THE USE OF STEAM IN TEA FACTORIES.*

W. F. A. RIDLER, A. M. I. Mech. E.

It has long been known that where a supply of steam is required for process work in any industry, it is most economically obtained by the use of back-pressure or steam extraction engines, and, although it was usual in the early days of the tea industry to use steam engines and boilers for providing the necessary power, it was not until very recently that any use has been made of the exhaust steam.

Through the energy and initiative of a Dutch consulting engineer in Java, several factories have now been built in both Java and Sumatra in which the motive power is supplied by a steam engine and boiler, and the exhaust steam (supplemented if necessary) is used for heating the air required for the tea dryers and withering lofts.

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It is found in practice that the amount of fuel burned in the stoves of the dryers, if burned in an efficient modern type of boiler, will provide sufficient steam for heating the air for the dryers, and this steam passed through an engine will provide the necessary amount of power for driving the factory, so that while drying is going on, the power is provided for no more than the cost of drying alone. It is, however, necessary to run the engine for some three hours for rolling only, before drying commences, so that the total daily operating cost exceeds the cost of drying only by the cost of the fuel that has to be burned to provide the power needed before drying starts.

Figures for a large factory in Java, which prior to conversion to the "all-steam" system, purchased electric power for driving the factory and used wood for drying and withering, show that before conversion the cost of power was 1·3 guilder-cents per half kilo of made tea, and the cost of drying and withering 0·4 guilder-cents per half kilo, making a total cost of 1·7 guilder-cents per half kilo of made tea. After conversion to the "all-steam" system, the total cost for power, drying and withering is 0·465 cents. In other words, the wood consumption has increased from 0·4 to 0·465 and the power is provided for only 16% more than the previous cost of drying and withering alone.

These figures are based on six months' working, and on a crop of approximately the same size as before the conversion.

For normal conditions in North-East India, South India and Ceylon, it is probably correct to estimate that the cost of the "all-steam" system will be about 25% more than the cost of drying and withering alone.

There is a further saving in that stove and chimney renewals are eliminated from the annual maintenance charges as far as the dryers are concerned, and it is well established that over a period of years the cost of repairs, depreciation and replacements is much less with steam plant than with internal combustion engines. The simplicity and reliability of steam plant in the hands of native labour is also a very attractive feature.

The ease and convenience of steam drying has to be seen to be appreciated. The temperature remains steady and can readily be controlled automatically. As an example of what could be done the writer saw the fermented leaf placed on the feeder of a "stone-cold" dryer, the steam being turned on at the radiators simultaneously. By the time the leaf had gone up the feeder and along the top row of trays the temperature was up to normal.

In the case of new installations, the dryers would be provided without stoves and the steam radiators are then fitted on the suction side of the dryer fan, but in the case of a conversion where stoves already exist there is no need to dismantle them. In the case of an "Empire" or "Paragon" dryer, the radiators would be placed on the side of the air chamber, and when in use the tubes would be plugged. If it is desired to use the stove, the radiator is fitted with a blank cover, the tubes are unplugged, and the stove operated in the normal manner. In the case of the E.C.P. dryer, the duct connecting the suction side of the fan can be removed and connection made with a special duct between the radiator and fan, and, if it is desired to use the stove, it is only necessary to disconnect the new duct and replace the old one.

The cost of a dryer with steam radiatoı and without stove is considerably less than a dryer with stove, and in the case of a new factory the total cost of steam plant and steam-heated dryers is only very slightly in excess of the cost of internal combustion engines and ordinary fuel-fired dryers.

In cases where steam plant is already in existence, it will probably be quite feasible to incorporate it in an "all-steam" system.

There are two main types of installation. In one, low-pressure steam only is used in the radiators, in which case a comparatively high back-pressure, about 25 lbs. sq. inch, is necessary in the exhaust main to heat the air up to the necessary temperature, and a comparatively large number of sections in the radiator. Alternatively, it is quite feasible to equip the radiator with one live steam section, in which case the back-pressure for the low-pressure sections needs to be only about 7-10 lbs. sq. inch.

Automatic controls are provided to discharge the exhaust steam to the atmosphere when the amount of steam is in excess of that required by the dryers and/or withering lofts, and alternatively to bye-pass the necessary amount of steam direct from the boilers into the low-pressure main, through a reducing valve under the control of a sensitive pressure governor, to keep the pressure in the low-pressure main up to the required figure when the demand for steam by the dryers exceeds the amount required by the engine, as, for example, at the end of the day when rolling has stopped and the engine is on light load driving the dryer fans only.

It should be clearly understood that if water power is available for working a factory, there is nothing to be gained by installing the "all-steam" system, and, similarly, it is not economical to use live steam alone for heating the dryers for the simple reason that the thermal efficiency of a direct-fired tea dryer stove, especially the modern types now on the market, is higher than the thermal efficiency of a boiler of the size under consideration. It is only in cases where water power is not available that the "all-steam" system offers such remarkable economy in working.

To take a typical example, consider a factory having 8 rollers and two 4-ft. dryers. The total power required will be in the neighbourhood of 80 b.h.p. The dryers will require, if woodfired, say 250 to 300 lbs. of wood per hour each. Now this 500 to 600 lbs. of wood, if burned in a boiler, will generate 2,400 lbs. of steam per hour, which, if passed through a modern high-efficiency steam engine, is more than sufficient to provide 80 b. h. p. As each dryer will require about 1,200 lbs. of steam per hour, the amount of fuel required for the dryers alone is sufficient, if burned in an efficient boiler, to provide the amount of steam required for both drying and power.

At high elevations the economy becomes more pronounced as the amount of steam required for the dryers decreases directly as the reduction in density of the air, and at 3,000 feet elevation the amount of steam required is only 88% of the amount needed at sea level, and at 5,000 feet 82% of that required at sea level.

The possibilities of the "all-steam" system merit close investigation when a new factory is under consideration and water power is not available.

It is, of course, immaterial what type of fuel is used and this would be the same as would be used for drying with direct-fired stoves.