

steam and water main, and especially in those establishments where steam is not always kept up day and night throughout the year. The initial expense of these appliances will probably be found less costly than a thoroughly efficient system of mains and a fire pump, though the latter have many advantages, the most obvious of which is the fact that the water can be supplied by hydrants at any convenient point required—irrespective of the distance from the main water supply, and under a better head than could be obtained by pumping through long lines of hose from either a manual or steamer. Provided that a fairly good public water main supply is obtainable, a steamer or manual, in conjunction with a reservoir or river, is a useful addition to a fire protective plant.

These engines should be placed in a well-ventilated room or station of their own, conveniently situated for quick "turning-out," and for easy access to the different parts of the buildings. They should be kept scrupulously clean, in thorough working order, and provided with the necessary gear. They should be so arranged that they can be taken by hand or horse draught to any desired spot. A steam fire engine is to be preferred to a manual, owing to its greater power and ease of working. A supply of boiling water should be constantly kept for the boiler of the steamer either by means of a gas jet or heater. With some instruction it will be found that any intelligent mechanic can efficiently take charge of the steam fire engine. In order, however, to work the fire appliances efficiently—no matter if they take the form of mains and hydrants, fire engines, or both—it is advisable to form a body of trained men who have a thorough acquaintance with the fire protective measures and appliances at the disposal of the works or factory in question. This body of men should be known as the Works Fire Brigade, and its members should be picked men residing in the near vicinity of the works.

It is advisable that the brigade be a relatively large one, so that the services of a certain number of them can be relied upon during the stoppages of the works. The officers should be chosen from amongst those having authority in the works, and the whole placed under the direction of one of the superior officials or heads of the firm. The men should have the proper clothing and helmets supplied to them, and every effort made to make the members feel that the brigade is one of the valued institutions of the establishment. It is perhaps more satisfactory that the men be remunerated for drills than that their services be voluntary. The remuneration is a useful lever for the maintenance of proper discipline, and is in many ways a more efficient system than a voluntary one combined with some special benefit such as an annual dinner or excursion. The paid system, further, need not, and should not, exclude any such special benefit as a dinner or outing for the men of the brigade. The brigade can be divided into companies or sections, each in charge of a foreman. Each company should have its special duties in case of an outbreak of fire, one company having charge of the stationary fire pumps and the maintenance of the steam and water supply, whilst another has charge of a steam fire engine. The whole organization should, however, be under the command of one chief officer, who would be responsible to his employers. The brigade should be drilled regularly, and every member should be made acquainted with the working of all the different appliances, hydrants, water sources, and so forth, no matter what special section he may be attached to. The drills should have special reference to the buildings they are primarily expected to protect. A certain number or all the men may also be conveniently instructed in ambulance work. An ambulance corps is of great utility in any works for dealing with the accidents which unfortunately take place from time to time, but for fire brigade work the possibility of obtaining "first aid" on the spot is essential. The fire appliances

throughout the works should be inspected weekly by some responsible officer of the brigade and a report made to the chief, who would have to verify these reports from time to time. This weekly inspection should not be of a perfunctory nature, but a thorough examination of all pumps, hydrants, valves, etc., about the place, and any defect should be promptly repaired. A special report book with the necessary headings should be kept and signed by the officer charged with this inspection. In this report book a record of all tests should also be kept and it should show when the appliances were last thoroughly overhauled. All appliances should be cleaned and every hydrant flushed out once every week under the supervision of the inspecting officer. To avoid friction with the heads of departments, etc., the internal appliances can be put under the charge of the respective foremen of rooms or shops, but these foremen should be made responsible for their being kept clean and in good order, and the appliances should, nevertheless, be regularly inspected. The engines and appliances at the fire station should be in the charge of one or more firemen especially told off for this duty, and would also be subject to regular inspection. The fire alarm can be given by means of a steam whistle when steam is always kept up, or by means of a bell. The whistle should be of a distinctive sound, and not the same one which calls or dismisses the work-people. The fire whistle should occasionally—once or twice a week—be blown at pre-arranged times, preferably at the middle of the day and simultaneously with the works whistle, in order to keep it in thorough working order. It can be placed either on the watchman's room, the central office, the fire station, boiler house, or other recognized building. In large establishments it is, however, better to have a supplementary system of electrical fire-calls communicating from the different buildings to wherever the whistle may be placed. Where an establishment covers a very large area, there can be more than one whistle.

The watching service or patrolling of the works as a precautionary measure against outbreaks of fire, is a most important feature of any system of fire protection. This precaution of watching is now practically always undertaken at every factory of any size, and it often constitutes the sole fire preventative measure. The system can be elaborated according to the size and the risk of the premises in which it is employed. In other than very large establishments, it is generally performed by the night watchman, who must be a trustworthy, active, and resourceful man, and have a thorough knowledge of every part of the premises under his care, of the position of the fire appliances, their nature, and the resources generally at his command. It is of paramount importance that the patrolling is systematically carried out, and that every part of the works or factory, however insignificant, receives a regular visit from those appointed to this duty. It is therefore necessary that some means be adopted to ensure that this duty is satisfactorily carried out. Surprise visits are of value, but some mechanical or electrical system of recording the visits of the watchman to the various points of his rounds, are very desirable. The use of peg clocks or control watches will be found to meet this desideratum. The control watch is carried by the watchman, and its distinctive feature consists of a strip of paper round the inside of the watch, the strip is graduated or subdivided into hours, half hours and quarter hours. Each room or determined point is provided with a case affixed to the wall containing a special key attached to the case by a chain. Each key makes a separate and distinctive mark on the strip of paper, showing the time the watchman inserted the same into the watch. The strip on its removal in the morning gives a faithful record of the various points visited, the route taken and the time of each visit to the different parts of the works. By a judicious distribution of the keys and a determination of the