatus made by Mr. Crookes, is fastened a disk of pith, white on one side and black on the other, the black surfaces of all the disks facing the same way; the pith disks are each about the size of a sixpence. The whole arrangement is inclosed in a glass globe, which is then exhausted to the highest attainable point and hermetically sealed.

This arrangement rotates with more or less velocity under the action of light. With one of the instruments, the arms revolved once in 182 seconds when a candle flame was placed at a distance of 20 inches. When the same candle was placed at a distance of 10 inches, one revolution in 45 seconds was the result; and at 5 inches, one revolution was given in 11 seconds. Thus it will be seen that the mechanical effect varies almost exactly inversely with the square of the distance, so that the theory and the experiment coincide as to their results.

In these experiments Mr. Crookes had to be very careful to guard against the effects of undesired radiation. The lighted sun burners of the roof of the hall of the Royal Society interfered with some of the results, and a candle placed incautiously near his bulbs would send the contents of some