never known to occur, but with a 7/16 it would be a rare thing to find one lamp of a large number that had not this cause for being out recorded against it on more occasions than one, particularly if, as frequently happens, the carbons are slightly crooked. All things considered we feel we are but echoing the sentiments of the present users of ½ carbons when we repeat that in an all night lighting plant there is an advantage in their use.

In the Annual Report of the Chief of the Bureau of Steam Engineering of the United States Navy for last year, attention is called to the fact that from nearly every war vessel in service in the navy, reports had come of the inefficiency of the firemen, and of the insufficient number employed. The Chief points out that no matter how efficient the vessel and the equipment may be in every other department, failure in the boiler room spoils the whole. If during an action, when the fullest power of the machinery is required, unskilfulness on the part of the fireman should let the fires become dull or choked with ashes and clinkers, all hope of success would be gone. The report urges upon the Government the necessity of attempting to remedy this evil and to encourage the firemen in becoming skilled and expert in their duties. In all factories and establishments where steam is used there should be more attention given to this very important subject. In these days of competition profits can be made by skill and care in saving. Begin here, not as is too often done by employing the man who is willing to work for the lowest wages, but the man who can earn good wages by skill in the use of the coal shovel. A few years ago a certain flour mill in Canada was closed. The engineer was ordered to dismiss his staff of firemen. In about three months the mill was again started, but the firemen had gone elsewhere looking for work, and the old hands could not be found. With the same engineer and same machinery, but with new firemen, twelve tons of coal per day were required to do the work formerly done with nine tons. Here a change of firemen increased the fuel bill by 33⅓ per cent.

A case has come under our observation quite recently in which an existing electric light company was about to purchase a power generator for the supply of power to numerous small manufacturers and in which there existed the doubt as to whether it should be of 250 or 500 volts E. M. F. Eventually the 250 volt generator was given the benefit of the doubt. It may be pointed out to those similarly situated, that for many reasons, the 250 volt machine is undoubtedly the proper one to install. The principal reason is that it is absolutely safe to handle a current of this voltage. As the current is required to be carried into buildings and rooms in which there are quite a number of employees, this safety in handling becomes most imperative, for while there may be but one person whose duty it will be to handle and take care of the motor, there will likely be some inquisitive young person about the place who when opportunity offers will try his hand at it, and ten chances to one receive a shock, if it is possible to do so, before he gets through. If a low tension current is used it can do no greater harm than frighten, whereas if it were of 500 volts potential and contact were made with it for any length of time, it might not only cause a severe shaking up, but serious results would in all probability follow. True the cost of constructing the line will be much greater if 250 volts are used than it would be with 500 volts. Another point to consider is the lesser liability to short circuiting of the lines from any cause, for with the 250 volt circuit there will only be one half the risk of serious results following such short circuit; an arc of any length cannot be maintained; whereas with 500 volts it is quite easy to produce and keep going such an arc as would cause damage to the machine or some of its parts, or set fire to the building if not checked promptly. We are of the opinion therefore that the 250 volt circuit possesses an element of safety quite superior to that of the 500 volt, and is the only one that should be used for supply of small motors that are liable to be used in all manner of places and under all sorts of conditions. We cannot condemn too strongly the practice of connecting such motors on a grounded street railway circuit, as is done in some places. With 500 volts and a grounded circuit, it becomes absolutely dangerous, and should not be handled by other than a practical man at any time, much less should it be placed in a position to be handled by those who perhaps have not the faintest conception of the danger lurking therein. It is not the purpose of this article to make it appear that a 500 volt circuit is what is recognized as a dangerous one, for such is not the case, but we feel that we are not over-stepping the bounds when we again repeat that contact with a grounded 500 circuit is dangerous, particularly if such contact is made for any length of time.

CENTRAL STATIONS OPERATED BY WATER POWER.

Mr. George A. Redman writes on the above subject in the columns of *Practical Electricity* as follows:

The adaptation of water power for electrical purposes has grown very rapidly within the past few years: there are several causes operating to enhance the value of water power, none more so than that of electricity.

Streams that have had no pecuniary value heretofore are now being utilized for the purpose of running electrical machinery; yet at the same time the supply of water is diminishing, caused by the destruction of forests, and water right owners in various parts of the country are devising means of storing water during the rainy seasons to furnish a supply during the dry season; also storing it in the daytime for night use. One large water right owner in Western New York, during the months of July and August, places flash boards two and one-half feet high on top of his dam, at an expense of $100, and stores up for night use the water which is not necessary for him to use in the daytime, thereby saving in the two months a coal bill of $2,100.

The Johnstown, N. Y., Electric Light Company have improved their water power at the Cuyadota Falls by erecting a dam 34 feet high on top of the falls, giving them a total head of 75 feet and nearly doubling the amount of power.

A survey of the upper Genesee River, between Mount Morris, N. Y., and the celebrated Portage Falls, has been made during the past year, for the purpose of establishing a reservoir that will furnish the city of Rochester 30,000 h.p. more daily during the entire year, than they have at present.

The earliest forms of water wheels were the paddle and flatter wheels, that only utilized the impulsive action of the water; these being followed by simpler wheels of the reaction type, and others.

We now have the improved forms of the Leffel, Victor, Lesner, Success, and many others. There is a demand for the best and most economical turbine that can be manufactured.

Turbines should be built to secure the delivery of the water upon the turbine without checking the velocity of the water more than one-third, and to permit the free discharge of same after passing through the turbine, and to work with as good efficiency under part gate as under full gate, and to be made of the best phosphor bronze, to stand the wear and tear under high heads.

It is essential in locating central stations to be run by water power, to locate them where there is no great danger of a flood, or so protected by a breakwater as to make it perfectly safe, and also to avoid trouble with backwater upon the turbines. Where a station is situated on the bank of a river, it is best to take the water from the river by means of a raceway, with the headgates parallel with the flow of the water; and at times of a freshet or running of anchor ice, it will more than pay any expense incurred by so doing. The raceway should be of a sufficient depth and width to permit the water to flow not more than 90 feet per minute, and a waste gate should be placed in the side or end of the race to use in case of emergency; and when cleaning out the raceway a rack should be built across the race to prevent driftwood and other rubbish from passing into the turbines. For that purpose I recommend a rack built of iron slats two inches wide, one-eighth of an inch thick, and placed five-eighths of an inch apart on seven-eighths inch iron rods, at an angle of 45 degrees. Particular attention should be taken to keep the rack clean by raking. A trough or platform should be placed over and immediately back of the rack to rake the rubbish and anchor ice into, and so arranged that the current of water from the race will pass through the trough and carry off all of the rubbish, etc. For any station that is using 100 h.p., or over, it will be a great saving in labor to them and pay well for the extra expense. For winter service a boom should be placed in front of the headgates, and the current will carry off a large portion of the anchor ice and other floating objects.

The headgates should be built to work with a rack and pinion;