

far to deal with, all these matters would be very simple, but in a large installation, such as this South Staffordshire Company's installation, there is no real difficulty, because there is space enough to build up the scrubbers; but if anything of that sort had to be done on board ship, say, it would be a very different matter.

TEA-MAKING MACHINERY.

An interesting report is furnished by Consul Anderson, of Amoy, on the use of machinery in curing tea. The consul says the machine process is not a success, and that it is not regarded with favor in Formosa and other tea-growing districts. The letter follows:

A number of tea-trade journals in the United States and England at the present time are containing accounts of the successful operation of tea-curing machinery at An-Pei-Ching, near Tamsui, Formosa. The accounts are so much alike as to suggest that they have come from the same source. They represent that the operation of the machine-curing plant in Formosa, which was established by the Japanese government late in 1902, is very successful, and intimate that the machine process is likely to soon supersede all others. As a matter of fact the machine process is not a success from a commercial standpoint, and if it should supersede present methods, would likely revolutionize the Oolong tea trade of the world.

The machinery plant was established by the government in Formosa a little less than three years ago, in line with the movement in Japan to produce machine-cured tea for competition with the rapidly growing Indian and Ceylon tea trade, the firing of the latter teas being practically altogether by machinery. The plant was well built and splendidly equipped and is beautifully situated. It was realized at the beginning of the enterprise that the Indian and Ceylon methods would have to be modified considerably before they could be adapted to the Formosan or Chinese tea, and the plant established in Formosa was constructed partly in England and partly in Japan by a Japanese expert who has studied Indian and Ceylon methods, this expert practically constructing a new machine for "withering," "sieving," and "rolling" the leaf. The factory thus established is supposed to have a capacity of 500 pounds of tea per day, or possibly 100,000 pounds of tea per season, working under pressure. Speaking of the results of the establishment of the factory, a tea expert well known in America as one who has long been identified with Formosan and Chinese teas, says:

"So far as I am able to get at the results of the experiments in this connection, as demonstrated in the working of the Formosan government's An-Pei-Ching plant, the 'withering,' 'sieving,' and 'rolling' machine processes are a success with the leaf, while the 'cutting' and 'firing' are considered, at least by Chinese experts, to be unsatisfactory. Firing by 'desiccator' machine is said to be too quick, better results being obtained by the old-style basket firing. It is generally believed here that the government experiments in the machine plant have so far been carried on at a loss."

It is a notable fact, therefore, that the portion of the machine plant which is a success is the portion which was worked over or adapted by the Japanese expert. Practical tea men here are unanimously of the opinion that machine curing will not become general in Formosa, at least with labor at its present price and with no greater success on the part of the machine plants than has so far been attained. There are a number of reasons why machine curing will not be rapidly introduced, other things being equal, and these reasons will appeal to the trade in the United States.

The bulk of the Formosan Oolong tea trade is with the United States. It consists of a number of certain well-known chops or brands prepared by certain well-known processes and representing certain qualities. The tea men of the United States have built up trade in these respective grades, and a variation from these would probably have very disastrous results to that trade. It has been the custom of the American houses to buy their tea from year to year of Amoy or Formosan houses, chiefly the former, and they have come to rely upon them for their particular brands or grades to supply their own particular trade. The "good will" of the business of these Amoy tea houses has come to be very valuable, and the unity of interests between the American tea seller and the commission houses here which do the buying for the American sellers is strong. It is easy to appreciate the fact that unless the machine-cured tea is practically the same as the several chops or brands to which the American consumer, who takes nine-tenths of the Formosan crop, is accustomed, the trade will be interfered with directly and vitally.

The machine-made tea is not the same as the other brands, and it is likely that it would not be a success for that reason if for no other. The machine-curing plant has been interesting as an experiment, but it is hardly probable that the tea business of Formosa will be revolutionized at this time, when the island's best customer is not willing to have it revolutionized. So long as the grades and chops now in use can be produced as cheaply as the machine-made tea, there is no reason why American tea men or their representatives here should turn to the machine-made product. The firing and curing processes of expert Chinese workmen—processes worked out after centuries of experiment, trial, study, and practical experience—can best deal with varying leaf and changing conditions

in the crops. Delicate flavors are not always conserved best by machinery.

So far this season the Formosan tea crop is fairly good. It is moving to the United States with unusual promptitude, 1,205,521 pounds having been shipped out of Amoy for the United States previous to June 15. The weather at present is also favorable to good crops later in the season.

THE USE OF BOILER COMPOUNDS.*

By WILLIAM M. BOOTH.

THERE are three chemicals which are known, even by unscientific men, to attack boiler scale. These are caustic soda, soda ash, and tannic acid compounds, the last being derived from sumac, catechu, and the exhausted bark liquor from tanneries.

Caustic soda in large excess is injurious to boiler fittings, gaskets, valves, etc. That it is injurious, in reasonable excess, to the boiler tubes themselves, I have yet to prove. Foaming and priming may be caused through excess of caustic soda or soda ash, as is well known by every practical engineer. I can strenuously condemn tannic acid, and of the use of its salts, I am fearful. It may unite with the organic matter, present in the form of albuminoids, and with calcium and magnesium carbonates. That it removes scale is an assured fact; that it removes iron with the scale is also assured, as tannic acid corrodes an iron surface rapidly.

Compounds of vegetable origin are widely advertised, but they often contain dextrine and gum, both of which are dangerous, as they coat the tubes with a compact scale, not permitting the water to reach the iron. Molasses is acid and should not be used in the boiler. Starch substances generally should be avoided. I have not investigated the action of kerosene, but in large quantity its use must be dangerous, as it is very volatile and must soon leave the boiler and pass over and through the engine.

There are two materials, the use of which in boilers is not prohibited through action upon the metal itself or on account of price. These are soda ash and caustic soda. Sodium triphosphate and sodium fluoride have both been used with success, but their cost is several hundred per cent greater than soda ash. If prescribed as per analysis, in slight excess, there should be no injurious results through the use of caustic soda and soda ash. It would be practicable to manufacture an intimate mixture of caustic soda and carbonate of soda, containing enough of each to soften the average water of a given district.

There is a great deal of fraud in connection with boiler compounds generally. The better class of vendors advertise to prepare a special compound for special water. This is expensive, save on a large scale, in reference to a particular water, for it would mean a score or more of tanks with men to make up the mixtures. The less honest of the boiler-compound guild consign each sample of water to the sewer and send the regular goods. Others have a stock analysis, which is sent to customers of a given locality, whether it contains iron, lime, or magnesium sulphates or carbonates.

Any expense for softening water in excess of 3 cents per 1,000 gallons is for the privilege of using a ready-made softener. Every superintendent in charge of a plant should insist that the compound used be pronounced by competent authority free from injurious materials, and that it be adapted to the water in use.

Boiler compounds should contain only such ingredients as will neutralize the scale-forming salts present. They should be used only by prescription, so many gallons per 1,000 gallons of feed water. A properly proportioned mixture of soda ought to answer the demands of all plants depending upon that method of softening water in limestone and shale regions.

The honest boiler compounds are, however, useful for small isolated plants, because of the simplicity of their action. For plants of from 75 to 150 horsepower two 24-hour settling tanks will answer the purpose of a softening system. Each of these, capable of holding a day's supply, provided with a soda tank in common, and with sludge valves, has paddles for stirring the contents. Large plants are operated on this principle, serving boilers of many thousand horsepower. Such a system has an advantage over a continuous system, in that the exact amount of chemical solutions required for softening the particular water can be applied. For some variations of such a system, several companies have secured patents. The fundamental principles, however, have been used for many years and are not patentable.

CAN A STEAM TURBINE BE STARTED QUICKER THAN A RECIPROCATING ENGINE?†

By A. S. MANN.

If a large steam turbine is cold and at rest, how quickly can it be started? Can it be brought up to speed as readily as can a good cross-compound engine that is cold all over? Most station men would have doubts as to the adaptability of the large turbine, say 1,500 kilowatts, or 2,250 horsepower, for emergency work. The possibilities of an engine with a 62-inch low-pressure cylinder in starting practically cold and coming up to synchronous speed are well understood. A station manager would criticize an engineer who would open his throttle as fast as he dared without wrecking his piping system and let his machine

* Abstract of an article in The Chemical Engineer, April, 1905.

† Abstract of paper presented at the Scranton meeting (June, 1905) of the American Society of Mechanical Engineers.

jump into her work. Most engineers would consider ten minutes as rather a fast start, and fifteen minutes as a more usual starting period, including time taken for warming up.

The station at present under consideration is equipped with three Curtis turbine-driven alternators, 40 cycles, 10,000 volts, each of 1,500 kilowatts, normal capacity. During the summer months the station is operated as an auxiliary to a water-power plant, taking all sudden overloads. A signal has been arranged, a $\frac{3}{4}$ -inch whistle, so that it can be blown instantly should the power fail.

The boiler room has steam up at all times, supplying a system for manufacturing purposes other than power, and slow fires are kept in enough boilers to make steam needed for the normal load.

At the sound of the whistle the water-tender starts a blower on the extra row of boilers; all blast dampers are opened up and all stokers are allowed to feed at the maximum rate. Each fireman dumps his free ash and bars over his red fire. The man in charge of the coal and ash conveyor starts the pressure pump for step bearings. One of the turbine men starts the exciter which supplies current to the auxiliaries beside its field current; a second turbine man starts the circulating pump and then his turbine. The hot-well pump and the air pump are started by the oiler. These movements take place simultaneously. The force is organized upon the lines that obtain in a fire station—each man has his specific duty, and after performing it looks to see if there is nothing more for him to do. Only a few seconds elapse between starting the first pump and starting the first turbine. The turbine throttle is opened as fast as an 8-inch steam valve can be opened without endangering the steam piping system. It is not considered advisable to open the throttle valve as fast as a man's strength will permit; but if nothing unusual occurs in the pipe line, sentiment does not spare the turbine. One electrician attends to the switchboard and telephone. As soon as the machine approaches speed, the synchronizing system is cut in and the main switches are got ready. One and one-half minutes will do the work here outlined, including the time taken in mustering the crew.

Manipulating an engine regulator so that it shall be at a precise speed and at an exact phase relationship from some other machine, not more than 1/1500 part of a second removed from it, is no matter that can be hurried, and one minute is fast time on such work. But the whole thing, phasing-in and all, has been done in two and one-half minutes, including full load on the turbine, which started from a standstill. This performance has been gone through a great many times, and our record book shows that, out of forty-three such calls, ten starts were made in two and one-half minutes, eighteen in three minutes, and fifteen in three and one-half minutes.

The two quickest starts have been made in forty-five seconds and seventy seconds respectively, including phasing-in. These two quickest starts were made on a turbine which had stood for twenty-four hours with the throttle valve shut tight, though there was a slight leakage past the seat. After the throttle valve is off its seat, it is not more than thirty seconds before the turbine is up to speed. A cross-compound reciprocating engine of the four-valve type, 2,250-horse-power capacity, can be brought up to speed from a standstill in five minutes if it is hot all over. This five minutes is to be compared with the seventy seconds required for the similar turbine operation.

A reciprocating engine which is turning over slowly with the throttle valve just off its seat or with by-pass open and having all its oil cups open and regulated can be brought up to speed, say seventy-five turns, in two and one-half minutes. This can be compared with the thirty seconds necessary for bringing the turbine up under the same conditions—that is, about one-fifth the time necessary for bringing up the engine. If the engine is cold all over and has all its oil cups shut tight, all its auxiliaries quiet, fifteen minutes is called a rapid start. Starts have been made under such conditions in twelve minutes. When we start a cold turbine, we open up the valve and let her turn, and in two minutes we are ready to bring her up to speed, and she will be at speed in two and one-half minutes, dividing the engine's time by more than four.

ECONOMIES OF MECHANICAL DRAFT.

CONCERNING mechanical draft the following statements are made in Chemical Technology by Mills and Rowan:

"The principles of what is now becoming well known under the name of 'forced combustion' have been repeatedly advocated during past years by those who have devoted thought and study to the subject. The position assumed by them—which is now finding favor among engineers—has been, in brief, that the air supply required for combustion in furnaces can be more economically furnished by mechanical power than by the action of chimneys and that the mechanical method has other advantages which enable it to be preferred to the one which is older, but more imperfect. One of these advantages is the higher temperature of combustion, which is equivalent, with a boiler of good design, to an increased evaporative power of the boiler or to increased evaporative effect for the fuel. Another advantage, which has not been fully realized in any plant as yet introduced in practical work, is that the rate of travel and escape of flame and hot products of combustion is under control. It is thus possible to cool them more completely than can be done when chimney