REPORT ON THE WESTERN PORTLAND CEMENT COMPANY'S PROPERTY AND PLANT AT YANKTON, S.D.

J. W. Fuller Jr., President
REPORT ON THE WESTERN PORTLAND CEMENT COMPANY'S PROPERTY
AND PLANT AT YANKTON, S. D.

Wm. Woods Plankinton, Prest.
Western Portland Cement Co.,
Milwaukee, Wis.

Dear Sir:-

INTRODUCTION: In accordance with arrangements
made with Mr. James C. Stewart, of James Stewart & Co., New York City,
our Engineer, Mr. Henry G. Barnhurst, has made an examination of your
property at Yankton, S. D., for the purpose of determining just what
are the conditions of this plant, and what they could be made into
should it be shown that it would be profitable to make further in-
vestments in connection with same.

The following report is based upon the personal examination of
our Engineer, upon our experience in the design and construction and
operation of cement industry in general.

ORGANIZATION: We understand that the Western
Portland Cement Company was incorporated under the laws of the State
of Wisconsin in the year 1889, and started operations in 1890.

The officials of the Company as reported to us are:

President, Wm. Woods Plankinton.
Vice " G. S. Bartlett.
Treasurer, Geo. P. Miller.
Secretary, H. A. J. Upham.
Superintendent H. L. Shock.
Chemist, Borger Lee.
The directors of the Company are:

Wm. Woods Plankinton
G. S. Bartlett
Geo. P. Miller
R. A. J. Upham
Mr. Jones

CAPITALIZATION: The capital of the Company is $200,000, par value of $100 per share. The common stock is all issued; 110 shares, however, were bought in and are held in treasury. The bonds authorized amount to $120,000, of which $70,000 have been issued. In addition to the above, there are notes outstanding to the extent of $24,000. Also accounts payable to date and salaries accrued, of about $20,000.

HISTORY: The Western Portland Cement Company originally started operations in 1890, with an installation of five Johnson intermittent kilns. The capacity of the plant being about 20,000 barrels per annum. The materials were chalk-rock and clay and a modification of the English process was used. The kilns were charged with alternate layers of dried slurry and fired with gas coke. The Works were located on the hillside, near the chalk-rock and clay beds. Four rotary kilns were installed in 1904, and 4 in 1906.

PROPERTY: We are informed that the Company owns in fee, approximately 533 acres of land, located 5 miles north-west of Yankton. Some 250 to 270 acres are covered with deposits of chalk-rock and clay. Map herewith shows outlines of the property.
The railroad connections from the property to Yankton are controlled by the Company.

In addition to the above, the Company owns some small lots in St. Helena, Nebraska.

We have not checked the area of the property, or verified the titles or deeds.

**METHODS OF MANUFACTURE:** In general the manufacture of Portland cement by the wet process consists of: First, crushing, pulverizing and mixing in proper chemical proportions in the form of a slurry; Second, drying, burning the mixture; Third, grinding the resulting clinker to a powder, forming the finished cement. This is practically the same as the dry process, with the exception that in the dry process, no water is added to the crushed and pulverized raw materials, which are dried before being pulverized and are fed to the kilns in a dry form.

In order to determine the future success of this plant for the manufacture of Portland cement, the following essentials must have careful consideration:

<table>
<thead>
<tr>
<th>1st: RAW MATERIALS</th>
<th>Quality, quantity, physical structure and accessibility.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd: FUEL</td>
<td>Cost, quality and where obtained.</td>
</tr>
<tr>
<td>3rd: WATER SUPPLY</td>
<td>Location, quantity and quality.</td>
</tr>
<tr>
<td>4th: EQUIPMENT OF PLANT</td>
<td>Machinery, buildings and condition of same.</td>
</tr>
<tr>
<td>5th: LABOR</td>
<td>Cost, experience, living conditions, etc.</td>
</tr>
</tbody>
</table>
6th: MANUFACTURING COST.
7th: TRANSPORTATION.
8th: MARKET.

RAW MATERIALS: The materials from which the Yankton Brand of Portland cement is made, are chalk-rock and clay.

The formation of the raw materials is as follows: The deposit of chalk-rock and clay, we understand, covers an extent of about 250 to 270 acres. The clay is of a shaly nature, and is covered with 10 to 25 feet of stripping. It lies directly above the chalk-rock formation and is from 10-15 feet in thickness.

The chalk-rock has a depth of at least 200 feet and is of a stratified formation, consisting of layers of chalk interspersed with beds of gypsum. The layers of chalk vary from a few inches to four or five feet in thickness. The upper rock, on account of the large percentage of iron oxide which it contains, is not quite so good as that obtained from a greater depth, as will be noticed from the table herewith giving analyses of the various layers in the quarry.

The chalk quarry has been opened up to the extent of about 760 feet long, 200 feet wide and to a depth of about 60 feet. At the present time, the bottom the extent of many thousand yards, which necessarily will have to be cleaned off in order to operate economically.

Assuming that the quarry is thoroughly cleaned, the present bottom could be worked to a depth of at least 30 feet deeper, which would give an ample supply for 1,500 barrels daily, for about 1½ year without any further stripping.
There are some springs in this quarry, hence pumping in a small way would be continuous. This pumping, however, would not be a serious item and is no greater than that encountered at a great many other plants.

Should it be desired to increase the area of the quarry, stripping will be necessary. There is an excellent steam shovel for doing this work. There is no reason why this chalk-rock quarry should not operate on a fairly reasonable basis. The cost of taking out stone has not been excessive, considering the production and natural conditions.

It is advisable, however, that a certain percentage of stripping be carried on constantly so that the top and bottom rock can both be used. The top rock, which is high in iron, can be thus used gradually and thereby cut down cost of quarrying operations later on.

There are other deposits of chalk in the neighborhood, but the stripping, general location and scarcity of mill sites on account of the nature of the country, gives the Company a strong position regarding any local competition.

The clay is rather dark, is of a shaly nature, disintegrates on exposure and is very easily quarried. There is from 10 to 15 feet of stripping overlying the clay deposits, but as only a small amount of clay is necessary, this stripping cuts very little figure in the cost of quarrying the raw materials.

The gypsum used is obtained from the U. S. Gypsum Co., at Fort Dodge, Ia., and the price delivered is $3.20 per ton. As very little is used, this is not a serious item.
The following results have been found from samples obtained by cut representative and analyzed by our chemist:

**CHALK:**

West Side —— 300 ft. north of crusher

**Analysis made upon dried sample.**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Silica</td>
<td>3.24</td>
</tr>
<tr>
<td>Iron Oxide</td>
<td>1.85</td>
</tr>
<tr>
<td>Alumina</td>
<td>2.01</td>
</tr>
<tr>
<td>Carbonate of Lime</td>
<td>86.70</td>
</tr>
<tr>
<td>Carbonate of Magnesia</td>
<td>.97</td>
</tr>
<tr>
<td>Sulphur Trioxide (total sulphur as)</td>
<td>3.95</td>
</tr>
<tr>
<td>Moisture as received</td>
<td>17.52</td>
</tr>
</tbody>
</table>

No. 2 —— Taken from bottom in middle of quarry, about 200 feet north of incline.

**Analysis made upon dried sample.**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Silica</td>
<td>8.10</td>
</tr>
<tr>
<td>Iron Oxide</td>
<td>2.60</td>
</tr>
<tr>
<td>Alumina</td>
<td>3.44</td>
</tr>
<tr>
<td>Carbonate of Lime</td>
<td>76.01</td>
</tr>
<tr>
<td>Carbonate of Magnesia</td>
<td>1.26</td>
</tr>
<tr>
<td>Sulphur Trioxide (total sulphur as)</td>
<td>5.56</td>
</tr>
<tr>
<td>Moisture in sample as received</td>
<td>20.25</td>
</tr>
</tbody>
</table>

**CLAY:**

Taken from Clay Bank.

**Analysis made upon dried sample.**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Silica</td>
<td>59.78</td>
</tr>
<tr>
<td>Iron Oxide</td>
<td>4.30</td>
</tr>
<tr>
<td>Alumina</td>
<td>19.54</td>
</tr>
<tr>
<td>Lime</td>
<td>1.48</td>
</tr>
<tr>
<td>Magnesia</td>
<td>1.75</td>
</tr>
<tr>
<td>Sulphur Trioxide (total sulphur as)</td>
<td>1.29</td>
</tr>
<tr>
<td>Combined water</td>
<td>11.04</td>
</tr>
<tr>
<td>Moisture as received</td>
<td>5.18</td>
</tr>
</tbody>
</table>
Examination of these results, and also of those contained in table shows that the chalk is very close in composition to a proper mixture for burning, and that in most cases only a small addition of clay is necessary. The chalk is high in Oxide of Iron and comparatively speaking, low in Silica. The high iron causes the clinker to be very fusible. Now, this may cause rings in the kilns and the clinker hard to grind when burned with the dry process, unless the mix is properly controlled. The chalk is also very high in Sulphur Trioxide, a good part of which is present in the form of Sulphides. This will to a large extent, burn out in the kiln with the dry process, just as with the wet.

The analysis of the clay shows the proportions of this to be excellent; low in Oxide of Iron and relatively speaking, high in Silica. Consequently it is well adapted to be mixed with this chalk in any proportions.

Both materials are low in Magnesia.

FUEL: The fuel used in this plant, for both for boilers and kilns, has been obtained from the Lakota and Albia districts of Iowa, near Des Moines. The steam and kiln coal for last year's operation, averaged $2.30 per ton. For temporary coals, the Company has been paying $4.40 f.o.b. plant. Coal has been bought heretofore on a yearly contract. Same comes over the Chicago, Milwaukee & St. Paul, and the Northwestern Railroads.

Average analyses of run-of-mine coal obtained from your records are as follows:
Moisture   5.82  5.12
Volatile  43.02  39.18
Fixed Carbon  36.60  33.84
Ash     15.56  21.86
B.T.U's  12705  11564
Sulphur  4.92  5.31

These coals are high in sulphur and moisture.

The dried coal analyses about as follows:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Volatile</td>
<td>45.25</td>
</tr>
<tr>
<td>Fixed Carbon</td>
<td>31.65</td>
</tr>
<tr>
<td>Ash</td>
<td>23.09</td>
</tr>
<tr>
<td>B.T.U's</td>
<td>10504</td>
</tr>
</tbody>
</table>

According to laboratory reports, the highest B.T.U's in the coal in September, were 11099; and the lowest, 10397. In the boiler coal, th B.T.U's for September were, highest, 11983; and lowest, 11638.

The coal has been purchased from the following parties:

Geo. S. Pope, Waterloo, Ia.
Philip Fuel Co., Ottumwa, Ia.
Hocking Coal Co., Hocking, Ia.
L. G. Everest & Co., Sioux City, S. D.
Saylor Coal Co., Des Moines, Ia.
Elijah & Winnie Co., Cedar Rapids, Ia.

There has been no trouble encountered with the coal supply.

For the entire year of 1909, the total number of tons purchased for drying and kiln purposes, was 29,271 tons. Based on net tons of 2,000 lbs. and taking production of cement, 173,000 bbls. for the year, the total amount of coal used per barrel was 338 lbs. The high percentage of ash accounts also to some extent, for the large amount of coal used. It appears, however, as will be noted later that the above result of 338 lbs. is not correct and that there has been an inter-mingling of your boiler and kiln coal accounts. We estimate that the total amount of coal used per bbl. in the kilns was about 280 lbs.
The total amount used for the boilers and crane in the quarry was 10,000 tons, or a total of 115 lbs. of coal per barrel, as reported in your books.

These figures show that the coal consumption, even taking into consideration the high ash, at this plant is considerably higher than it should be; therefore, it is absolutely essential first to consider the installation of the dry process, and second more improved machinery for pulverizing the coal to a higher degree of fineness, as the reports show that 85% through the 100 mesh sieve is the average fineness to which this coal has been pulverized. It is a well known fact that the more finely you pulverize your coal the more economy is obtained, as considerably less coal is used in connection with manufacturing a barrel of cement, and it is necessary on account of the quality of your coal. It is also necessary on account of the sulphur content of your coal. It is also necessary on account of the sulphur content of your coals, as it has also been proven the finer the coal, the less sulphur enters the cement.

The Company has no way of telling the amount of coal received. There are no track scales and it is necessary for them to take railroad weights at all times, and there has been considerable complaint due to the fact that the cars do not appear to have weight as specified in the bills.

WATER SUPPLY: At the present a large quantity of water is used daily for the boilers and also for the making of slurry. There are two six inch artesian wells, about 600 feet deep, located right alongside of the plant, which have given ample supply
heretofore for the operation of their present boilers and for operating condensers. A Kennicott water softening system was found necessary, on account of the nature of the water, and since installing same, the scale in the boilers is gradually disappearing. This system was installed about the middle of last year. The analyses of the water as it comes from the well; also from the Kennicott softener is given hereewith.

RAW WATER:

<table>
<thead>
<tr>
<th>Substance</th>
<th>Grs. per U. S. Gal.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium Carbonate (Chalk)</td>
<td>4.40</td>
</tr>
<tr>
<td>&quot; Sulphate (Gypsum)</td>
<td>26.22</td>
</tr>
<tr>
<td>Magnesium Sulphate (Epsom Salts)</td>
<td>9.84</td>
</tr>
<tr>
<td>&quot; Chloride</td>
<td>1.71</td>
</tr>
<tr>
<td>Iron and Alumina</td>
<td>0.29</td>
</tr>
<tr>
<td>Silica (Sand)</td>
<td>0.92</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>43.85</strong></td>
</tr>
<tr>
<td><strong>Lbs. in 1000 Gals.</strong></td>
<td><strong>6.26</strong></td>
</tr>
</tbody>
</table>

TREATED WATER:

<table>
<thead>
<tr>
<th>Substance</th>
<th>Lbs. in 1000 Gals.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium Carbonate (Chalk)</td>
<td>2.90</td>
</tr>
<tr>
<td>Magnesium Carbonate (Magnesia)</td>
<td>0.55</td>
</tr>
<tr>
<td>Iron and Alumina</td>
<td>0.23</td>
</tr>
<tr>
<td>Silica (Sand)</td>
<td>0.32</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>4.00</strong></td>
</tr>
<tr>
<td><strong>Lbs. in 1000 Gals.</strong></td>
<td><strong>9.57</strong></td>
</tr>
</tbody>
</table>

The analyses show the scale forming elements in the water to have been reduced to about 10% of their former quantity, by means of the water softening plant. This system is generally conceded a very good one and has been employed successfully in a great many plants.

Should the plant be put on the dry process, operating 1500 barrels per day, there would be no trouble in obtaining sufficient water from the present two wells to operate the boilers. Also, we
understand that the Kennicott water softening system has a capacity of 96,000 gals. per day, which may be ample, providing new condensers are installed that work efficiently. The two wells mentioned above are flowing wells. It may be that it will be necessary to put down an additional well, but from the amount of water used for slurry and operating the present boilers and condensers, there no doubt would be enough water to fully take care of the increased output, operating under more efficient conditions. It may be necessary later to increase water softening system 25%.

EQUIPMENT OF PLANT:

CHALK QUARRY:
1 Steam Shovel.
2 Locomotive Cranes with clam-shell buckets.
1 Double cylinder drum 7x10 hoisting engine.
12 Steel dump cars.
1 Electric drill.

SHALE QUARRY:
3 Wood dump cars.

WET MILL:
2 #6 "D" Jeffrey disintegrators.
1 Small Jeffrey disintegrator.
2 5'x22' Gates Tube Mills.
2 Centrifugal pumps.
5 Agitators.

KILN BUILDING:
1 8x100' Bonnot Kiln.
5 7'6" x 100' Bonnot Kilns.
2 8x120' Bonnot Kilns.
8 Sturtevant feed bins with Reeves speed regulators.
6 Pressure Blowers.
2 60" Garden City fans.
1 Bell crusher.

CLINKER MILL:
5 Kent mills.
1 Maxecon mill.
6 Emerick separators.
1 Automatic Weighing Mach. Co's weighing machine.
COAL HOUSE:
2 Williams’ #2 Hammer mill.
2 Ruggles-Coles No. 8 Dryers, 5’x30’.
2 60” exhaust fans for same.
3 Kent pulverizers.
2 8’ Emerick separators.
1 10’ “ “
2 Cyclone dust collectors.

BOILER HOUSE #1:
4- 66x19 Sioux City Horizontal tubular boilers; 54-3/4” tubes.
1- 6x14 Stell settling tank.
1- 7x4x8 Harris steam pump (double acting)

BOILER HOUSE #2:
4- 60x16 Horizontal tubular boilers; 42-3/4” tubes.
1 #9 Cochran heater, 1000 HP.
2- 7x3x10 Prescott duplex steam boiler pumps.
1- 7x5x7 Fairbanks-Morse duplex boiler feed pumps.
1- 6” Morris centrifugal pump.

ENGINE ROOM #1:
1- 26x48 Allis Horizontal Corliss engines, 20’ sheave; 11/2” rope.
1-24” diam, 12” stroke, 1/2” condenser.
1 Reynolds’ patent belt driven type.
1 Reynolds 50’ H. P. patent feed water heater and purifier.
1- 10 ft. swing jib crane.

ENGINE ROOM #2:
1- 13x20, 100 HP. Ball engine, 300 RPM, D. C.
to Northern 75 KW. generator, 250 volts.
1- Bullock generator, 650 RPM, 420 amp.
240 V., 100 KW.
1- Bullock generator 830 RPM, 313 amp., 240 V.,
75 KW.
1- Krouse-Hinds switchboard.
1- 2 HP. motor.
1- Buffalo Forge, #2 pressure blower.

ENGINE ROOM #3:
1- 20-42x48 Minneapolis, 1000 HP. horizontal cross compound engine, rope drive, 20’ sheave, 19- 1 3/4” ropes.
1- Belt driven air pump, 10x12 (Union Steam Pump Co.)
1- 10x36 Weisel & Vilter Mfg. Co., horizontal.
corliss engine, with 12’ fly-wheel.
1- Surface condenser.

MOTORS AT VARIOUS POINTS:
1- 60 HP. motor, 725 RPM, 22x12 pulley.
8- Northern Electric, 15 HP. motors, variable speed. 6 with 8x10 pulleys; 1 with 7x8”
diam. pulley; with 8x8” diam. pulley.
1 Fairbanks-Morse, 2 HP. portable motor.
1 Fairbanks-Morse 10 HP. motor, 1150 RPM.
1-60 HP. Bullock motor, 725 RPM. with
1-20x16 Fiber pulley.
1-36x30 Blast forge.
1-24x24x6 American Tool Works' planer.
1-28" back geared drill press, 24" table.
1-Putnam 18" - 42", 8 ft. lathe.
1-Le Blond 24" x 14" Engine lathe.
1-Emery grinder.
1-12" Foster drill.
1-30" double geared circular cut saw.
1-42" Wood frame hand power bending roll.
1-5½ HP. Northern, 4 cylinder gasoline
engine.

CARPENTER SHOP:

1-20" hand saw.
1-Iron frame grind stone.
1-Hoisting winch.

OUTSIDE MACHINERY:

1-Portable mixed, #1 McKelvey.
1-Steam shovel.
1-Locomotive.

BUILDINGS:

New Boiler House, 45'3" x 55\', 1 story brick building
Old Boiler House, 36' x 39'7\'', 1 "  "  "
Old Engine House, 24' x 39'7\'', 1 "  "  "
New Engine House, 36'8" x 42'3\'', 1 "  "  "
Generator House, 24' x 39'7\'', 1 "  "  "
Wet Mill, 51' x 121'4\" 2 Story Brick & Frame.
Kiln Building, 121'4\" x 151\', 1 story Brick & Iron Bld.
Kiln Extension, 32'8\" x 46' 1 story concrete & Iron B.
Dry Mill, 46' x 121'4\'', 1 story brick & frame B.
Machine Shop, 30' x 121'4\'', 1 "  "  "
Coal Mill, 1 story brick
Ware House "A" 60' x 180' 1 story concrete & frame
Ware House "B" 28' x 200' 1 story frame bldg.
Ware House "C" 60' x 180' 1 story concrete & frame
Laboratory, 32' x 40' 2 story frame bldg.
Carpenter shop, 30'8" x 60' 1 story frame bldg.
Oil House, 16' x 32' 1
and 8' x 15' 1 story frame bldg.
Motor House, 16' x 16'
and 8' x 15' 1 story frame bldg.
Well House, 16' x 16'
Fire Brick House, 28' x 85' 1 story frame bldg.
Factory Office, 18' x 30'3" 1 story brick bldg.
1 Story frame building 16' x 16' and 3' x 3'

5 Tenement houses.
The construction of the above buildings is fairly substantial. They can be used for the proposed increased capacity, provided our plans are adopted. As the buildings are arranged now, however, with their present process of manufacture, there is a great deal of woodwork in the plant, hence this company has had to carry insurance to the extent of $120,000.

An appraisal was made by the American Appraisal Company, of Milwaukee, Wis., in February, last year, which showed a total inventory of buildings and machinery of $452,057.70. We estimate that new machinery has been bought since the above appraisal was made amounting to about $15,000.

LABOR: The number of men employed varies from 100 to 120. Common labor heretofore has been obtained at the rate of from 17½ to 20¢ per hour; Millers, 25¢; Burners, 25¢; Machinists, 30¢; Foremen, 32½¢. The hours have been 10½, in the day, and 13½ in the night. Administration and labor are about as follows:

<table>
<thead>
<tr>
<th>Position</th>
<th>Salary</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Manager</td>
<td>$2000</td>
</tr>
<tr>
<td>Superintendent</td>
<td>3600</td>
</tr>
<tr>
<td>(and when plant is increased, salary to be increased to)</td>
<td>4000</td>
</tr>
<tr>
<td>Assistant Superintendent</td>
<td>150</td>
</tr>
<tr>
<td>Chief Electrician</td>
<td>125</td>
</tr>
<tr>
<td>Chief Chemist</td>
<td>150</td>
</tr>
<tr>
<td>Assistant Chemist</td>
<td>80</td>
</tr>
<tr>
<td>Physical Tester</td>
<td>50</td>
</tr>
<tr>
<td>When the plant is operating, we understand that there is another Chemist employed at</td>
<td>80</td>
</tr>
<tr>
<td>Chief Engineer</td>
<td>27½¢</td>
</tr>
<tr>
<td>Engineers</td>
<td>22½¢</td>
</tr>
<tr>
<td>Electricians</td>
<td>25¢</td>
</tr>
<tr>
<td>Machinist Apprentice</td>
<td>12½¢</td>
</tr>
</tbody>
</table>
Quarry Foreman $25\text{¢ per hour}$
Shovel Engineers $25\text{¢} "$$
Tinner $25\text{¢} "$$
Dry Mill Foreman $25\text{¢} "$$
Burners $25\text{¢} "$$
Head Burner $27\text{¢} "$$
Shovel Foreman $20\text{¢} "$$
Carpenters $22\text{¢} "$$
Labor in Kiln Room $22\text{¢} "$$
Boss Carpenter $30\text{¢} "$$
Tinner Foreman $32\text{¢} "$$
Tinner $30\text{¢} "$$

The men live in Yankton; train service two trips per day, costing the Company $10\text{. per day: Sunday service, costs $16.90.}$
The Company has been carrying no liability insurance, which we would recommend for the future.

MANUFACTURING COST: In relation to the manufacturing cost, we wish to state that after a close investigation of the accounts as kept in your office at the plant, the following condition was shown.

Total labor for the year, $376,931. based on 173,547 bbls.
produced, $4\text{4\text{¢ per bbl.}}$
Supplies, $17,853. $10\text{¢} "$$
Repairs, $16,635. $9\text{¢} "$$
Coal, boiler and crane, $23,183 $13 " ) See remarks
Coal, dryers and kilns, $67,327 $39 " ) later.
Packing and shipping $4.2 "$$
Selling and administration $14 "$$
Interests on notes and bonds $9 "$$
New construction $14,188 $8 "$$

No depreciation at 10% $1,502 "$$
Making total cost... $1,767 "$$

In addition (?) to the above cost, there is a charge for railroad service of at least 2\text{¢ per barrel.}

Note: Please note that the amounts given for boiler and kiln coals are not correct. This must be due to the intermingling of the accounts. The boiler coal based on that actually required for the plant with present conditions should be $20\text{¢ per barrel, and the kiln coal, 32\text{¢ per barrel.}$
TRANSPORTATION: The location of the Yankton plant permits the product to find outlets by three railroads: The Chicago, Milwaukee & St. Paul; the Chicago and Northwestern; and the Great Northern. The plant is connected to Yankton by a small railroad, known as the Yankton and Western RR., owned exclusively by the Western Portland Cement Co. The Company furnishes the right-of-way, grading and original ties; the track metal was furnished by the three railroads, and there is an agreement with the Company that the Railroad Companies shall keep the track properly graded and everything in good condition. Should the Company desire to control and own absolutely this railroad, they would have to pay the Railroad Companies a sum of about $23,750. The property is favorably located for shipments to the North West and also to points within 150-200 miles in all directions. This plant is only subject to car shortage during the grain season, which occurs from the latter part of September to about the first of November, or for a period of generally from 3 to 4 weeks.

MARKET: The location of the plant, so far as the market is concerned, is good. The competition to which this plant is subject, is the Atlas Portland Cement Co., at Hannibal, Mo.; Iowa Portland Cement Co., at Des Moines, Ia., which plant is about ready to go into commission; The Northwestern States Portland Cement Co., at Mason City, Ia.; 4,000 bbl. per day controlled by the Cowham System and The Nebraska Portland Cement Co., at Superior, Neb., now being promoted. All prices are made with a Hannibal basis, which at the present time is 80¢ per barrel. There
would be very little competition from the Kansas plants.

In Minnesota, the Western Portland Cement Co. comes in competition with Eastern Mills, through Duluth; the Atlas, at Hannibal, and the Universal, at Buffington, Ind. In the extreme southwestern part of South Dakota, it is subject to competition from the Colorado Portland Cement Co., at Florence, Colo. There is a new mill contemplated at Chamberlain, S. D.: The materials will be the same as at the Yankton Plant, but they are further away from the coal supply.

The freight rates to the following cities which comprise the main market for this plant, are as follows:

Aberdeen, S. D. 8¢ per cwt.
Mitchell, " 7¢ "
Points between Mitchell and Rapid City, 7¢ to 30¢ " (at Butte Mo.)
West from Aberdeen 8¢ to 35¢ "
Coast points: 40¢
Sioux City, S. D. 5¢
Des Moines, Ia. 10¢
Spencer, S. D. 8¢
Sioux Falls, S. D. 5¢
Hannibal, Mo. 15¢
Chicago, Ill. 15¢
Mason City, Ia. 10¢
Duluth, Minn. 15¢

The main market is South Dakota, Western Minnesota, Northwestern Iowa, or for a distance of 200 miles east of Yankton, and 400 miles west. With a larger capacity, the Western Portland Cement Co. can extend its sales into Northern Dakota field. Nebraska is prohibitive.
CONDITION OF THE PRESENT EQUIPMENT:

QUARRY: The steam shovel, the 2 locomotive cranes, and clam shell buckets are in good condition. The 12 steel dump cars are new and have never been used. The hoisting engine for hauling the cars up the incline to the plant will, however, have to be overhauled. It seems to be in pretty bad condition and it may be necessary to buy a new one, as this one is rather small for operating under a larger output. The No. 8 Gates gyratory crusher was recently purchased and has never been erected.

The wooden cars in the Shale Quarry could be used, but need some slight repairs.

WET MILL: The 2 Jeffrey disintegrators seem to be in fairly good condition, as is the small one and the tube mills, pumps, etc. The capacity of this department is limited principally by the tube mills.

KILN BUILDING: The kilns all seem to be in fairly good condition so far as the kilns themselves are concerned. They have been recently re-lined and are about ready to start up. There will be sufficient capacity in the 3 kilns to the south, using dry process, including one 7'6" x 100' and 2- 8' x 120' kilns to take care of 1,500 barrels per day. The other kilns could be used for coolers and dryers, if so desired.

The kiln stacks are in bad condition. There are two sets of two kilns each connected with one stack, which is very bad practise. Also two 50" stacks back of two of the 100 ft. kilns have fallen
down and new stacks would have to be put in their place. The stack diameters throughout the plant are entirely too small for the kilns, and this had considerable effect upon their capacity.

**CLINKER MILL:** The Kent mills have been overhauled and are in good condition and could be used only in connection with the wet process and in connection with separators.

**COAL HOUSE:** Everything generally in good condition. The Kent mills, however, have been grinding coarse, hence, as mentioned before, these mills should be replaced by mills that will grind to a higher degree of fineness, or 10% finer on the 100 mesh. This coarse grinding is responsible, to a certain extent, for the high amount of coal used during previous operations.

**BOILER HOUSE #1:** Has an installation of 4-66" x 18' boilers, with 54- 4" tubes, with 3/8" plate, 1/2" heads. These boilers are only suitable for 100 lbs. pressure when new. The normal rating of these boilers is 120 HP. each, or a total of 480 HP.

**BOILER HOUSE #2:** Has an installation of 4-60" x 16' horizontal boilers, with 42- 4" tubes, with 3/8" plate, 1/2" heads. These boilers when new are good for only 100 lbs. pressure, and their normal rating is good for 80 HP. each.

All the boilers in both houses have been condemned by the Hartford Steam Boiler & Inspection Co., and should not carry a pressure over 85 lbs., but they have been operating them at from 90 to 100 lbs., regardless of the notification from the insurance company.
The boilers had quite an accumulation of scale, but since the water softening system was installed, we are informed that the percentage of scale has been greatly reduced.

The coal used has been averaging about 10,000 B.T.U.'s per ton, and the efficiency of such coals very rarely rises above 60 to 65% (See Kent, 1900, pp.634) The maximum efficiency when hand fired would probably be obtained by firing 4,600 lbs. per hour; evaporating at a maximum 32,000 lbs. of water hourly into steam, which equals about 1066 HP., convertible at 23 lbs. into about 1390 engine HP. The amount of coal used per sq. ft. of grate under these boilers in order to obtain the above results, would be in the neighborhood of 20 lbs. per sq. ft. per hour. It would be hard to go much beyond this, on an average.

**ENGINE ROOMS 1 - 2 & 3:**
1= 26x48 Corliss simple condensing engine.
1= 22x42x48 Cross compound engine.
1= 13x20 Ball engine.

The 22x42x48 engine has been operating at 75 RPM., equalling 600 ft. piston speed, with 90 lbs. at the boiler, and practically 80 to 85 at the engine. Assuming a 24" vacuum, the HP. at the present time is equal to about 543. This engine operating at the same speed, with 140 lbs. boiler pressure, with a 24" vacuum, would generate 824 HP.

The 26x48 simple engine, 90 lbs. at the boiler, 80 at the engine, with 24" vacuum, gives about 482 HP. This engine operating at 140 lbs. pressure, with a 24" vacuum, running 75 RPM., would give 781 IHP. It is doubtful, however, in regard to this engine whether it
could be operated under this condition. This engine was possibly designed for only about 100 lbs. steam pressure, and it would be well to put in a reducing valve in the steam line permitting but 100 lbs. to be used. Under this condition it would generate 574 HP.

The 13x20 Ball engine gives in the neighborhood of 90 HP. with the present pressure and speed, and is perfectly suitable to increase to 100 HP.; provided a reducing valve is put in the steam line and boilers operate at 140 lbs.

In addition to the above engines, there is a 18x36 Corliss engine in the Coal House, which operating at 100 RPM., at the present time would give about 150 HP., but with steam at 100 lbs. pressure, this engine would develop about 215 HP. It is not good practice to use 140 lbs. of steam in a simple condensing engine, and as this engine is running non-condensing, it would be out of the question to carry 140 lbs., hence a reducing valve would have to be used in connection with this engine also.

The above shows that were the engines operated at their most economical point with present steam pressure, they would develop 1265 I.H.P. Any excess of power requirements above this would be at the expense of economical operation. With higher pressure available from the boilers, the same engines would economically develop about 1713 I. H. P.

The 18x36 engine has not been in operation and at the present time is not in condition to run; hence the total power available on the main engines would be 1498 with engines operated at points of good economy.
The power required to drive the plant at the present time from the engines operating, is estimated as per the following table:

<table>
<thead>
<tr>
<th>Item</th>
<th>Power (HP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Jeffrey Mills (2 operating only)</td>
<td>80</td>
</tr>
<tr>
<td>2 5x22' Tube Mills</td>
<td>120</td>
</tr>
<tr>
<td>8 Kilns and feeders, fans, etc.</td>
<td>200</td>
</tr>
<tr>
<td>5 Kent Mills</td>
<td>200</td>
</tr>
<tr>
<td>1 Maxecon</td>
<td>40</td>
</tr>
<tr>
<td>6 Emerick Separators</td>
<td>60</td>
</tr>
<tr>
<td>1 #2 Williams Mill</td>
<td>25</td>
</tr>
<tr>
<td>2 Driers with fans</td>
<td>60</td>
</tr>
<tr>
<td>3 Kent Mills</td>
<td>90</td>
</tr>
<tr>
<td>2 Emerick Separators</td>
<td>20</td>
</tr>
<tr>
<td>2 Dust Collectors</td>
<td>10</td>
</tr>
<tr>
<td>Machine Shop</td>
<td>10</td>
</tr>
<tr>
<td>Elevators, conveyors, etc.</td>
<td>200</td>
</tr>
<tr>
<td>Line shafting, friction, lights, etc.</td>
<td>250</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>1365 HP.</strong></td>
</tr>
</tbody>
</table>

The above table being based upon the brake horse powers would require about 1500 I.H.P. collectively; the actual brake horse power of an engine being about 90% of the indicated horse power, the difference being the friction of the engines themselves and transmission losses.

It therefore appears that these engines have been operated beyond their normal capacity, the excess being about 235 HP., or about 18 per cent., although it is probable that the demands of each machine for maximum power were not coincident, the loads being intermittent.

The above power list presupposes the operation of these machines at full capacity, which point was doubtless not reached. This conclusion is borne out by the limits of the average daily production.

Assuming an average daily capacity during 1st year of 550 bbls. the horse power per barrel of output is 30% greater than is usually encountered in plants of this size, showing that the arrangement of the equipment and the output per HP. for the different units, is
far below average practice.

**CONDENSERS:** At the present there is a surface condenser directly back of the Engine Rooms, which appears in very bad condition. It consists of 34 sets, 10 tubes each - 340 tubes, 4"x20", 6800 sq. ft. condensing surface. Cooling water 65 degrees. These iron tubes will pit rapidly and not last long. This surface condenser if operated by sufficient cooling water in the ordinary manner, by submerging the tubes, would have a capacity far in excess of any possible requirements, but as it has been operated with sprayed cooling water, it has a very low efficiency coupled with a use of about double the quantity of cooling water used in ordinary practice. A low vacuum could hardly be reached or maintained. Its only merit lies in giving back to the boilers the water condensed.

In view of the effectiveness of the Kennicott purifiers in removing the minerals from the feed water, a more effective and reliable condenser should be installed. The present condenser requires twice as much cooling water as a barometric condenser of good construction to produce equal results. In all surface condensers, the tubes must be submerged so that in case of leaks, water will enter the condenser instead of air, which latter impairs the vacuum while water does not.

It would be advisable on the new installation, to put in condensers of the barometric type.
MISCELLANEOUS: As far as the balance of the equipment is concerned, the motors are in fair condition. The machine shop equipment is fairly good, but in a larger size plant, it would be advisable to put in a boring machine. The locomotive under "Outside Machinery" is second hand and worthless so far as its use in connection with operating the plant is concerned.

ESTIMATES:

According to the understand of our representative, while at the plant, it is desired that an estimate be given on the amount necessary to increase this plant to 800 bbls. wet process; and also an estimate on the cost of manufacturing operating under this process.

The following gives an approximate estimate of the amount needed for putting this plant on a 800 barrel per day wet process basis.

**ESTIMATE ON INCREASING OUTPUT TO 800 BARRELS - WET PROCESS:**

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installing #8 Gyratory crusher, elevator, etc.</td>
<td>$2500</td>
</tr>
<tr>
<td>Storage bins, 2000 tons capacity</td>
<td>$4000</td>
</tr>
<tr>
<td>Belt conveyor to Jeffrey Mills</td>
<td>$2500</td>
</tr>
<tr>
<td>2 5x22' Tube mills, erected</td>
<td>$5000</td>
</tr>
<tr>
<td>Installing 2 new Kent mills on hand</td>
<td>$2000</td>
</tr>
<tr>
<td>1250 HP. new high pressure boilers erected</td>
<td>$16250</td>
</tr>
<tr>
<td>New condenser and piping</td>
<td>$3000</td>
</tr>
<tr>
<td>1250 HP. stokers</td>
<td>$6250</td>
</tr>
<tr>
<td>Building over 2- 8'x120' kilns, 30x170'</td>
<td>$4000</td>
</tr>
<tr>
<td>Clinker handling</td>
<td>$8000</td>
</tr>
<tr>
<td>Additional shafting and installing same</td>
<td>$4000</td>
</tr>
<tr>
<td>Repairing stacks and lining them, on kilns</td>
<td>$5000</td>
</tr>
<tr>
<td>Incidentals 10%</td>
<td>$6250</td>
</tr>
<tr>
<td>General labor, 4 months</td>
<td>$20000</td>
</tr>
<tr>
<td>Engineering fee, 10%</td>
<td>$88750</td>
</tr>
<tr>
<td></td>
<td>$8875</td>
</tr>
<tr>
<td></td>
<td>$97625</td>
</tr>
</tbody>
</table>

24
The above estimate includes the general cleaning up of the plant, but no charge for cleaning out the present quarry.

**ESTIMATED COST OF MANUFACTURING IN 800 BBLS. WET PROCESS PLANT:**

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost (¢)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labor</td>
<td>30¢</td>
</tr>
<tr>
<td>Repairs</td>
<td>8¢</td>
</tr>
<tr>
<td>Supplies</td>
<td>9¢</td>
</tr>
<tr>
<td>Boiler coal</td>
<td>16¢</td>
</tr>
<tr>
<td>Kiln coal</td>
<td>32¢</td>
</tr>
<tr>
<td>Packing</td>
<td>3¢</td>
</tr>
<tr>
<td>Selling and Administration</td>
<td>12¢</td>
</tr>
<tr>
<td>Interest on bonds, notes and new construction</td>
<td>8¢</td>
</tr>
<tr>
<td>Railroad charge for carrying laborers</td>
<td>1¢</td>
</tr>
<tr>
<td>Depreciation, 10%</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>22¢</strong></td>
</tr>
</tbody>
</table>

**Total: $1.42**

The above estimate is based on the total labor employed to be the same as in the present plant. Owing to the fact that present plant has been poorly managed, there is no doubt that an increase in output of 23 to 30% could be obtained for the same number of men employed. The repairs and supplies operating under these conditions would be the same per barrel. The kiln coal would be practically the same. You will note that packing and shipping is cut slightly; as is also, administration.

With a proper installation of boilers and stokers it is easy to obtain an evaporative efficiency of 72 to 75%, as compared with 60% gained by hand firing of the low grade coal, so that but 60 lbs. would be required to do the work of 72 lbs. as has been fired. For 1000 boiler horse power in constant use, this saving would be about 16,000 lbs. per day, or about 20 lbs. per barrel for boiler coal. This would reduce cost of this item approximately 2.3¢ per barrel.
Cost of manufacturing 256,000 bbls. per year @ $1.42 $363,520
Selling Price, 256,900 bbls. per year " 1.25 320,000

Showing a net loss of $43,520 per year and an additional investment of $97,625.

In addition to the above, by installing up-to-date grinding machinery in the coal and clinker mills, a saving could be made over the amount of coal used, amounting to about 4¢ per barrel. Also, a very much higher quality of cement would be obtained. To make these changes an additional expenditure of $20,000 would be necessary.

**TO PUT THE PLANT ON A 1500 BARREL DRY PROCESS,**

**THE FOLLOWING TABLE GIVES AN APPROXIMATE ESTIMATE:**

<table>
<thead>
<tr>
<th>QUARRY:</th>
<th>Installing #8 crusher, elevator, etc. $2500.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Storage bin, 3000 tons capacity 5000</td>
</tr>
<tr>
<td></td>
<td>Belt conveyors and 2 elevators 2500</td>
</tr>
<tr>
<td></td>
<td>$10000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STONE DRYING:</th>
<th>Changing 3 old kilns and erecting same as dryers $9000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2 Elevators erected 1200</td>
</tr>
<tr>
<td></td>
<td>$10200</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RAW MILL:</th>
<th>1 Elevator $600</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 Mixing bin 1500</td>
</tr>
<tr>
<td></td>
<td>1 Raw mill bin 1500</td>
</tr>
<tr>
<td></td>
<td>Changes required to shafting, clutches, belting, etc. 2000</td>
</tr>
<tr>
<td></td>
<td>New foundations and labor for new machinery 2000</td>
</tr>
<tr>
<td></td>
<td>4 42&quot; Fuller mills 12000</td>
</tr>
<tr>
<td></td>
<td>$19600</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>KILN BUILDING:</th>
<th>New building over kilns, 30x180' $6000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Kiln stock bin for 2 - 8'x120' kilns 2400</td>
</tr>
<tr>
<td></td>
<td>New kiln stack, 6'x100', lined and erected 1200</td>
</tr>
<tr>
<td></td>
<td>Alterations 1000</td>
</tr>
<tr>
<td></td>
<td>$10600.</td>
</tr>
</tbody>
</table>
CLINKER COOLING: Changing 2 old kilns to coolers, and erecting them
2 Clinker elevators
Shafting, belting, piers, etc.
$6000
1500
$4100

CLINKER STORAGE: Trestle and handling apparatus
$6000

CLINKER MILL: 1 #8 Krupp Ball Mill, erected,
2 Elevators
Ball mill bin
1 Clinker bin
7 Fuller mills
Screw conveyors and troughs
Alterations to drives, belting, clutches, etc.
Foundations and labor
$3400
$1200
$900
$2500
$21000
$1000
$2000
$2500
$35100

COAL MILL: 2 ½" Fuller mills
Changing drives, etc.
New bin
Labor and foundations
$6000
$1000
$750
$750
$8500

POWER HOUSE: Installing 1500 HP. boilers, (1 extra) $19500
Stokers
Condenser and piping
Alteration to building
$7500
$3000
$2000
$32000

The present brick stack, shown on B/P as 7½' inside diam., 98' high, if these dimensions are O.K., is plenty large enough for these boilers.

MACHINE SHOP: 1 Boring mill
$2000

STOCK & PACK HOUSE: Packing bin and conveyors
$2000

SUMMARY:
Quarry
Stone Drying
Raw Mill
Kiln Building
Clinker Cooling
$10000
10200
19600
10600
8900
Clinker Storage $6000
Clinker Mill 35100
Coal Mill 8500
Power House 32000
Machine Shop 2000
Stock & Packing House 2000
Incidentals & Contingencies, 10% 14500
Additional general labor, (6 months) 20000

Engineering fee, 10% $17940
Freight, etc. 2660

TOTAL... $200000.

1250 HP. in constant use would have 235 sq. ft. grate. Area of 88" stack, 42 sq. ft. Ratio grates to stack 5.6 to 1, which is good. Ratio when 6 boilers are in use; grates to stack 6.7 to one which is fair.

POWER REQUIREMENTS FOR ABOVE 1500 BARREL DRY PROCESS PLANT:
The following is estimated as the amount of power required for 1500 bbls.

1 #6 crusher, etc., 80 HP.
1 Clay crusher 25 "
2 Jeffrey mills 100 "
3 Driers 45 "
4 Fuller mills 260 "
3 Kilns 75 "
1 Ball mill 50 "
3 Coolers 45 "
7 Fuller Mills (Clinker) 500 "
2 Fuller Mills 100 "
2 Driers 50 "
1 Williams Mill 25 "
Elevators & conveyors 175 "
Shafting & friction 150 "

TOTAL.... 1680 HP.

Additional, but operating intermittently;

Lighting 50 HP.
Packing 30 "
Hoisting engines 50 "
Machine Shop 20 "

1830 HP. for 1,500 barrels - 1½ HP/ per barrel.
### COST OF MANUFACTURING IN A 1500 BBL. DRY PROCESS PLANT

320 Operating days; Day shift 10½ hrs., night shift, 13½ hours.

**QUARRY:**
- **1 Foreman (10 hrs.)** @ 25¢ = $2.50
- **1 Shovel Engineer** = 2.50
- **1 Shovel Fireman** = 2.00
- **2 Helpers** = 3.50
- **20 Laborers** = 35.00

**STONE CRUSHING DRYING AND RAW MILL:**
- **1 Miller (10½ hrs.)** = 22½¢ = $2.36
- **5 Men** = 9.19

**POWER:**
- **3 Firemen (10½ hrs.)** @ 17½¢ = $5.51
- **1 Chief Engineer** = 2.89
- **3 Firemen (13½ hrs.)** = 7.09
- **1 Night Engineer** = 3.38
- **1 Electrician Asst.** = 3.38

**KILOMETER:**
- **1 Boss burner (10½ hrs.)** = 27½¢ = $2.89
- **1 Burner** = 2.63
- **1 Oiler** = 1.84

- **2 Burners (13½ hrs.)** = 6.75
- **1 Oiler** = 2.36

**CLINKER:**
- **2 Millers (10½ hrs.)** = 22½¢ = $4.73
- **2 Helpers** = 3.68

- **2 Millers (13½ hrs.)** = 6.08
- **2 Helpers** = 4.73

**COAL MILL:**
- **2 Helpers (10½ hrs.)** = 17½¢ = $3.68
- **1 Miller** = 2.10

- **2 Helpers (13½ hrs.)** = 4.73
- **1 Miller** = 2.70

**Total Cost:** $45.50

29
### MACHINE SHOP:
- 1 Machinist (10 hrs.) @ 30¢ $3.00
- 2 Helpers " 22½¢ $4.50
- 3 $7.50

### PACKING HOUSE:
- 1 Boss (10 hrs.) 22½¢ $2.25
- 14 Packers 20 ¢ 28.00
- 4 Truckers 17½¢ 6.70
- $37.25

### MISCELLANEOUS:
- 1 Night Foreman, 13½ hrs. 35¢ $4.73
- 2 Millwrights, 10 hrs. 32¢ 6.40
- 2 Carpenters, 1 @ 35¢ and 1 @ 22½¢ 5.75
- 1 Outside Foreman 25¢ 2.50
- 10 Laborers 17½¢ 17.50
- 4 Extras 17½¢ 7.00

### Department:

<table>
<thead>
<tr>
<th>Department</th>
<th>No. of men</th>
<th>per day</th>
<th>per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quarry</td>
<td>25</td>
<td>$45.50</td>
<td>$1,138.00</td>
</tr>
<tr>
<td>Raw Mill</td>
<td>12</td>
<td>26.39</td>
<td>8,444.80</td>
</tr>
<tr>
<td>Power</td>
<td>9</td>
<td>22.25</td>
<td>7,120.00</td>
</tr>
<tr>
<td>Kilns</td>
<td>6</td>
<td>16.47</td>
<td>5,274.20</td>
</tr>
<tr>
<td>Clinker Mill</td>
<td>8</td>
<td>19.22</td>
<td>6,150.40</td>
</tr>
<tr>
<td>Coal Mill</td>
<td>6</td>
<td>13.21</td>
<td>4,227.00</td>
</tr>
<tr>
<td>Machine Shop</td>
<td>3</td>
<td>7.50</td>
<td>2,400.00</td>
</tr>
<tr>
<td>Packing</td>
<td>19</td>
<td>37.25</td>
<td>11,920.00</td>
</tr>
<tr>
<td>Night Foreman</td>
<td>1</td>
<td>4.73</td>
<td>1,513.60</td>
</tr>
<tr>
<td>Millwrights</td>
<td>2</td>
<td>6.40</td>
<td>2,048.00</td>
</tr>
<tr>
<td>Carpenters</td>
<td>2</td>
<td>5.75</td>
<td>1,844.00</td>
</tr>
<tr>
<td>Outside foreman and men</td>
<td>12</td>
<td>20.00</td>
<td>6,400.00</td>
</tr>
<tr>
<td>Extras</td>
<td>4</td>
<td>7.00</td>
<td>2,240.00</td>
</tr>
<tr>
<td>General Foreman</td>
<td>1</td>
<td></td>
<td>1,500.00</td>
</tr>
<tr>
<td>Electrician</td>
<td>1</td>
<td></td>
<td>1,500.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>110</strong></td>
<td><strong>$77,134.20</strong></td>
<td></td>
</tr>
</tbody>
</table>

1,500 bbls. per day at 320 days = 480,000 barrels. Labor = $77,134.20

**SUPERINTENDENT & LABORATORY:**

<table>
<thead>
<tr>
<th>Position</th>
<th>Salary</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Superintendent</td>
<td>$3600</td>
</tr>
<tr>
<td>1 Chemist</td>
<td>2000</td>
</tr>
<tr>
<td>1 Asst. Chemist</td>
<td>1500</td>
</tr>
<tr>
<td>1 Tester</td>
<td>600</td>
</tr>
<tr>
<td>1 Timekeeper</td>
<td>720</td>
</tr>
<tr>
<td>1 Stenographer</td>
<td>720</td>
</tr>
</tbody>
</table>
| **Total**          | **$9140** | 1.9 "
SELLING & ADMINISTRATION SALARIES:

Sales Manager $3,000
Stenographer 720
Bookkeeper 960
Boy 80

$5,040

1,000

18.9¢ per bbl.

DISTRIBUTION OF EMPLOYEES:

General Labor 110
Superintendent & Laboratory 6
Selling & administration 4

120

120 men for 1,500 barrels = 12½ barrels produced per man employed.

MANUFACTURING COST IN A 1,500 BARREL PER DAY PLANT OPERATING 320 DAYS PER YEAR UNDER THE DRY PROCESS:

<table>
<thead>
<tr>
<th>Cost Item</th>
<th>Cost ($ per barrel)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labor</td>
<td>19¢</td>
</tr>
<tr>
<td>Boiler fuel</td>
<td>12</td>
</tr>
<tr>
<td>Kiln fuel</td>
<td>14.2</td>
</tr>
<tr>
<td>Repairs and supplies</td>
<td>12</td>
</tr>
<tr>
<td>Packing and shipping</td>
<td>3.3</td>
</tr>
<tr>
<td>Selling and administration</td>
<td>4</td>
</tr>
<tr>
<td>Railroad cost</td>
<td>1</td>
</tr>
<tr>
<td>Interest or bonds &amp; notes now outstanding</td>
<td>65.2</td>
</tr>
<tr>
<td>Interest on new investment to put plant on 1,500 barrel basis</td>
<td>3.3</td>
</tr>
<tr>
<td>Total</td>
<td>71.0</td>
</tr>
</tbody>
</table>

Depreciation or sinking fund @ 10% on $680,000 14¢

TOTAL COST... 85¢

Inasmuch as the allowance of 12¢ per barrel upon 480,000 barrels would be provision for not only the ordinary repairs caused by wear and tear, but for extraordinary renewals in the operation of the mills, the setting aside of an additional 14¢ per barrel for depreciation, or 10% upon the whole investment, many be looked upon as a sinking fund which would in ten years
extinguish the whole investment, in addition to the profits otherwise shown.

Selling price, Cost of manufacturing 480,000 bbls. per year @ $1.25 $600,000
0.85 408,000
Showing a net profit of 192,000 per year for an additional investment of $200,000.

COMPARISON STATEMENT:

<table>
<thead>
<tr>
<th>Capacity</th>
<th>Process</th>
<th>Investment</th>
<th>Mfg. Cost</th>
<th>Profit &amp; Loss @ $1.25 per bbl.</th>
</tr>
</thead>
<tbody>
<tr>
<td>800 bbls.</td>
<td>Wet</td>
<td>$97,625</td>
<td>$1,42</td>
<td>$43,520 (loss)</td>
</tr>
<tr>
<td>1500</td>
<td>Dry</td>
<td>200,000</td>
<td>0.85</td>
<td>192,000 (profit)</td>
</tr>
</tbody>
</table>

There would be experienced no difficulty as to quality in making cement by the dry process with the materials found at Yankton.

The calculations of costs of manufacture herein submitted are based upon liberal estimates under the observed conditions. With care and watchfulness they could doubtless be reduced somewhat below the figures we have set.

The estimate is in parallel with the results obtained in other mills under our observation, where machinery of similar excellence has been installed and maintained at good efficiency. Each machine we have indicated and recommended herewith is the best of its class for the purpose intended, and the adoption of these recommendations when carried out, will place the Yankton Mill of the Western Portland Cement Company in position to maintain its business competitively.
There should be a current cost system maintained, inspection of which would make a constant exhibit of the output and the expenses of the various departments, kept in such manner as to guide the management in its economies.

Blue prints are attached showing the present arrangement of the plants, and the proposed arrangement for a 1500 barrel dry process mill.

Respectfully submitted,

FULLER ENGINEERING COMPANY,

J. W. Fuller Jr.
President.