A LENS WITH VARIABLE FOCUS.

The human eye has frequently been compared with the camera obscura, and in many respects this comparison serves to illustrate the formation and action of the eye; but one of its most sensitive members, the crystalline lens, is so far superior to all instruments that can be produced, that all attempts to illustrate its nature and functions by means of instruments have so far been in vain. The camera is only adapted to clearly produce the images of objects when they are within certain limited distances governed by the nature of the lens, whereas images are produced in the human eye with the greatest clearness, independently of distances. This property is due to the crystalline lens, which, under certain influences which we cannot examine here, changes its form and produces greater or less deviations in the directions of the pencils of luminous rays that enter the eye.

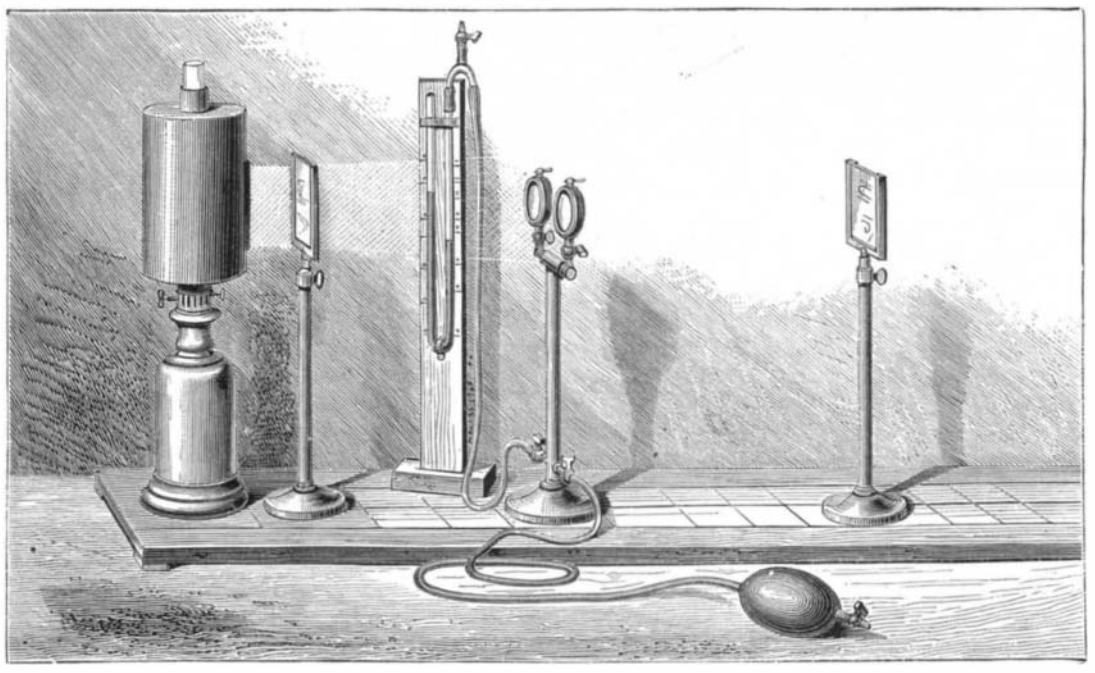
Dr. Cusco, who has occupied himself very extensively with ophthalmology, has invented a lens with variable focus which beautifully shows the action of crystalline lens. A metal ring of a suitable thickness is mounted on the top of a hollow standard, and two disks of glass are secured in the ring, one at each edge, with tight joints. The hollow disk thus formed is filled with water or some other transparent liquid, and the hollow standard is connected with a small reservoir that can be conveniently raised or lowered, as may be desired, or with a rubber syringe bulb connected by means of flexible tubing.

The reservoir must be adapted to be raised or lowered so as to permit of varying the pressure of the liquid in the apparatus. In this case two rings, or double disks, are shown, but they are provided with cocks so that either can be shut off from communication with the rest of the apparatus. The apparatus is connected with a siphon pressure gauge, filled with water or mercury. If the pressure gauge indicates zero the pressure in the apparatus and between the glass disks will be equal to the pressure of the exterior air, and the glass disks will remain plane, simply forming a refractive disk with two surfaces, which cannot produce any variation in the divergence and convergence of the pencil of light that traverses it; so that if a real image of a luminous object is produced on a screen by means of another lens, and the above described disk or water lens is interposed so as to cause the rays of light to traverse it, the clearness of the image will not be impaired; but if the pressure of the water in the apparatus is increased, the disk of glass will swell outward under this pressure, and the two disks will form a double-convex lens, which produces an augmentation of the convergence of the rays of light, and thereby destroys the clearness of the image on the screen. The changes of the pressure may be very minute, for the instrument is so very sensitive that the least compression of the rubber bulb, which corresponds to the most feeble variation of the pressure, will produce a change of the focal distance. But the experiments with this interesting instrument do not end here, for a concave lens can be produced in a similar manner. If the pressure gauge indicates zero, the rubber bulb or the reservoir is lowered and consequently produces a vacuum between the two disks, so that the pressure of the outer air presses them inwardly, forming a double-concave lens. This lens will diverge the rays of light and cause the images obtained by another lens to appear more distant.

This apparatus is very well adapted for obtaining and making lenses of a certain power. Each model is specially graduated according to the thickness of the glass used, its nature, the manner in which it is secured in the ring, etc., as all this influences the action of the pressure of the water.

It is necessary to determine directly the focal distance that corresponds to a certain given pressure. The method of doing this is represented in the engraving, which we take from *La Nature*.

In a dark chamber an opaque cylindrical hood, provided with a longitudinal slot, is placed over a lamp in such a manner that the rays of light can only pass through the slot, and are thrown upon a screen of ground glass, upon which graduated lines are drawn. Another similar screen is placed upon a standard provided with a scale, and the variable lens is placed in the middle between the two screens. The pressure in the variable lens is equal to the ordinary air pressure. A lens of known strength which produces a real image on the second screen is added to the combination. Then the lens and the second screen are gradually moved from the lamp, but always in such a manner that the lens is midway between the screens, until an image of the figures on the first screen is seen clearly on the second. The pressure of the water in the variable lens is then gradually increased until this lens produces a clear and exact image on the second screen. The subdivisions on the lines of the screens permit of comparing the sizes of the images very accurately.

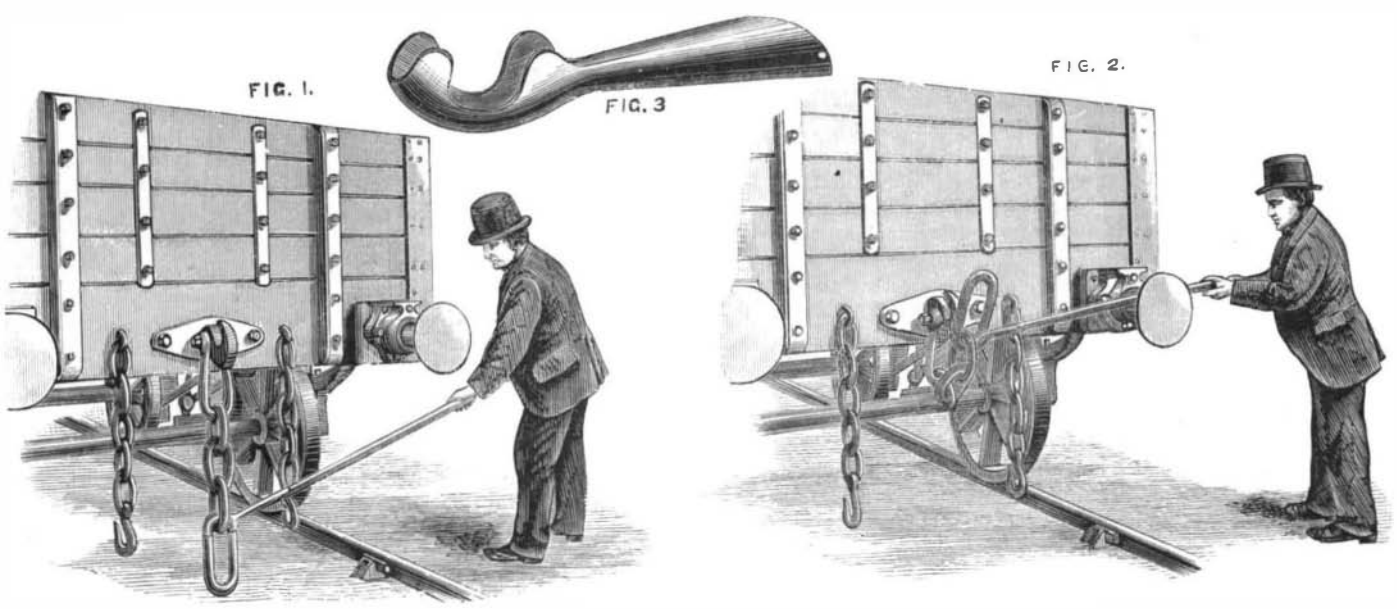


DR. CUSCO'S LENS WITH VARIABLE FOCUS.

NEW COUPLER.

During the past few years attention has been prominently directed to the dangers attending the coupling and uncoupling of railway trucks in shunting operations, and a good deal of ingenuity has been expended in devising means of diminishing this risk. The inventions which have been produced for this purpose may be broadly divided into two classes; namely, first, those in which the ordinary couplings are replaced by automatic appliances, which couple the trucks on the latter coming together; and, second, those which consist of appliances by means of which the ordinary couplings can be connected or disconnected without the necessity of a man going between the wagons for the purpose. As regards inventions of the first class, they are open to the objection that, however efficient they may be, they involve extensive alterations of rolling stock, and a large expenditure, which railway companies are little disposed to undertake, while, moreover, they also involve for their efficient introduction something like a concerted action between different railway companies and wagon owners—a most difficult thing to secure. Even for this latter reason alone appliances of the second class are far more likely to find favor.

These appliances of the second class above mentioned, may, in their turn, be divided into two sub-classes, the first comprising appliances fixed to the wagons (and some efficient arrangements of this kind have been devised), and the second comprising portable appliances to be carried by the men engaged in shunting operations. Mawlam's railway truck coupler, the illustration of which we take from *Engineering*, belongs to this last-named class. It consists simply of a light wooden handle, having mounted on it an instrument of the form shown in Fig. 3 of the annexed engravings, this instrument enabling an ordinary coupling link to be effectively grasped. The mode of using the instrument will be at once understood from an inspection of Figs. 1 and 2, but we may remark that many shunters prefer keeping the handle wholly below the buffers during the coupling operation instead of resting it upon the buffers, as shown in the last mentioned figure. Mawlam's coupler has now been in use about two years at the Northeastern yard at Stockton-on-Tees, England, and a shorter time at some other yards, and the testimony of the shunters using it is very strongly in its favor, both as to the rapidity and safety with which it enables the work to be done.



MAWLAM'S RAILWAY TRUCK COUPLER.

NEW INVENTIONS.

Mr. William R. Phillips, of Milford, Del., has patented an improvement in fruit driers, which consists in combining with slotted walls slides, cleats, and movable cross bars.

Mr. Gerhart Rauman, of Middletown, Conn., has patented a spring closer for doors, gates, and blinds, so constructed that it will close a door, gate, or blind however much or little may be opened.

An improved toy pistol has been patented by Mr. Henry S. Lockwood, of South Norwalk, Conn. The improvement relates to pistols having their barrels pivoted so that the breech may be swung upward to permit insertion of a cap or cartridge. The object of the invention is to dispense with the use of springs or catches for holding the barrel in place, and thereby simplify and cheapen the construction of the pistols.

Mr. Edward P. Haff, of New York city, has patented a double crochet needle formed of a tube, into each end of which a crochet needle is inserted. These needles may be fine or coarse, and may be replaced by others when desired and are inverted in the tube when not in use.

Mr. John McAnespey, of Philadelphia, Pa., has patented an improvement in ice cream beaters, which consists in a novel construction and combination of a vertical barred beater and an automatic scraper for removing the ice cream from the interior surface of the can.

Mr. Emil P. Raether, of New York city, has patented an improved bottle stopper especially adapted to bottles containing sirups, bitters, and other fluids used in restaurants

An apparatus for filling casks and bottles with lager beer or other liquid impregnated with air or gas under pressure, so constructed that the pressure may be regulated as desired and without wasting the liquid, has been patented by Mr. J. C. G. Hilpfel, of New York city.

A simple and efficient apparatus for extinguishing fires has been patented by Mr. Lewis A. Folsom, of Dalton, Ga. The invention consists of two barrels or other vessels, set one within the other, the outer one containing sulphuric or other acid, and the inner one carbonate of soda or other alkaline carbonate, and into the latter vessel a third vessel, containing gunpowder or other explosive, is introduced, the explosive vessel having a fuse or tube filled with powder connected with it and extending upward through the cover of the other vessels, so that fire applied to the tube or fuse will be communicated to the explosive in the interior vessel, and cause an explosion which will burst asunder the containing vessels, and thereby cause their contents to mingle, generating a sufficient volume of carbonic acid gas to extinguish the fire.