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Opposite Bay State House.
On account of the meeting of the W. M. E. Society occurring so soon after the date of our regular issue, and just before the spring recess, it was decided to delay this issue, in order to report the meeting, and print the papers read.

It is now just a year since the W P I publicly announced its intention to change to a bi-weekly and thus become more of a newspaper. Although a little doubt was felt at that time as to the success of the undertaking, the past year has proved that we were justified in making the attempt, and we flatter ourselves that we have been fairly successful and that the paper has been more satisfactory to the students in general as a bi-weekly.

It has been possible to report nearly all events of interest before they have lost their newness, and in a number of instances we have been able to make the first public announcements of important events.

The Ninety-three editors leave the Board with feelings slightly akin to sorrow. For more than a year it has been our pleasant though rather laborious task to carry on our editorial duties and we have enjoyed them as most interesting features of our Institute life.

We extend to the Ninety-four men whose duty it now becomes to take in charge the paper a hearty right hand of fellowship. We have little doubt but that under them the W P I will fully maintain and we hope raise its standing among college periodicals and still more satisfactorily fill its position as the organ of the Institute.

When we first entered the Institute, social life was conspicuous by its absence. Since that time a great deal has been said and nearly as much done in the matter so that at the present time things are very different. A number of societies have been formed having in view the creating and extending of friendship and sociability among the students.

A number of pleasant receptions have been given by various organizations, and now the "Last of the Middlers" have distinguished themselves by inviting the Seniors to a reception. We hope that this is the inauguration of an annual Junior Promenade or Reception such as is held in nearly every college.

This means a great deal of work and expense to its projectors, but if successfully carried out, Ninety-four may well feel proud.

We want to say just a word about the W P I. The paper is carried on at the sacrifice of a considerable amount of time,
which is very feebly compensated for when
the annual "spoils" are divided. It is
necessary for the students to give the ed-
tors hearty support in every way, and
every one should subscribe for the paper.
Let each student who has not yet subscribed
for the coming year do so at once that the
editors may feel encouraged to increase
their efforts for the welfare of the students.

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BALLASTING THE BRITISH SHIP
"BRUNEL."

By Hugo F. Fearn, Naval Architect, Union Iron
Works. Written for the "Washburn
Mechanical Engineering Society."

Last March, Captain John Metcalfe, Sur-
voy to Lloyd's Register for the port of San
Francisco, requested the writer to verify some
estimates he had made as to the amount of rock
ballast the British ship "Brunel" would require
to carry a load of mixed lumber to Australia.

The ship's captain reported that she was very
tender, and perhaps underrated her stiffness a
little, and owing to his caution and that of the
agents of the ship, it was at first undecided
whether to carry a deck load, as lumber is
carried in the Pacific coasting trade, or to fill
only the hold. It was therefore thought best to
calculate the amount of ballast required, both
with and without a deck load.

Captains of sailing vessels do not, as a rule,
possess the knowledge to determine how much
ballast a ship needs, unless they have a case
which has already come within their experience,
and then they judge by comparison; and if they
had the knowledge, any data which would help
them much is seldom placed aboard ships, and
indeed, exact data on the subject is very scarce.

A British captain especially, meets with a
new problem when he attempts to carry lumber
as it is carried here on the Pacific coast. Our
coasting schooners are wide in proportion to
their depth of hold, and are loaded down deep,
so their decks amidships are sometimes below
the water line, the deck load and great sheer at
the ends answering for freeboard. Their ships
are deeper in proportion to their beam, and they
generally have what is called Plimsol's mark
painted on their sides, which shows the maxi-
mum depth to which they can load, and also
shows the minimum freeboard under which they
can go to sea. It has been humorously said
that the Plimsol mark on our coasting schooners
was placed on the mast.

It might be mentioned that a cargo of lumber
is one of the safest cargoes that can be carried,
because it stays where it is placed and cannot
shift.

Lloyd's freeboard is designed to be sufficient
to allow a vessel to ship a deck load of water,
which, according to her size, might amount to
several hundred tons, which of course, tem-
porarily materially reduces her stability. It
therefore stands to reason that if her deck is so
loaded with lumber as to exclude the water, her
freeboard is increased an amount equal to the
height the lumber is piled, and her stability can
not be reduced from that cause. She is there-
fore in a safer condition for going to sea; or
with a deck load it would be safe to load her
down a certain amount below her Plimsol mark.
But as Lloyd's rules do not provide for carry-
ing deck loads of lumber, it will be impossible
to load her below her regular load draught.

We can, however, allow her less initial
stability with a deck load in consequence of the
great additional freeboard, or in other words,
allow less ballast proportionally with a deck
load than without one.

There are certain statical conditions which
must exist in order that a vessel be stable and
seaworthy. The point called the meta centre
must be sufficiently high above the centre
of gravity. The distance between these two
points is termed the meta centric height. The
most suitable meta centric height varies con-
siderably with different classes of vessels,
the largest ones having the smallest amount.
Records of meta centric heights are much
scarcer than they should be when it is so easy
to heel a ship at the dock and find them exactly.
Too much meta centric height is a greater fault
than too little. Some of our coasting schooners
are known to have less than twelve inches, and
perhaps a good meta centric height for a large
ship under sail would be from thirty to thirty-six
inches. After obtaining a point to start from,
the meta centric heights desired for the two con-
ditions of load will be determined and then the
amount of ballast necessary for them will be
calculated. A displacement scale, a scale of
meta centres and scale of block co-efficients,
together with a midship section, and the dimen-
sions of the ship, were all that was given to
solve the problems. Having the meta centres
it only remains to find the centre of gravity of
the ship to make the balance of the problem
one of simple mechanics.

The "Brunel," a three-masted, full-rigged ship,
is 256.4 feet long, 38.95 feet beam and 22.45
feet depth of hold. These dimensions are suffi-
ciently close to those of the four-masted barque
"Earle of Dalhousie" to admit of comparison.
The "Earle of Dalhousie" is 264 feet long, 38.7
feet beam and 23.4 feet depth of hold.
In the Spring of 1885 she was lying at anchor in the Bay of San Francisco with 270 tons of coal in her hold. The Captain receiving a charter decided to discharge the coal, at the same time lowering all his yards, hanging them over the side, thus hoping to retain sufficient stability to move his ship to a new berth to receive his cargo; but unfortunately, his ship capsized and went to the bottom in forty feet of water, and was subsequently raised by the Union Iron Works.

The “Earle of Dalhousie” could be safely moved with 270 tons of coal for ballast and the meta centric height of six inches would be sufficient for this purpose.

Let us assume then that she had a meta centric height of six inches, which could hardly have been a greater error than two inches either way.

The “Brunel” is a little shorter, about the same beam and about a foot less depth of hold. She is heavier sparred, has a fuller load water line and perhaps a little fuller bottom in proportion to her water line.

The foot less depth and full water line would be in her favor, and the heavier spars and full under water bottom would be against her, but the difference in the stability of the two ships is not very great, and to be safe, assume that the “Brunel” would have six inches meta centric height with three hundred tons of ballast.

The displacement scale reads 990 tons for the light draught, but in reality the “Brunel” weighed 1100 tons with stores aboard and a swept hold.

Then to find centre of gravity of ship empty and without ballast, assume,

Light displacement, 1,100 tons
Light ballast, 300 tons
Meta centric height, 6 inches
Displacement in light ballast, 1,400 tons
Centre of gravity of ballast above top of keel, 5 feet

The displacement scale shows that the draught is 9 feet 1 inch, and the curve of meta centres measures 13 feet 6 inches above top of keel. Hence the centre of gravity of the ship under these conditions is 13 feet above top of keel, since we assume that it was 6 inches below the meta centre.

Then the centre of gravity of ship without ballast in feet $x = \frac{280 \cdot (13.5)}{1100} + 13 = 15.18$ feet above top of keel. The moments being taken about centre of gravity of ship in light ballast. While this centre of gravity is not absolutely correct, because it has been calculated from assumed facts, it is sufficiently accurate for all practical purposes and will be used as a base for the balance of the problem.

From the curve of block co-efficients the capacity of the hold was calculated, and it was estimated that 1,000,000 feet of lumber could be stowed in it. It was assumed that 750,000 feet of this would be green redwood at 4\frac{1}{2} pounds per foot, stowed in its bottom, and the balance, 250,000 feet of Oregon pine at 3 pounds per foot, placed on top, which together made 1840 tons. The centre of gravity of this was placed at sixteen feet above the top of keel.

It was also estimated that 268,800 feet of Oregon pine at 3 pounds per foot, or 260 tons, would constitute a deck load. The center of gravity of this was placed 29 feet above the keel.

Then the centre of gravity of ship and total cargo without ballast, in feet, above top of keel $x = \frac{1100 \cdot 15.18 + 1840 \cdot 16 + 360 \cdot 29}{1100 + 1840 + 360} = 17.14$ ft.

And the centre of gravity of ship and cargo in hold only, above top of keel, in feet, $x = \frac{1100 \cdot 15.18 + 1840 \cdot 16}{1100 + 1840} = 15.69$ ft.

It is now necessary to determine what meta centric height we will aim to attain for the two conditions of load, and then calculate the ballast to suit.

Again referring to the “Earle of Dalhousie” for data, it was found that her plain sail area was 23,872 square feet, and that the centre of effect of the wind was 58 feet above the deck.

From this it was assumed that the plain sail area of the “Brunel” was 28,000 square feet and that the centre of effort was 74 feet above the centre of lateral resistance.

It was then decided to allow her a steady angle of heel of 8 degrees with a deck load, and 5 degrees without a deck load, under a wind pressure of one pound per square foot. The greater angle of heel for a deck load was allowed for reasons already stated. From this the respective meta centric heights desired can be calculated, assuming the amount of ballast to get approximately the displacements, and also assuming that the meta centric heights will be practically constant for these angles of heel.

In the first case assume sufficient ballast to bring her down to her load, which gives a displacement of 3900 tons, 600 tons being ballast.

Then $3900 \times 2240 = 8,736,000$ pounds.

And $23000 \times 74 = 1,702,000$ foot pounds of wind pressure.

$1,712,000 = .196$ feet $= 2.352$ inches $=$ righting lever of ship at 8 degrees angle of heel.
The meta centric height or G. M. = 
\[ \frac{2.352}{\text{Sine 8 deg.}} = 16.90 \text{ inches.} \]

In the second case assume 520 tons ballast which gives a displacement of 3460 tons, and 3460 \times 2240 = 7,750,400 pounds, and 1,712,000 
7,750,400 = .2209 feet = 2.6508'' = righting lever of ship at 5\(^\circ\) degrees angle of heel.

\[ \text{G. M.} = \frac{2.6508}{\text{Sine 5\(^\circ\) deg.}} = 27.61'' \]

As has been hinted there are many lumber vessels on this coast whose meta centric heights would fall far short of the G. M. which the above assumptions and calculations have led the writer to select, and furthermore, if the "Brunel" was going in the coasting trade instead of the Australian, a larger angle of heel might have been selected, and a smaller meta centric height used.

The amount of ballast was determined by trial calculations, or in other words, the ballast was assumed and then it was ascertained whether the meta centric height was sufficiently close to those we had settled on.

As above, with a deck load, assume 600 tons ballast. Then the centre of gravity with 
\[ \frac{3300 \times 17.14 + 600 \times 5}{3300 + 600} = 15.26 \text{ feet for its height above top of keel.} \]
The meta centre on this displacement according to the scale is 16.66 feet above top of keel, giving a meta centric height of 1.4 feet or 16.8\(^\prime\), which is about what is required.

For a hold cargo only, assume 500 tons ballast, then 
\[ \frac{2940 \times 15.69 + 500 \times 5}{2940 + 500} = 14.13 \text{ feet above top of keel.} \]
The meta centre on this displacement is 16.41 feet above top of keel giving a meta centric height of 2.28 feet or 27.36\(^\prime\), practically the height desired.

600 tons ballast is then required for carrying a deck load and 500 tons ballast for a hold cargo only.

It may be stated the amount of ballast, both for determining the meta centric heights and also to see if we had the meta centric heights desired, were not assumed so closely at first, but trial calculations were first made so that they could be assumed within close limits.

The heights of the centres of gravity of the various amounts of ballast were all placed 5 feet above the top of keel, the ballast in every case being trimmed the same height, but over a greater length of the vessel. It was finally decided not to carry a deck load. 550 tons of ballast were placed aboard.

The actual cargo consisted of
- 487,000 feet of redwood,
- 96,280 feet of sugar pine,
- 488,696 feet of Oregon pine,
- 33,338 feet of Yellow pine,
- 1,250 doors, about 30,000 feet,
- 20 Bbls. of oil,
- 4 Buggies in crates.

The mean draught ready for sea was 19 feet 2\(\frac{1}{2}\) inches.

Before the "Brunel" sailed, Captain Metcalf suspended a weight at the main-top sail yardarm, and satisfied himself that she was in sea-going trim.

The displacement according to the scale was 3600 tons, or 60 more than calculated; but it will be noticed that 50 tons more ballast was placed aboard than estimated, so that the dead weight of cargo was within 10 tons of that estimated.

The 50 tons extra ballast was put aboard because there was to be less redwood, and it was thought the centre of gravity of the cargo would be a little higher.

The position of the various calculated centres of gravity and meta-centres are shown on the midship section, and are according to the following numbers:

1. C. G. of ballast ........ 5 feet above keel.
2. C. G. of ship light .......... 15.18
3. C. G. of cargo in hold ...... 16.00
4. C. G. of deck load .......... 29.00
5. C. G. of ship and total cargo 17.14
6. C. G. of ship and hold cargo 15.69
7. C. G. of ship, total cargo and ballast ...... 15.26
8. Height of meta-center for (7) 16.66
9. C. G. of ship, hold, cargo and ballast ...... 14.13
10. Height of meta-center for (9) 16.41

The captain of the ship, on arriving at Australia, reported that he had a comfortable voyage, but thought the "Brunel" was a little tender, which, however, was as intended.

[The paper was accompanied by a large diagram to which reference is occasionally made, but on account of its size and because it was not absolutely necessary to an understanding of the article it is not printed.—Ed.]

THE BOARD OF EDITORS.

E. Walter Davenport, '94, has been elected editor-in-chief; H. S. Favor, '95, assistant editor; C. G. Harris, '94, business manager for the ensuing year. C. W. Eastman, '94, and Percy E. Barbour, '96, have also been elected to the Board. The general plan of the paper during the coming year will be the same as in the past.
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<th>REPORT OF BOILER TRIAL.</th>
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<td><strong>The Morgan Spring Co.</strong> Robinson Horizontal Fire-Tube Boiler.</td>
</tr>
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Read before the W. M. E. S. by C. O. Rogers, 93.

<table>
<thead>
<tr>
<th>Time of trial 5 hours.</th>
</tr>
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<tbody>
<tr>
<td>Boiler 16' long by 4' in diameter; 52 three-inch tubes.</td>
</tr>
<tr>
<td>Water-heating surface, 788.98 sq. ft.</td>
</tr>
<tr>
<td>Super-heating surface, 0.</td>
</tr>
<tr>
<td>Average boiler pressure, 106.3 absolute.</td>
</tr>
<tr>
<td>Average temperature external air, 24°</td>
</tr>
<tr>
<td>Average temperature boiler-room, 81.5°</td>
</tr>
<tr>
<td>Average temperature feed water, 183°</td>
</tr>
<tr>
<td>Average temperature petroleum, 143.6°</td>
</tr>
<tr>
<td>Average temperature steam, 331.97°</td>
</tr>
<tr>
<td>Total petroleum used, 1,077.5 lbs.; per hour, 215.5.</td>
</tr>
<tr>
<td>Fuel per sq. ft. ht. surf. per hour, .273 lbs.</td>
</tr>
<tr>
<td>Quality of steam, 98.1 dry.</td>
</tr>
<tr>
<td>Factor of evaporation, 1.068.</td>
</tr>
<tr>
<td>Total weight of water, 13,826 lbs.; per hour, 2,765.2.</td>
</tr>
<tr>
<td>Total weight of vapor, 13,563.35 lbs.; per hour, 2,712.67.</td>
</tr>
<tr>
<td>Equiv. from and at 212°, total, 14,485.8 lbs.; per hour, 2,897.16.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Evaporation—</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per lb. fuel, actual, 12.596 lbs.; equiv. 18.45.</td>
</tr>
<tr>
<td>Per sq. ft. ht. surf., actual, 17.2 lbs.; equiv. 18.4.</td>
</tr>
<tr>
<td>Commercial H. P., 83.98; builder's rating, 40; ratio, 2.095.</td>
</tr>
<tr>
<td>Petroleum used per H. P. per hour, 2.556 lbs.</td>
</tr>
<tr>
<td>Heat generated per hour, 4,389,570.</td>
</tr>
<tr>
<td>Heat absorbed per hour, 2,805,212.</td>
</tr>
<tr>
<td>Efficiency, 63.77 per cent.</td>
</tr>
</tbody>
</table>

Blue Gas Analysis Dry Gas Petroleum Combination

<table>
<thead>
<tr>
<th>by vol.</th>
<th>by wt.</th>
</tr>
</thead>
<tbody>
<tr>
<td>N.</td>
<td>82.6</td>
</tr>
<tr>
<td>CO₂</td>
<td>8.7</td>
</tr>
<tr>
<td>O.</td>
<td>8.6</td>
</tr>
<tr>
<td>CO</td>
<td></td>
</tr>
</tbody>
</table>

99.75 99.94

Cost of petroleum per pound, $0.00044.
Cost of petroleum per hour, $0.046; or $4.48 per day of 10 hours.
Cost of petroleum per H. P. per hour, $0.01117.
Cost of petroleum per gal. 2.85 cents; 64 lbs. per gallon.

Calling 14,000 heat units the equivalent of a pound of anthracite coal,—
Equivalent of petroleum per hour in coal, 314.17 lbs.
Equivalent of petroleum per H. P. per hour in coal, 2.74.
Cost per hour, $—; per H. P. per hour, $—. At 12,000 heat units per pound of bituminous coal, Equivalent coal per hour, 388.6; per H. P. per hour, 4.62.
Cost per hour, $0.7226; per H. P. per hour, $0.0068.
Evaporative power of petroleum per pound from and at 212°:
Morgan Test, 13.44 lbs. of water.
G. H. Babcock in Theoretical Manual:
Chimney Draft, 18.56 lbs. of water.
Evaporated Draft, 19.9 lbs.
Theoretical, 21.74 lbs.
Bit. coal, 4.10 per long ton.

<table>
<thead>
<tr>
<th>Description of Plant and Test.</th>
</tr>
</thead>
<tbody>
<tr>
<td>This interesting test of the efficiency of a petroleum plant was made December 22nd, 1892.</td>
</tr>
<tr>
<td>It was a five-hour test, during the middle of the day, from 11 a.m. to 4 p.m., inclusive.</td>
</tr>
<tr>
<td>For purposes of measurement, the supply water for the boiler was run into a large tank on scales in the shop yard. Here the weight was recorded, and the water drawn off into tank No. 2 in the boiler room, from which the pump forced a steady supply through the heater into the boiler. Before the commencement of the experiment, tank No. 2 was partly filled and its amount measured. The boiler is the source of power for the entire shop, consequently a flying start was necessary. At the word, the height of water in the boiler was recorded, and the pump commenced to take its supply from the tank in the boiler room. When the experiment was over, care was taken to have the level of water in both boiler and tank slightly lower than that at the start, so that both might be carefully filled from the tank on the scales; thus the entire amount of water used was ascertained.</td>
</tr>
<tr>
<td>The oil reservoir consists of two tanks, of perhaps 500 cu. ft. capacity each, placed in the yard near by. They are but a few hundred feet distant from the railroad, so that tanks on the cars are emptied direct into the tank into the oil pipe beneath, leading to the engine room. When the tanks are half full, the oil has a head of about 18° to give it flow. During the trial, this petroleum was measured in the same manner as the water. It was pumped from one of the main tanks by hand to a smaller one on scales, from which it flowed at the command of the officer in charge, and which was connected with the main supply pipe. In the boiler room, the oil goes through a coil of pipes heated by exhaust steam where its temperature is raised to about 180°. An eighth-inch pipe conducts it to the furnace doors where its flow is regulated by a valve.</td>
</tr>
<tr>
<td>Several different burners have been in use, but many have given dissatisfaction by incomplete spraying of the oil; they throw drops about the inside of the furnace. The one in use now, the engineer describes as a home-made burner. The oil comes in its ¼' pipe to the centre of a short nozzle of one-inch pipe, into which, around the oil, is discharged a circular jet of steam. This stream of steam and surrounding oil is of a sufficient quantity to ignite the oil; it is directed into the fire-pot beneath the boiler with considerable force. The gases and flame return through the tubes, and upwards to the chimney.</td>
</tr>
<tr>
<td>From the analysis of these gases, the combustion is evidently good. The excess of oxygen, and consequently of cold air draft, is very slight, but 8 per cent. By the method of analysis of the gases, the 82 per cent. of nitrogen probably includes a considerable amount of moisture, both from the steam jet, and from the results of combustion of the petroleum. The calorimeter results show a remarkably good quality of steam when it is considered that a 40 h. p. boiler is being forced to 84 h. p. This quality was very even and constant, varying but 1% per cent. above or below the average of 98.1 per cent. The calorimeter used was a Peabody throttling calorimeter.</td>
</tr>
</tbody>
</table>
| The calculated evaporative power of the oil per pound during this trial is very low, compared with the theoretical power, or with other tests at hand. This low inefficiency is doubtless due to the fact of the forcing of the boiler. The strong draft necessary carries the gases to the chimney at a very high
temperature. At 60 h. p. probably the evaporative power of the oil would be greater, and consequently the efficiency of the boiler would be higher.

In calculating the cost, as between oil and soft coal for instance, it is difficult to balance between the two quite fairly. We must charge against the oil that it costs, in this plant, about 22½ cents per hour more. In addition, it uses a jet of steam at boiler pressure, through a ⅜ in. pipe. This is a direct loss to the boiler of 70 pounds of steam per hour, or about 2.6 per cent. The oil must be credited with the difference of a fireman's wages, which it practically saves. It eliminates any possible inefficiency in the details of coal firing, where it is so easy to cause a large waste. The ease of handling, and the absence of ashes and clinders, and the general cleanliness in the boiler-room incident to its use are strong points for its favor.

After considerable deliberation, the engineers in charge of the great power plant of the Columbian Exposition have put in a plant much after the principle of this, upon a grand scale. There is an interesting description of this system as applied there in the mechanical journal Power, for March.

"OLD ASSYRIAN LIFE."

Lecture before the Historical Society, by Rev. Austin S. Carpenter.

The exceedingly inclement weather rendered it necessary to postpone the lecture from the date announced to Thursday evening, March 16th. On that evening the society, together with a number of its friends, met in the Physical Lecture Room and listened to an exceedingly interesting lecture, a brief outline of which we print:

Until the beginning of the present century all the knowledge that was had of Assyria was gained through the meagre references of classical writers to that country. About 1800, a German scholar noticed some strange inscriptions, cut in the rock, in the land of the ancient Assyrians. By making a number of wise guesses, he made out the name Xerxes, and comparing it with another name, which he thought was Artaxerxes, he found the character for "x" alike in each case. No further progress was made in reading these strange cuneiform characters till about fifty years ago. An expedition under Sir Henry Laird, sent out by the British government, began excavations at that time on what proved to be the site of ancient Nineveh. Very soon rich finds rewarded the searchers, and before many years a vast deal of knowledge of old Assyria had been gained. The writings of those times are in a peculiar wedge-shaped form, and are preserved on terra-cotta cylinders and tablets. As a general thing, the cylinders contain the royal narratives while the tablets contain the records of every-day life, business transactions, school exercises, contracts, etc. They are of small size; indeed, some of the cylinders are no larger than a lead pencil and are finely marked in cuneiform characters.

Most of these cylinders and tablets date back to about 900 B.C. But the French in making explorations at Babylon developed the relics of a civilization, ancient compared with that of the Assyrians. The language of these Babylonian people was written in a linear character and was an ancient tongue to that of the cuneiform. At Babylon many statues were unearthed bearing inscriptions in these linear forms and most of them headless. These statues were finely cut in a very hard black stone found near Mt. Sinai and bear a strong resemblance to certain of the statues of the Egyptians which were of the same material. Now it has been found that this civilization dates back to 4000 B.C., and there is still in the books of this people an account of king Sargon, who lived at this period. Many stories are told of him, but besides being a great soldier, he was evidently a lover of learning, for he had a great library. In this library a book was found showing that the Assyrians of that time could calculate eclipses and, what is more, had a calendar exactly like ours, with 12 months, weeks, days, hours, minutes and seconds. These ancient tablets and cylinders, many of them, contain great epics. One tells of a great hero, a sort of Hercules, and in its eleventh book an account of the deluge very much like the story in Genesis. It is evident from the excavations that the very great city of Assyria had its University, and that the keenest rivalry existed among these cities as to which should have the finest library. The great library at Nineveh has been partly exhumed and it is found that the books were all numbered and the shelves correspondingly. Indeed, there is evidence that the people had access to them, that it was a real circulating library some 4000 years ago.

After showing a number of slides illustrating the cylinders and tablets, the lecturer spoke of the skill of the Assyrians in fashioning clay to beautiful vessels and glass in the most delicate and exquisite forms, rivaling the finest Venetian glass of to-day. They also knew how to work bronze, and were masters in the art of gem cutting. These Assyrians are beyond a doubt the ancestors of the Jews, and had their intense love of physical life. Their great pleasures were in the hunt and in war. The lecturer then showed a number of pictures representing the lion hunt done with a fire and vigor, and appreciation of nature worthy of a modern artist. If there was any animal the Assyrians loved it was the horse. He is very frequently carved and always represented in spirited and striking attitudes. The Assyrians loved art as well as
hunting and fighting, and were skilled in carving stone and ivory, in painting and frescoing, and did some of the finest embroidery ever wrought. Their art not only long precedes Greek art but is the real parent of it.

The lecture was illustrated by some sixty lantern slides and was listened to with the close attention that its interesting presentation deserved.

SOCIALISTS' BANQUET.

Monday evening, March 20th, will long live in the memory of the Socialists of '93.

On that occasion twenty-four members of this mysterious band and three guests assembled in the parlor of the Lincoln House. The guests were candidates for admission to the organization and were initiated later in the evening.

At 8:30 the company repaired to the dining-room and there the following problem was presented to them:

**SOUP.**

| Tomato.          | Celery.          |
| Rib of Beef.     | Ham. Tongue.     |
| Roast Turkey.    | Cranberry Sauce. |
| Boiled Ox Tongue.| Roast Beef—Dish Gravy. |

**ENTREES.**

| Apple Fritters.  | Escaloped Oysters. |
| Sweet Potatoes.  | Relishes of all kinds. |
| Mashed Potatoes. | VEGETABLES.         |
|                  | Peas.             |
|                  | Squash.           |

**DESSERT.**

| Wine Jelly.      | Lemon Jelly.     |
| Raisins.         | Bananas.         |
| Squash.          |    |    |    |    |

**TEA.**

| Coffee.          |    |

For more than an hour each one present applied himself conscientiously to the enjoyable task, and it is safe to say, that never in the history of the class did these men do more earnest work.

After the menu had been carefully gone through the buzz of conversation was stopped by President C. O. Rogers, who rapped for order and in a few well-chosen words introduced Wm. H. Parker as toast master. Mr. Parker entertained the company for a few minutes by one of his fascinating talks and then called on the following members to respond to toasts:

L. W. Rawson,—The Socialists of '93.
A. Mackay,—Photographs of Senior Life.
C. H. Andrews,—Illustrations of Fossils.
E. W. Vaill, Jr.,—The Ladies.
H. A. Coombs,—Bachelorhood.
E. E. Kent,—Reminiscences.
J. F. Coghlin,—Electric Sparks.
H. B. DaCruz,—The City of Worcester.
T. S. Perkins,—The Quiet Game.
N. M. Paull,—The Class of '94.

After the toasts a quartet composed of Messrs. Higgins, Perkins, Phillips and Coombs sang two selections, and Mr. Dyer sang a solo with banjo accompaniment.

The party then adjourned to the parlor and after indulging for a short time in college songs, the candidates for admission to the Socialists, Messrs. Phillips, Farwell and Hodgkins were asked to withdraw, and the initiatory committee, consisting of A. Mackay, L. W. Rawson and F. H. Greenwood prepared to apply their formula to the candidates. After the candidates had made satisfactory substitutions in this formula they were declared members.

A short business meeting was called, and at 12:45 the party broke up, declaring that the affair had been an unqualified success.


COMMUNICATION.

Cleveland, Ohio, 1253 Curtis Ave.
March 9th, 1893.

Editor WPI,

Dear Sir:—I notice a communication and its short editorial in the last issue concerning the World's Fair. I do not know but you are already aware of what has been done toward the subject of visiting the fair by the Western Alumni Societies. The Society in Cleveland has communicated their assurances of hearty support to the Society at Chicago should they think it feasible to hold a gathering of the Alumni under their auspices. The Chicago Society has written to the parent Society at Worcester, suggesting the issue of a circular to each Alumnus to ascertain whether he would favor a reunion to take place July 18th, '93, in Chicago, at the joint expense of the participants, invitations to extend to the families of the Alumni and the Faculty of the Institute. We are awaiting the action of the executive committee.
in Worcester; I hope there will be a good big reunion at the Fair.

I think Mr. Griffin’s suggestion good: that the Alumni vote in what exhibits they are interested in the W. P. I.

I am with the Brush Electric Co.; they will exhibit a complete line of electric apparatus, including open-coiled arcs, dynamos, closed-coiled generators, incandescent dynamos and motors, alternating current dynamos and convertors, arc lamps, alternating and direct current switch-boards. Among the arc dynamos will be a new 100-light machine, with the mechanical design and construction of which I am closely related. It is a radical departure, mechanically, from the form of Brush arc machines so far built, though the electrical difference is slight. It is open-coiled, four-pole field, instead of two, and will deliver about 10 amperes at 6000 volts. Mechanically the machine is very simple indeed. The field castings, instead of separate and connected by steel rails as hertofore, is made into one casting. It has two self-oiling and self-adjusting bearings. The shaft is of one diameter throughout, with two ridged collars to hold the armature in place. The machine proper rests on cast-iron, flatways; belt adjusted on either side by a handwheel.

Yours,

JANG LANDING.

THE WPI.

THESS SUBJECTS.

Mechanical Engineering.

Blanchard, C. B. Steam Power on Common Roads.

Comins, A. C. Power Tests of Woolen Machinery.

Derby, J. A. Test of Steam Plant in the Washburn Shops.


Goodrich, M. F. Design of Sailing Yacht.

Kuwada, G. Computations for Steam Plant.


Strong, L. P. Test for Comparative Efficiency of Compound Engine when used Condensing and Non-Condensing.


Denny, W. J. Test of Steam Plant (Norton Rawson, L. W. Emery Wheel Co.)

Gage, E. A. Cable Railways.

Greenwood, F. H. Wood, E. S. Test of Steam Plant.

Higgins, A. C. Valve Motion for High Speed Compound Engine.

Paull, N. M. Design for a Steam Yacht.

Rogers, C. O. Test of a Morse Triple Expansion-Sinclair, H. sion Rotary Engine.


Physical and Political Science.


Bingham, A. R. Not chosen.

Bucklin, F. Artesian Wells.

Wright, D. I. A System of Street Sprinkling for Worcester.

Post Graduate Electrical Engineering.


Y. M. C. A. TOURNAMENT.

The members of the Young Men's Christian Association gymnasium held the third of the series of tournaments at their gymnasium on the evening of March 15th. Students of the Institute are especially interested in the result, as Derby, '93, and Gallagher, '94, are tied for first place, each having scored 18 points. The pole vault, which will decide the winner, was not finished, as the lights went out while it was in progress. Both Gallagher and Derby cleared the bar at 8ft. 9in., but each failed once at 8ft. 11in. The standing at the time put Gallagher first with a mark, including handicap, of 9ft. 5in. Derby's mark, with his 4in. handicap, was 9ft. 1in. He will, undoubtedly, go much higher when the event is farther contested. Gallagher never vaulted higher than 8ft. 6in. The first event was a 20-yard dash, in which Marshall, scratch, won first; Zadera, 6in.; second; and Whipple, 36in., third. Putting the 16-pound shot was next. Derby, with his handicap of 5ft., won easily with 33ft. 11in. Brigham, scratch, won second, making an actual put of 34ft. 54in. Wall, scratch, got third, 33ft. 34in. In the running high jump, Derby, 6in., was first, making a record, with handicap, of 5ft. 7in.; Gale, 4in., second; Gallagher, 1in., and Stone, 5in., tied for third, at 5ft. 5in. In the bar vault Derby made an actual vault of 6ft. 4in., winning first place. Pierce, 5in., and Whipple, 9in., were tied for second, their vault, including handicap, being 6ft. 7in. The pole vault was the last on the programme. This event only affects the two leaders. The one who defeats the other, for any place, is the winner of the series. The following are the points won by the Tech men: Gallagher, '94, 18; Derby,
THE WPI.

'93, 18; Zaeder, '96, 7; Whipple, '94, 4; Brigham, '95, 3. It has not been decided when the pole vault will be finished.

W. A. C. GAMES.

The Worcester Athletic Club held an open indoor meet in the Rink, Wednesday evening, March 22nd. Quite a number of Tech men were entered in the various events. The games were interesting and at times quite exciting, there being some close struggles.

In the 40-yards dash Dadmun won in his heat, but got no place in the finals. Bliss, the Harvard man, was scratch, but only succeeded in winning second after two exciting dead heats.

The event of especial interest was the team race between the W. P. I. and the W. H. S. It was arranged rather hastily. Each man ran three laps, something like 375 yards, which is a very short distance for the W. P. I. men, as all are half-mile runners. The race was quite close at first, but the last two W. P. I. men had little trouble in beating their speedy young opponents. O'Connor, '95, Allen, '94, Whipple, '94, and Gallagher, '94, ran against Hackett, Badger, Davis and Bigelow.

In the mile walk, Strong, '93, took third place with a handicap of 40 seconds. Morgan did not have much difficulty in winning the running high jump, and created considerable amusement by his nonchalant manner of jumping.

Wellington, '95, ran in the mile, but got no place; Whittal, '96, also ran in the half-mile. Dadmun, scratch, came within a few inches of winning this last event, running a beautiful race, and passing man after man, but the track was so crowded that he was forced to take second place.

THE BURLESQUE.

The management wish to keep the cast of characters and definite particulars regarding the entertainment quiet, as it is believed that more enjoyment will be had if all is entirely new to the audience.

Everything, however, is progressing well. Rehearsals are frequent; more will be held during the last part of vacation, and it is expected that the show will be given on the evening of April 21st. Costumes are being made, and everything pushed as rapidly as possible. The music is very catchy and taking, and so far has been readily taken hold of by the students.

Tickets will be issued immediately after the vacation, and then every one will have an opportunity to help in making the affair a success.

THE INSTITUTE PIN.

The committee appointed by the various classes have met and decided to report in favor of a reduction of the size of the pin to three-fourths its present size. This will make the pin much neater, and in no way diminish its appearance or crowd the lettering. The committee is now busy endeavoring to make more satisfactory arrangements for the manufacture and sale of the pin, and will report before long to the classes. Immediate steps can then be taken to settle these important questions.

RECEPTION TO THE SENIORS.

The Reception to-night given by the class of Ninety-four to the class of Ninety-three, promises to be a very pleasant affair. It is to be in Colonial Hall and Bicknell's Orchestra will furnish music. The Committee from Ninety-four which has the matter in charge consists of G. W. Heald, C. G. Harris, C. A. Burt, H. L. Cobb, and C. H. Dwinnell, and they have done every thing in their power to make the evening an enjoyable one for every one present. Only the members of the two classes, with ladies, and the Faculty with their wives have been invited, and it is hoped that all of these will make a special effort to be present.

Y. M. C. A.

At the regular meeting Tuesday noon, March 21st., an Amendment to the Constitution was adopted, according to which, the Officers shall be elected annually at the last meeting in March. Consequently the regular election will occur Wednesday, March 29th.

Friday evening, March 24th, the Association tendered a reception to the members of the Apprentice class, at the parlors of the local Association on Elm street.

About eighty members of the Institute were present, including a good number of '96 men. After an informal social and singing, the Tech Banjo and Guitar Club, assisted by two from the Mandolin Club, gave a short entertainment.

President A. D. Butterfield, '93, spoke briefly, welcoming those present and explaining the work of the Y. M. C. A., and then introduced Secretary H. L. Gale, who extended a hearty welcome to all the students to make free use of the rooms of the Association.

Ice cream and cake in abundance were served in Curtis Hall, and the reception ended with further selections by the Banjo Club.
BASE BALL.

The schedule as arranged up to the present is as follows:
April 5. Holy Cross.
April 22. Tufts at Worcester.
April 25. Holy Cross Reserve.
April 29. Amherst Aggie at Amherst.
May 8. Wesleyan University at Middletown.
May 11. Holy Cross Reserve.
May 20. Wesleyan University at Worcester.
May 30. A. M. Bowdoin at Worcester.

It is probable that a game will be arranged with Worcester Academy.

The idea has been to play only College teams, as there is no credit in defeating a preparatory school team and defeat by such a team is disgraceful.

The batteries are practising in the second story of the shop addition and the fielders are already getting in out-of-door work.

If the students will only give the association a reasonable backing there is no doubt that the debt will be paid and the season will be a most successful one.

SENIOR CLASS MEETINGS.

At meetings of the senior class held March 13th and 14th, a list of nine candidates for the valedictory honor was made up by the class. On being compared with a similar list chosen by the faculty, the following seven names were found to be common to the two:—Baker, Kent, Heard, Flinn, Phillips, Farwell and Larkin.

March 20th, a meeting was called to elect a valedictorian. On the second ballot, Charles Baker, Jr., was chosen.

The committee on Class Day reported the following list of parts for the campus exercises: Class Orator, Tree Orator, Class Poet, Class Oddist, Banner Orator, and Orator to address Undergraduates. The Poet and Oddist are to be selected by "competitive examination." After electing Nathan Heard, Class Orator, the meeting adjourned.

T. C. S.

On Tuesday evening, March 14th, the Tech. Co-operative Society entertained a few of the underclassmen at the Society's rooms, No. 4 John street. The interest of the evening centred in a paper on the American Mound-Builders and their Mounds, read by Dr. L. P. Kinnicutt, who has spent considerable time and study upon this subject.

ATHLETIC ASSOCIATION.

At a meeting of the Athletic Association held Wednesday noon, March 22nd, the resignations of Mr. A. C. Comins, '93, as manager, and Mr. H. W. Moore, '94, as keeper, were read and accepted. Mr. L. W. Rawson, '93, was chosen manager, and Mr. E. W. Peck, '94, was elected keeper, to fill the vacancies.

ALUMNI NOTES.

'87. F. L. Emory of Morgantown, West Virginia, was married on Thursday, March 23, to Miss Mary M. Dille, daughter of Judge Dille of Morgantown. The couple are to reside in Minneapolis.

'88. G. F. H. Von Wrede has taken charge again of the Reading Division of the Philadelphia and Reading R. R.

'89. A. W. Gilbert writes that he is in Warren, O., superintending the erection of the Warren & Miles Electric R. R., and would be glad to see any W. P. I. men travelling that way.

'90. Lee Russell, for the last two years Principal of the Manual Training School at Halifax, N. S., has been appointed by the Provincial Council of Education to re-organize and take charge of the department of physics, chemistry and manual training in the Provincial Normal School of Nova Scotia at Truro. Mr. Russell will probably accept the position.

'92. George H. Miller, a graduate of the Worcester Polytechnic Institute, class '92, and Miss Emily Frances Stowe were quietly married at the bride's home, 5 Dudley street, Monday evening, March 20th. Mr. and Mrs. Miller will reside in Holyoke, where Mr. Miller is engaged as draftsman with the Merrick Thread Company.

COLLEGE NOTES.

The University of Virginia is building a $25,-000 gymnasium.

Twenty-one married men are in attendance at the University of Wisconsin.

A national college song-book is to be published at the World's Fair next summer.

Candidates for Amherst's base ball team were reduced to fourteen or fifteen men recently.

Exeter is to have a new dormitory. It is to be a brick structure, and is to accommodate fifty students.

The University of Michigan has been awarded 3000 sq. ft. in the Hall of Liberal Arts at the World's Fair.
The Leland Stanford, Jr., University will this year follow the lead of Eastern universities in opening a summer school,—the first of its kind on the Pacific coast.

The faculty of Kentucky University has suppressed all college sports on account of alleged gambling among the students.

Provost William Pepper of the University of Pennsylvania, turns back to the University every year, by various gifts, his salary of $10,000.

The total endowment of Chicago University amounts to $6,500,000, including lands and buildings. John D. Rockefeller has given $3,600,000.

In accordance with the wish of the trustees, the faculty and undergraduates of the University of Chicago will wear the cap and gown on all public occasions.

Leland Stanford, Jr., University is to have a boat crew. A club has been organized with twenty charter members.

Harvard's exhibit at the World's Fair will include specimens of all pamphlets published by the University, examination papers, college papers and class-room work.

The Massachusetts Institute of Technology will have an exhibit at the World's Fair. It has been said that only Boston Tech and Harvard will represent the Eastern Colleges.

The outlook for a successful cricket club at Harvard this spring is very bright. There are thirty candidates for positions, among whom are several men who have played on teams in Canada and Philadelphia.

A fund of $2000 has been raised by the surviving members of the class of 1842 at Yale, which has been given to the Yale corporation, the income to be devoted to the encouragement of extemporaneous speaking among the students.

Lasseli Seminary has been granted a room fifty-four feet square in the Woman's Building, at the World's Fair. This is made available to Lasseli during the whole summer, and subject to no conditions other than that the rules and regulations of the Woman's Building be not infringed.

The committee in charge of Amherst's minstrel show has decided to postpone the performance until next term. This is owing to the large number of engagements of the Glee and Banjo Clubs, and because there is naturally more enthusiasm in the season of base ball than in the winter term.

The meeting of the Harvard and Yale representatives of the University Track Athletic Cup Association was held at the Massasoit House, in Springfield, on March 17th. Yale brought up her undergraduate rule, but Harvard did not accept it. The team will meet under this condition: Yale will have an undergraduate team and Harvard will be represented as formerly. The games take place on May 13th.

The manager of the Tufts College Glee Club has received an offer for a London engagement for the summer vacation. The offer guarantees passage both ways, board and lodging and a small salary for each member. The Club will appear at one or more of the London musical halls, at the principal clubs, at receptions and at teas. Besides these the English manager promises every prospect that the Club will appear before the Queen at Windsor or Balmoral.

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TECHNICALITIES.

"May Gile depart."—This is the hymn now sung in chapel.

Middler: What is the matter with that valve stem?

Instructor: Oh, that is too long on one end.

The engagement of Jonathan H. Child, well-known as an old '93 man, to Miss Alice C. Knowles of this city is announced. Mr. Child has the congratulations of his former classmates.

A. H. Wheeler succeeds S. W. Putnam, Jr. as leader of the Tech Mandolin and Guitar Club. It is expected that the club will soon contain four mandolin and three guitar players.

Rev. Austin S. Garver of the First Unitarian Church conducted the chapel exercises on Monday morning, March 13th. A large number of the students were present and the exercises were enjoyed by all.

Calvin H. Andrews, '93, has gone into politics as a result of his training in the Political Science course, and has been honored by his fellow-citizens in Boylston with the office of Director of the Public Library for two years.

The Y. P. S. C. E. of the Plymouth Church will hold a social in the chapel of the church, on Tuesday evening, April 4th. An interesting and enjoyable program has been prepared. All students of the institute are cordially invited to attend.

B-tt-rf--ld has been making another sensation at the South end. He and a young lady appeared in a charade in Piedmont Church representing "Coming thro' the Rye." We understand that even the rye was shocked at his performance.

At a business meeting of the Socialists a new design for a pin recommended by a committee
chosen for the purpose was adopted. Perkins won the Whist Tournament, March 10th. Per­
kins and Coghlin will play the final match in the Checker Tournament. The Chess Tour­
ament is not progressing very rapidly.

MEETING OF THE W. M. E. S.

The regular bimonthly meeting of the society was held last evening in the Mechanical Model Room, at the Salisbury Laboratories. About fifty alumni and students were present and a few guests.

Mr. J. P. Coghlin, '93, and Mr. E. W. Davenport, '94, were admitted to membership.

Prof. Alden introduced Mr. C. W. D. Dyer, '93, as a man somewhat conversant with naval architecture to read the paper sent by Mr. Frear upon "Ballasting the British Ship Brunel," which we print in full elsewhere. Mr. Dyer explained many of the technical terms by the use of the blackboard.

Mr. Samuel M. Green, '85, with the Merrick Thread Co., Holyoke, Mass., then read a paper upon the "Webster Exhaust Steam Feed Water Heater," explaining its workings and giving an account of its successful trial in Holyoke. General discussion, of a very interesting character, followed this paper, and was participated in by a number of those present. We hope to further notice this paper in another issue.

Mr. C. O. Rogers, '93, read a Report of a Boiler Test made at the Morgan Spring Co.'s, Worcester. This paper will also be found in another column. The discussion upon this report brought out many points in regard to the use of petroleum as fuel. The meeting was of a highly interesting and profitable character. Prof. Alden announced that papers would be read by Mr. G. E. Camp, '88, and Mr. A. M. Powell, '79, at the next meeting on May 8th. After extending a vote of thanks to Mr. Green, the meeting adjourned.

Among the Alumni present were:—E. K. Hill, '71; E. F. Tolman, '71; W. L. Chase, '77; C. D. Parker, '79; V. E. Edwards, '83; J. O. Phelon, '87; G. I. Rockwood, '88; B. A. Gibson, '91; G. W. Booth, '91; A. L. Rice, '91; E. H. Fish, '91; G. H. Day, '92; A. B. Moulton, '92; J. F. Bartlett, '92; T. E. Bray­
ton, '92.

BASE BALL.

The following corrections are to be made in the schedule printed elsewhere.
April 1 and 3.—Holy Cross.
May 30.—Bowdoin cannot play.
June 17.—Worcester Academy.
June 24.—Holy Cross Reserves.

DANCING.

WINKS' ACADEMY,
38 Front Street.

The leading school and only Academy in WORCES­
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COUNSELLOR-AT-LAW AND SOLICITOR OF
PATENTS,
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