

such work since it was erected in Staples. The number of killed in this case, and the distressing condition of some of the families left, are strong arguments in favour of some plan being devised for the prevention of boiler explosions.

The jury, in their verdict, said: "We would earnestly recommend that users of steam should be compelled by law to have their boilers thoroughly tested at least once a year, and that some law enforcing a system of examination for engineers of stationary engines should be enacted and certificates granted to those passing such examinations, proving themselves competent to take charge of engines, and that a penalty be imposed upon any person assuming the charge of an engine who had not a certificate."

THE ACTION OF THE FLY WHEEL.

A fly wheel acts solely by its inertia. While the engine is up to its speed, the fly wheel is absorbing power. Any sudden and momentary tendency of the engine to increase its speed is counteracted in great measure by the fly wheel, which if heavy enough and of sufficient diameter, absorbs nearly all the excess, paying it out gradually until its normal speed is again reached; thus making of what might otherwise be a running away or racing, only a slight gradual increase of speed, followed by a gradual decrease to the normal amount, if the conditions remain normal. In the same way any sudden and momentary tendency of the engine to slow up would be met by the fly wheel by a giving out of momentum; so that what might be a very considerable momentary slowing up, is changed to a very slight and gradual decrease of speed, followed (if the conditions are restored to their normal state) by gradual return to the normal speed. In other words the fly wheel acts as a store house of power. Its inertia causes it to oppose any tendency either to slowing up or speeding up. The greater the weight of fly wheel rim for a given diameter and rotation speed, the heavier the rim for a given diameter and rotation speed, and the faster the rotation speed for a given rim weight and diameter, the more efficient it is in keeping the rotation speed uniform; so that where there are expected great variations of pressure or of load, or where great regularity is intended, it is only necessary to sufficiently increase either the rim weight, the diameter, or the rotation speed.

It must be remembered that a fly wheel can take off only momentary variations in pressure or in load. It only distributes through many rotations an excess of power that would be inconvenient if used up during a few; or stores up in retaining the regular rotation speed, enough power to keep the engine going for a few turns at nearly the regular speed, in case of momentary increase of load or decrease of pressure or of load. If the load were taken off and the pressure kept up, or the load kept the same and the pressure doubled, the engine would run away and probably wreck itself, despite the fly wheel; and *vice versa*, if the load were doubled and pressure not increased, or if the load remained the same and the pressure fell to one half, the engine would slow down, fly wheel or no fly wheel.

SOME OF THE TROUBLES OF MANUFACTURERS OF INCANDESCENT LAMPS.

WE suppose it will be conceded that every trade has its troubles and every manufacture its difficulties, and that these conditions govern to no small extent the selling price of the commodities; those who vehemently complain of the price they have to pay for their incandescent lamps will do well to bear in mind this platitude. There is scarcely any manufacture that could be instanced in which there is more loss from what may be termed "spontaneous" breakage. Finished lamps apparently well made and of the best material will for no very obvious reason crack without having been subjected to any shock or blow. Manufacturers of incandescent lamps always expect a reasonable amount of loss from breakage, but when a certain limit is exceeded some special cause is generally suspected to be operating, such as carelessness in the glass-blowing department, imperfect annealing, &c. Lamp-bulbs may exhibit this spontaneous cracking as a rule in three *loci*:—1. Where the platinum wires are sealed in. 2. Where the "stem" carrying the wires and carbon filaments is joined to the bulb proper. 3. Where the exhausting tube is sealed on at the apex of the bulb. Now in addition to the internal stresses existing in any such class of work, the lamp bulb when finished is subjected externally to the full atmospheric

pressure, and in, perhaps, the majority of lamps in use, the bulb is subjected to sudden heat stresses due to the instantaneous turning on of the current. This combination of stresses being considered, it is evident that differences in the glass used for the bulb and "stem," and consequent differences in the values of the coefficients of expansion will become of special importance; although in the case of ordinary glass-work subjected to no particular stress, such differences would be negligible. Glass blowers know by experience that similar grades of glass should be used together, but they are skilful enough to be able to work up grades of glass differing in composition far more than is permissible in incandescent lamps. Dr. Durand Woodman has had his attention called to this matter by an American firm of incandescent lamp makers, and he was able to investigate the character of the glass at a time when a percentage of spontaneous breaking was abnormally high, whilst every care in making up the lamps, in annealing, &c., was unavailing. A number of samples of glass rod and tubes used in making the bulbs were examined chemically. From the results Dr. Woodman concluded that the high spontaneous mortality was caused by using different grades of glass in making the lamps. The lesson to be derived from this investigation is obviously that it is desirable to use the same glass in every part of a lamp, or at least glass of practically the same composition. It has been asserted that some glasses of different composition may have similar coefficients of expansion, owing to the constituents compensating each other's effect, but the determination of this characteristic involves problems connected with the coefficient of expansion, which after all are unnecessary trouble, since it is a simple matter to obtain glass of practically the same composition for all parts of a lamp, or for any other complex glass-work.—*London Electrical Review*.

PLAYING CHESS BY TELEPHONE.

LAST December two chess clubs, one in London and the other in Liverpool, played a match game of chess by telephone. The distance between the two cities is about 200 miles. The telephone company arranged to have the receivers and transmitters connected with a direct wire between the two clubs, and stationed in the club room at each end. The success was perfect. As each move was made on the chess board it was at once telephoned to the other club, and the two games proceeded without any hitch or interruption. Several hours were consumed in the games, and when they were concluded every one was congratulated on the success of the experiment. Chess playing is a recreation which is peculiarly adapted to electricians, and many of them are good players and members of chess clubs. One reason why there have been so few team matches between different clubs has been the difficulty of gathering a team which could spare the time and expense involved in inviting another city to play the match. But the telephone affords a ready means by which games and matches can be played at a comparatively small expense, and without the members of either club leaving their own comfortable rooms. The success of the London-Liverpool experiment opens the way to many such experiments here, and there is no reason why the clubs in the cities should not play telephonic matches not only with each other but with clubs in adjacent cities.

AN ADVERTISER WHO TALKS BY THE BOOK.

ON Friday, an advertiser who has sent us a good many checks, says the *Northwestern Lumberman*, comfortably filled up a good arm chair, and talked considerably about advertising. "When I buy advertising," he said, "I want to feel assured that the paper in which I have space goes to the men whom I desire to reach, and, further, that the people to whom it goes have a good opinion of it. I place my advertising on that basis. I used to think that I did not receive my money's worth unless I could trace a certain number of sales to some particular ad. I am over that. I meet the demand of machinery in my line, and having done that I want to be known, and known all the time. I advertise, say in a dozen papers, and a man comes along and buys a big bill of goods. Can he tell me what particular paper directed him to my work? No; not once in a hundred times. I have been advertising for years so he may know where I am, and when he wants to buy he comes to me. Make first-class machinery, and let everybody know where the machinery can be had, and then treat your customers white, is the way to get business."