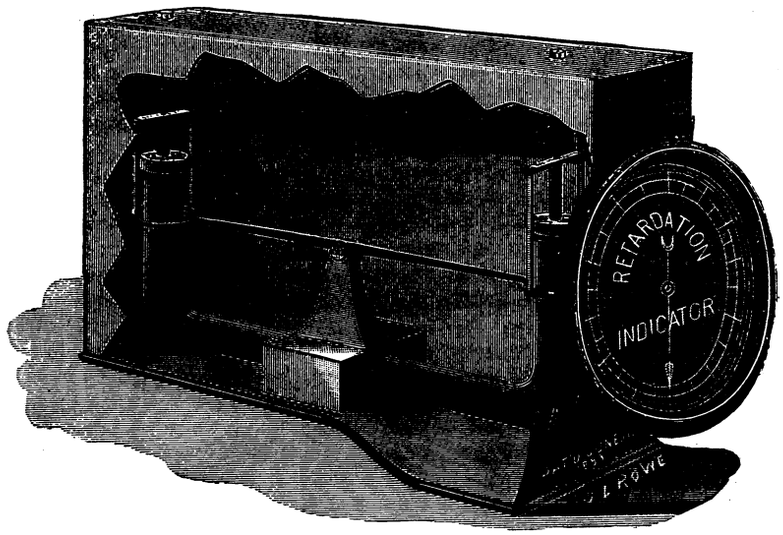
ARNOLD'S RETARDATION INDICATOR.

THE retardation indicator shown in the accompanying engraving is an apparatus intended to be placed in the cab of a locomotive, for indicating the relative measure of resistance exerted by the air-brakes when arresting the momentum of the train. By its use the person operating the brakes may be enabled to so regulate the steam or air pressure applied to the brakes as to prevent a too rapid stoppage of the train, and the consequent discomfort to the passengers.

The indicator consists of a tube, with upturned ends, arranged horizontally in the cab or car, the axis of the tube being parallel with the direction in which the train is to move. This tube contains mercury, which, as the train starts or stops, shows a difference of level in the upturned ends of the tube, governed by the rapidity of the starting or stopping, the change of momentum being proportional to the impulse producing it. Each end of the tube is provided with a freely moving piston, which rests upon the surface of the mercury. These pistons are attached to an arm which is pivoted in the centre, the pistons exactly balancing each other. Attached to an extension of this arm is a bevel-geared sector, which meshes into a pinion connected with the pointer on the dial-plate. When the train is at rest, or moving at uniform speed, the pointer remains at zero on the dial; but, when starting up or slowing down, the pointer moves around the dial, to the right or the left, a distance proportional to the rapidity of the starting or the stopping.



ARNOLD'S RETARDATION INDICATOR.

Among the advantages claimed for it are the following: it shows the engineer at any instant the effect of the brakes upon the wheels, and enables him to retard the train uniformly, regardless of the condition of the track or of the air-pressure; it economizes the air, and prevents an undue shock or strain on the brake-rigging or the car-body; and it enables the engineer to apply the brakes gradually, and with increasing effect, until the train is brought to rest. The indicator is manufactured by J. H. Reynolds of Troy, N.Y.

ELECTRICAL NEWS.

Incandescent Electric Lamp Filaments.

IN a recent communication to the Academy of Natural Sciences of Philadelphia, on the use of bamboo in incandescent electric lighting, Professor William P. Wilson states, that, for want of a homogeneous structure, the ordinary exogenous woods are not adapted to the construction of lamp-filaments. Such woods are made up of wood-cells of varying lengths and shapes in combination with a variety of ducts and vessels.

The walls of the wood-cells may be more or less thickened, the vessels and ducts may be larger or smaller, numerous or infrequent, according to the kind of wood examined. There are always enough of these vessels and ducts combined with the wood-cells in any stem to render the structure exceedingly heterogeneous. Most of these cells and vessels have their longer diameter parallel with the general direction of the stem. Groups of thin-walled, prismatic cells pass radially from the central portion of the stem to the circumference. These groups of cells are called medullary rays. It is impossible to cut a filament from any of these woods so that the medullary rays will not cross it many times at right angles to the ducts and long cells. The character of the cells forming these rays is so very different from the others in the filament, as to shape, direction, and thickness of the walls, that at the crossing points resistance is greatly increased, thus causing rapid burning and destruction at such points.

Such woods as hickory and rock-elm furnish the very best of our timbers. They are the toughest and most durable of our woods, but they do not make good filaments. The medullary rays are very numerous, and the walls of the cells composing them are greatly thickened. The long, pointed, thick-walled wood-cells do not follow a parallel course, but interlace with each other. This interlacing of the cells gives to these woods their toughness. It is the main characteristic, also, which renders them worthless when made into electric filaments. Upon carbonization of such filaments, the tension of the interlacing cells is relieved, and the tissues composing it become friable, and easily fall apart.

In the adult stem of the bamboo a combination of anatomical characters has brought about a result which makes it the most fitting material, so far as now known, for the electric filament. The nearly parallel fibro-vascular bundles grow more numerous as they approach the circumference of the stem, and, as is usual in similar stems, lose most, or sometimes all, of the woody elements, thus becoming pure bast. The parenchymatic tissue, which toward the centre of the stem may be composed of a layer of five or six cells between the bundles, decreases in amount near the circumference until but one layer of cells remains. The walls of the cells in this single layer often become so thickened, and at the same time compressed by the growth of the bast, that these bundles appear to make a solid zone of bast around the circumference of the stem. The bast-cells also continue to thicken their walls until they become, in the best specimens for the filament, completely filled and solid. It is from this zone of bast at the circumference of the stem that the filament is always taken. It is perhaps the nearest approach, in its continuity of structure and uniform character, to a metallic conductor, of any tissue which can be found in the vegetable kingdom.

Photographs of Lightning.

At a meeting of the Physical Society of London held June 22, and reported in *Nature*, Mr. A. W. Clayden presented a note on some photographs of lightning, and of "black" electric sparks. The lightning photographs, three in number, were obtained dur-

ing the storm on June 6. Two flashes, seen on one plate, show complicated and beautiful structure: one of them is a multiple flash, and flame-like appendages point upwards from every angle; the other is a broad ribbon, and, although the plate shows signs of movement, the displacement is not in a direction such as would produce a ribbon-like effect from a linear flash. The second plate shows four flashes, none of which are ribbon-like, though the camera had moved considerably. The third plate was exposed to six flashes, one of which was believed to pass down the middle of the plate; but, on development, only a triple flash in one corner of the plate was seen. Careful search, however, revealed the central flash as a dark one with a white core, and other dark flashes were subsequently found. The plate was very much over-exposed, and this suggested that black flashes might be due to a sort of cumulative action caused by the superposition of the glare from a white cloud upon the normal image of the flash. To test this, sparks from a Wimshurst machine were photographed, and, before development, the plates were exposed to diffused gaslight for a short time. The bright sparks yielded normal images with reversed margins, and the faint ones were completely reversed. Other experiments showed the reversal to spread inwards as the time of exposure to gaslight increased. Finally, reversal was effected by placing a white screen behind the spark, to represent a white cloud, the only illumination being that of the spark itself.

In the discussion which followed, Mr. W. N. Shaw exhibited a photograph taken during the same storm, which is particularly rich in dark flashes branching outwards from an intensely bright one. In some places the bright line has dark edges, and in one part a thin bright line runs along the middle of an otherwise dark portion of the flash. In answer to Mr. Inwards, Mr. Shaw said the plate was exposed about half a minute; and the former thought, that, under those conditions, the appearance of the plate did not contradict Mr. Clayden's hypothesis. Speaking of the same photograph, Professor Perry considered that Mr. Clayden's observations would explain the result, for a bright flash required more exposure to diffused light to reverse it than a faint one did. Professor Ramsay reminded the meeting that Professor Stokes's "oxides of nitrogen" explanation was still a possible one; and Mr. C. V. Burton asked whether they may be due to faint sparks cutting off light from brightly illuminated clouds, just as a gas-flame absorbs light from a brighter source. In reply, Mr. Clayden thought the "oxides of nitrogen" hypothesis improbable, and said his experiments did not enable him to answer Mr. Burton's question. As regards Mr. Shaw's plate, he believed the diffused light from the clouds would be sufficient to reverse the fainter tributary flashes, although it was insufficient to reverse the primary one. From data obtained when the ribbon-flash was taken, he had made some calculations which gave the height of the clouds about 1,000 yards, and the ribbon-flash 1,300 yards long and 100 yards wide.

PERMEABILITY OF IRON. — From experiments conducted during the last two years, J. T. Bottomley, F.R.S., finds that the permeability of iron can be enormously reduced by repeated heatings and coolings while undergoing magnetic cycles of small range.

AUTOMATIC ELECTRIC RAILWAY-LAMPS. — Mr. H. J. Dowsing, in a letter to the *Electrical Review* of July 12 (London), claims to have invented a lamp for train use. A penny is dropped into the apparatus, a handle half turned, and the light immediately shines forth; and without any arrangement of clockwork trains, springs, etc., the time is controlled and the light goes out at the end of half an hour. An advantage which perhaps could not be so easily managed by clockwork is, that one can arrange the apparatus to burn any time, from two minutes to say ten hours, by one half-turn of the handle.

HEALTH MATTERS.

Water-Supply of Paris.

THE Paris correspondent of the *Lancet*, writing in the issue for June 22, says that a great danger to visitors to Paris is due to the insufficiency of the water-supply. Paris is in a most unfortunate position. It cannot be said that the water-supply is bad. On the contrary, at immense cost, Paris has secured one of the best water-supplies enjoyed in any town of Europe. According to the last report, Paris was receiving 121,000 cubic metres of the Vannes water, 21,000 cubic metres derived from the Dhuis, and 5,000 cubic metres from the St. Maur springs, — in all, 147,000 cubic metres of pure and excellent spring-water. This, however, is not enough. The daily consumption is estimated at 158,000 cubic metres. The deficiency is not very great: still it is enough to compromise the whole town; for, when the store of good water is exhausted, the Seine water is provided, and this through the same channels and without warning. Thus, though a person may, as a rule, drink wholesome water, he will receive for a week or so, during the course of the year, water taken from the Seine, which is very likely to be contaminated. Again: a person may drink a glass of water in one quarter of Paris which is perfectly pure, while in another district he may, on the same day, get water that is certainly not free from the occasional presence of injurious organic matter. At the present moment, the supply of spring-water having reached a low ebb, the Seine water is turned on in four arrondissements. For twenty days these unfortunate districts are to receive only the Seine water; then three other arrondissements are to be served in the same way.

In the pavilion of the prefecture of the Seine, situated in the central court or garden of the exhibition, will be seen three glass tanks of water side by side. One receives the water of the Ourcq Canal, another of the Seine, and the third of the Vannes. The first two are more or less opaque, are of a green-yellowish tint, and vary more or less in aspect from day to day; but that which contains the water of the Vannes is always perfectly transparent, and never changes. Members of the Municipal Council have urged, so far in vain, that the water-supply should be increased. There are numerous projects, and recently a resolution was passed by the council, calling upon the legislative chambers to discuss at once the scheme for bringing the waters of the Avre to Paris.

That the Seine water may be dangerous will be obvious to all who are acquainted with the neighborhood of Paris. The intake for the supply is, of course, outside the town, and some little distance up the stream, but it is unpleasantly near the large manufactories of *poudrette*, or human guano. Also there are boats containing tanks which are filled with the contents of cesspools, and the manure is thus conveyed up the river to the works. A few years ago some scavengers, in their impatience to finish their day's toil, instead of conveying all the soil the barges contained to the works, simply threw a considerable portion over into the river. Fortunately this was discovered; and now there is a service of inspection organized both day and night, and careful watch is kept that these tank-barges should not again contaminate the water. But there are other causes of pollution, and it is an undeniable fact that many outbreaks of typhoid-fever in Paris have occurred about a fortnight after the substitution of Seine water for the usual and pure supply of water from the Vannes or the Dhuis. The question of water-supply is a very serious problem, which the French authorities should lose no time in settling.

THE NAPHTHA HABIT. — The *Medical Standard* calls attention to the growth of the "naphtha habit" among the female employees of rubber-factories. The inhalation of naphtha-fumes produces a peculiarly agreeable inebriation. Naphtha is used to clean rubbers, and is kept in large boilers, to the valve of which the female employees obtain access, and breathe the fumes. The habit was introduced from Germany, and is chiefly found in the New England States.

NOTES AND NEWS.

THROUGH the efforts of Dr. Filip Trybom, the Swedish Oyster-Culture Society is attempting to acclimatize the American oyster, imported from Connecticut, in several places along the coast of the province of Bohus. The young oysters seem to thrive well.

— The Victorian Government statist has published a return of the estimated population of the Australian colonies for 1888. In Victoria the estimated population on Dec. 31 last was 1,090,869; New South Wales, 1,085,356; Queensland, 387,463; South Australia, 313,065; western Australia, 42,137; Tasmania, 146,149; New Zealand, 607,380; making a total of 3,672,419 for the whole