THESIS

on

THE DESIGN OF AN ELECTRIC-DRIVEN SAW MILL.

Submitted to the Faculty
of the,

OREGON AGRICULTURAL COLLEGE

for the degree of

Bachelor of Science

in

Electrical Engineering

by

APPROVED.

Department of Electrical Engineering
THE DESIGN OF AN ELECTRIC DRIVEN SAW MILL.

Capacity 100,000 ft. 10 hr. run.

The electric motor has for an number of years occupied an important position in the operation of wood-working machinery, of moderate capacity, for example the planing mills, sash and door factories and many of the other similar wood-working shops. However its adoption in the more trying field of saw mill operation is of comparatively recent date. This has been brought about in a great measure by the perfecting and cheapening of the alternating current machinery.

The ideal attainment of modern production is a maximum output from a given investment and in so far as electricity is contributing to this result it is being given an ever increasing attention as experience has already proven. Under the severest service conditions the alternating current motor possesses the advantages of efficiency and economy that meet most successfully, the peculiar condition of saw mill service.

Undoubtedly there is no industry in which demands of operation are more exacting than in the manufacturing of lumber. The power required for a successful day's cut varies not only with the kind of timber but also with the different sizes and shapes
it is into which it is sawed before passing through the mill.

In order to successfully meet these demands a motor is required that has an ample overload capacity and primarily the simplest possible construction. The importance of the latter quality is almost absolutely necessary because the motor must not be affected by the dust and splinters which are incidental to saw mill operation. All these qualities are more completely embodied in the induction motor than in any other type. It is designed to supply, upon emergency from 200 or 300% of its normal output which feature enables it to take care of any sudden overloads.

When electrical power is compared with the mechanical it has the following advantages. The waste of power in transmission is greatly reduced and the production is increased for a given amount of power generated. It practically illiminates shafting and belts which, observation and experience have proven in saw mill construction to be detrimental to the distribution of air and light and the location of machines. This would cause an additional expense to be incurred due to the overhandling of lumber causing damage and congestion.

One of the most important features of electric power is the ability to drive any group or any machine
individually over-time or at any hour without putting the entire plant into operation. As an illustration of the practicability of the electric drive we may cite the case of the main band mill in a mechanical driven plant. When a change of saws is to be made it is necessary to shut down the entire power equipment until this operation has been completed. Then it can readily be seen what a waste of time is incurred and the congestion that is surely to result.

Other important features of the electrical power in saw mill work which have received considerable attention are, first; the quality of product is improved second, the factor of safety to machinery and operatives is greatly increased; third; the fire hazard due to open flames and hot boxes would be controlled to a marked degree. The latter is most important on account of the great quantity of inflammable material which is scattered about. This danger from fire is practically eliminated by having the power house so situated at a distance that the mill proper would be completely protected.
BOILERS.

For successful operation we have selected boilers whose steaming capacity will be sufficient to easily supply the necessary amount of power when the engines are working under a heavy load. The type which will satisfactorily fulfil these conditions is the fire tube size 20'x72" with a working pressure of 150 lbs.

Boilers of this type, under ordinary working conditions will have a normal rating of about 250 horse power. As we will use four of these, connected in batteries of two each it will be seen that ample provision has been made for obtaining a safe amount of steam.

The fire boxes are of the Dutch Oven type encased in iron. These are the most suitable because they are capable of keeping up a constant steam pressure using saw dust as fuel.

The fuel is supplied by means of an endless chain conveyor which carries it from the mill and discharges it directly into the furnaces.

As has been stated before, the setting of the boilers has been so arranged that they are connected in batteries of two each which makes an ideal arrangement for piping connections. In the setting of the boilers they have been so placed that, instead
of resting on the floor, they are suspended from a steel framework. The outside of the boilers is covered with brick and asbestos, the fire boxes being lined with fire brick.

The plan and elevation drawings clearly illustrate the arrangement as to the setting, the manner and location of steam pipes and connections and the method of conveying the fuel into the furnaces.
ENGINES.

Throughout the design of our power plant we have selected the machines that would give the highest efficiency under conditions of operation that are incidental to saw mill work. The type and number of engines we have selected are two simple 20x30, non-condensing, running direct connected to the generator at 150 R. P.M.

Although the compound engine is more economical in steam consumption we know that this advantage will be materially reduced as our supply of fuel is obtained at a value that is practically nothing. This is absolutely true because the vast amount of waste material which comes from the slabs and trimmings is greatly in excess of that which is needed for fuel purposes.

Another very important reason why we preferred to use the simple engines is the fact that they have a higher speed than the Corliss type, thereby effecting a great saving on the cost of a generator. This is substantiated by the fact that all low speed generators are much heavier due to the heavy magnet frame and the extra number of poles thereby making an increase in the cost on account of extra labor and material used in the construction.
The kind of generator which is to be installed is a 450 K.W. alternater, revolving field type, running at a speed of 150 R. P.M. In the selection of a generator the ordinary heavy duty generator has been chosen.
INDUCTION MOTORS.

General Electric Co. Type K.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Quantity</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 150 H. P. Motor</td>
<td>Band Mill</td>
<td>1</td>
<td>$1000</td>
</tr>
<tr>
<td>1 50 &quot; &quot;</td>
<td>Bull Whell</td>
<td>1</td>
<td>600</td>
</tr>
<tr>
<td>1 50 &quot; &quot;</td>
<td>Edger</td>
<td>1</td>
<td>600</td>
</tr>
<tr>
<td>1 35 &quot; &quot;</td>
<td>Slasher saws</td>
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<td>450</td>
</tr>
<tr>
<td>1 30 &quot; &quot;</td>
<td>Trimmer saws</td>
<td>1</td>
<td>400</td>
</tr>
<tr>
<td>1 50 &quot; &quot;</td>
<td>Hog</td>
<td>1</td>
<td>600</td>
</tr>
<tr>
<td>1 20 &quot; &quot;</td>
<td>Lath Mill</td>
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<td>275</td>
</tr>
<tr>
<td>1 10 &quot; &quot;</td>
<td>Wood saws</td>
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<td>160</td>
</tr>
<tr>
<td>1 40 &quot; &quot;</td>
<td>Timber planer</td>
<td>1</td>
<td>500</td>
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<tr>
<td>1 35 &quot; &quot;</td>
<td>Flooring planer</td>
<td>1</td>
<td>550</td>
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<tr>
<td>1 50 &quot; &quot;</td>
<td>Blower system</td>
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<td>600</td>
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<tr>
<td>1 50 &quot; &quot;</td>
<td>Horizontal resaw</td>
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<td>600</td>
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<tr>
<td>2 5 &quot; &quot;</td>
<td>Filing room</td>
<td>2</td>
<td>200</td>
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<tr>
<td>1 40 &quot; &quot;</td>
<td>Live rolls from Band Mill</td>
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<td>500</td>
</tr>
<tr>
<td>1 20 &quot; &quot;</td>
<td>Live rolls from Trimmers</td>
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<td>275</td>
</tr>
<tr>
<td>1 20 &quot; &quot;</td>
<td>Slab conveyor</td>
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<td>275</td>
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<td><strong>Total</strong></td>
<td></td>
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POWER HOUSE.

Roofing (galvanized iron) $350
Lumber and mill work 200
Cement, gravel, sand, reinforcing bars and labor 3000

TOTAL $3550

BOILERS.

Consisting of 4 return fire tube
200 H.P. steam pressure 150” 8000
Injectors and piping
Steam water 200
2 water pumps 6x6 4x6 250
Setting boilers and pumps 1600
Steel stack 90 ft. height 5' dia. 495

TOTAL $10545

ENGINES.

Consisting of 2 simple 20x30
direct connected to generator 7000
1 steam receiver 60
1 feed water heater 500
setting of engine, receiver and pumps 750
1-75 simple engine, light generator 900
All necessary steam piping and lagging 500

TOTAL $10310
GENERATORS.

One 450 K.W. A.C. revolving field type generator complete with excitor and field rheostat
One 50 K.W. D.C. generator complete with rheostat

TOTAL 8700

SWITCH BOARD.

The switch board consist of
- two panels $1 sq. ft. 30
- Eight ammeters 250
- One volt meter 35
- Two circuit breaker switches 75
- Six knife switches 30
- 3 T. P. S. Throw 30
- 1 Generator switch 20

$740

LIGHTING SYSTEM.

- 75 arc lights $2250
- 200 incandescent lights 300

TOTAL $2550
POWER CIRCUITS.

1000 ft. No. 8 B. & S. wire

3500 ft. No. 10 " "

TOTAL $400

Total cost of Power House, Motors, Lights and fixtures $44080
Plan of Mill and Power House showing location of motors and circuits.

Smith and Adson
May 11, 1909

Thos. Austin.
PLATE 5.

Saw Floor.