5-12-1894

The WPI Volume 10 Issue 3, May 12 1894

Students of Worcester Technical Institute

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CONTENTS

<table>
<thead>
<tr>
<th>PAGE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Editorials</td>
<td>25</td>
</tr>
<tr>
<td>The W. M. E. S. Meeting</td>
<td>27</td>
</tr>
<tr>
<td>Heavy Cast-Iron Gears</td>
<td>27</td>
</tr>
<tr>
<td>Glee Club Concert</td>
<td>33</td>
</tr>
<tr>
<td>A Communication</td>
<td>33</td>
</tr>
<tr>
<td>The Field-Sports</td>
<td>34</td>
</tr>
<tr>
<td>The Tech-Academy Game</td>
<td>35</td>
</tr>
<tr>
<td>Theses Subjects</td>
<td>36</td>
</tr>
</tbody>
</table>

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Send for Catalogue.
Judging from present indications it is hardly probable that this number will reach the students before Monday morning and on this account we owe our subscribers and readers an apology, believing that any paper should appear when dated if such a thing be possible. The W P I begs the indulgence of the students and assures them that it is ever the Editor's intention to have the paper out on time.

Almost invariably when the W P I management, and the same is true when it is for a programme or class-book, solicits an advertisement from a concern, the question comes from the prospective advertiser, “Do the students patronize the advertisers?” Of course an affirmative answer is given, which we believe to be in a great measure true. But do the students support as they should those who support them? We think not. It is for this reason that the Business Manager finds it difficult to get advertisements, and when the time comes to pay for the same, the merchant often asserts that the Tech trade obtained through the medium of the W P I has amounted to practically nothing.

The programmes for the recent concert were given to the Base-Ball Association and the duty of securing some of the advertisements fell upon us and it was not until then that we appreciated the position of the advertiser and the student. We now feel sure that many of our advertisers give us their “ads,” not only for this paper but for the programmes and class-books, with the idea of helping us rather than of gaining material aid themselves. Should this be so? Let every loyal Tech when he has occasion to purchase an article remember that those who advertise at the Institute are the ones who take an interest in the students and the welfare of the institution, and that they are the ones who offer inducements for the students’ trade. The fact that certain merchants advertise show that they are anxious to cater to our patronage and have the goods that they believe will please us. Then let us patronize our advertisers as much as possible, thereby helping those who help us.

The concert of the musical organizations recently given was a grand success from an artistic point of view. The clubs showed
the results of their untiring work and expenditure of time to excellent advantage, and the impression made upon the audience was most favorable. We congratulate the clubs on their fine showing and hope to see the Glee, Banjo and Mandolin Clubs all become permanent institutions.

Financially the affair was a failure, notwithstanding the fact that something was cleared. Two things combined to make this the case: lack of support by the students themselves, and lack of advertising by the management. How often is the complaint heard that social life at the Institute is an almost unknown quantity, and still when the students do have the opportunity to support a social affair they do not take advantage of it. Aside from those taking part in the concert, there were hardly twenty-five students in the audience.

The great fault, however, was with the management. Had the affair been advertised as it should have been, no doubt rests in our mind but that the audience would have been as large as could have been accommodated. To have any affair of this nature a success, judicious and liberal advertising is absolutely a necessity; no one can say that this was done by the management, and it is just here that fault in a great measure lies. We know from experience that many outsiders knew nothing of the concert. One of the Faculty was heard to remark this, and added that he believed with good management that the concert could be repeated and the house filled to its utmost capacity.

If glee clubs from the various New England colleges can come here and fill the same and larger halls, it does not stand to reason that the Institute clubs, right here at home and among their friends, cannot with good management draw a full house.

It was stated in our last issue that the annual field-day would be held last Saturday afternoon, and at that time it was so believed. But since then it has been found necessary to postpone the sports until this afternoon. Such action was caused by a misunderstanding between the Athletic Association and the Oval authorities regarding the date, the latter claiming that the Association had stated that it did not want the date, as it was too early. Be that as it may, it is certain that the sports have been postponed until to-day and that it looked at one time as though there would be no field-day this year.

It is most decidedly true that the sports are of infinite more importance than one ball game, and it is indeed surprising to us that Manager Gordon was not willing to make arrangements with the team scheduled to play by which the game could have been postponed until later in the season, and thus have the field sports uninterrupted. It is hardly probable that the plan of having a ball game and holding the sports at the same time, will be a success either financially or from an athletic standpoint. Certain it is that Ninety-Six's chances have been greatly hurt by having a ball game at the same time.

For the third time during the Institute year, it has become our painful duty to chronicle the death of a student of the Institute. The death of Nelson B. Hale which occurred at his home in this city, on Monday, April 23rd, was, however, not wholly unexpected by his classmates. For the past year Mr. Hale had been unwell, and last Fall it became necessary for him to cease his work here. His classmates here often visited him, and for the last month or more, while not confined to his bed, they had recognized that he had not long to live.

When we think of that part of his life
passed among us, of his honesty of character, of his sincerity of purpose, and of his cheerful disposition, we cannot but believe that his life was a model for many of us. As one of his old schoolmates we look back with feelings of deep sorrow when we think that so noble a young man was not spared a longer life of usefulness to his fellows and honor to his God.

We would suggest that the library be kept open Saturday afternoons, for the convenience of the members of the Institute. It often happens that students have practically no time but Saturday afternoons for consulting the books of reference and current periodicals there. Especially would such a scheme be advantageous to Ninety-Five, which class now have, in connection with the work in English Literature, two books and an essay to prepare each week, and for their preparation reference to the books in the library is essential.

Last Saturday afternoon the writer came up to spend an hour or so in reading in the library but found the doors to the library locked. Another student to our knowledge did the same thing. We do not believe it would necessitate additional work for anyone if the library were open for reference Saturday afternoons.

We take pleasure in announcing the election of Mr. Chalfant as a member of the Board, and also in announcing the appointment of Mr. Crawshaw as Assistant Manager.

THE W. M. E. S. MEETING.

The regular meeting of this society was held in Salisbury Laboratory last Monday evening, a large number being present. The first paper was read by Mr. Edwards, and was illustrated by means of two wooden models of evolute and cycloidal teeth showing the advantages and disadvantages of each.

The second paper was read by J. W. Burke, who also included a very practical and useful talk regarding contracts, what the Tech graduate is likely to be required to do, etc.

A brief discussion of the papers followed. Profs. Alden and Bird, Mr. Cole, Geo. I. Rockwood and others speaking.

HEAVY CAST-IRON GEAR.

BY V. E. EDWARDS.

The object of this brief paper is to start discussion and compare experiences in the use of heavy cast gears. We all know that gears are the cause of much trouble, expense, and delay, and are to be avoided if possible. But there are many places where we are at present unable to dispense with them. They must be used, and the best we can do is to make a careful study of all the probabilities and possibilities that may influence the result, and then design the gearing to suit the special requirements as far as possible.

Let us look briefly at some of the troubles that may appear in connection with the use of heavy gears. There are many little things that may go wrong and cause much vexation and expense. We may not have used the best shape of tooth. The proportions of the tooth may be faulty. The pattern may be wrong. The teeth may not be on square. They may not be made like the drawing. They may not be spaced uniformly. The pitch diameter may not come where it should. Neither the teeth, nor the pattern as a whole will remain for any length of time as left by the pattern-maker on account of the swelling, shrinking, and distortion common to all wood-work. The pattern, especially if old, is almost sure to be more or less out of shape when it reaches the foundry. The moulder cannot help springing it more or less in ramming up the sand. It is liable to blow if he rams too hard, and if not hard enough, it will "strain," as the foundry-men say, that is, the sand will be crowded back by the pressure of the iron and some of the teeth are liable to come altogether too thick in places, though the swelling may be so gradual as not to be noticed until the gears are run, when it will speak for itself. Then he may spring the flask in handling or in locking up, or he may spring the casting by improper exposure in cooling. It may not shrink to the diameter expected. This would be influenced by the ramming of the mould, by the mixture of iron used, and by the heat at which it is poured. The machinist may not be careful in truing-up for boring out. He may get a poor fit that will work loose after a while. The shafts may not come where they belong. The gears may not be set to run on their pitch circles. Bevels are especially hard to get right. The bearings may
be very uncertain in their position, perhaps bolted to unseasoned timbers or to a light framework which will spring and get out of place every time the work comes on the gears. Or the gears may be used in a place where we know the bearings will wear rapidly, and the shafts seldom if ever be in line. Pieces of iron may fall in between and break them. One thing we can be sure of. After they are once set up they will receive just as little attention as possible. They will be slushed, generally slushed liberally. Often a large amount of coal-tar is used to make the slush sticky, with great success. We can hardly blame the men for not being enthusiastic in their care of such dirty work. The gears and their adjacent bearings are sure to be neglected. This may look like borrowing a lot of trouble. But if we do not anticipate these things, and provide for them as far as possible, we are very sure to have to pay for it in the end.

There are so many requirements that must be met if heavy high-speed gearing is to be used successfully, that it is not strange we turn with longing eyes to belting, which requires fulfilment of but one condition—that the belt lead on squarely. If we also lead the belt off squarely it will ensure uniformity of strain through the belt and enable us to make satisfactory connection between shafts placed in any conceivable relation to each other; by having the pulleys just a little crowning, the shafts and pulleys may run quite appreciably out of place without our hearing from it.

But we cannot beg the question. Gears must be used in many places and we must furnish the best that can be had. We will now consider how to minimize some of the evils mentioned.

**Shape of Teeth.**

We will not attempt to discuss the mathematical and theoretical action of gears. We have had that fully treated in our course at the Institute. We know there are many forms of teeth which will work together with theoretical accuracy. But the cycloidal and evolute curves possess such marked advantages over all other forms that we will compare only these two styles. The vast majority of gears in common use are approximations—more or less correct—of one or the other of these curves. The cycloidal tooth has many old friends. Possibly more old friends than new. The principal advantage claimed for it is its higher efficiency or smaller loss from friction on teeth and bearings. The working angle averages more nearly tangential than with the evolute, and thus apparently would give the advantages claimed.

If the working angle were 90 degrees, or tangential, there would be no tendency to crowd the shafts apart, while, going to the other extreme, if the working angle were nearly 0 degrees, the stress crowding apart would be nearly infinite. It would seem that this crowding stress would be represented by the tangential force times tangent of angle. That this is true is strongly stated by some, and as strongly denied by others. An experiment was tried many years ago with carefully made wooden models which showed that—while in a majority of the trials there was a slight tendency to crowd apart—several of the trials showed an unmistakable tendency to draw closer together. We are unable to see the reason for this unexpected result unless the gears bore harder on the arc of recess than on the arc of approach. It was not stated in the description we saw of the above tests how much, if any, load was applied to the gears. The inference was that there was little more than their own inertia and friction. If this was so, of course the experiment was of little value. We have hoped to learn of this being fully demonstrated in some one of the many experimental laboratories now in active use.

The evolute tooth averages somewhat stronger than the other on account of its shape making the tooth decidedly thicker at the root than at the pitch line. As to its alleged crowding we can only say that we have never heard of any cases where it was demonstrated to be worse than that of the cycloidal.

We recently started up a mill transmitting 2000 H. P. through nine pair of bevels, all facing the same way. The teeth were evolute, with a working angle of about 70 degrees. Several millwrights predicted that the gears would crowd back so as to make serious trouble. But we never saw any indication of it; not a collar warmed up. This is the finest lot of cast bevels we have ever seen. After a few hours' running the entire length and breadth of every working face was polished and they ran so smoothly one could hardly hear them. They were all set by measurement, and any one who has tried it knows that it is not the easiest thing to work from the imaginary pitch line of a bevel gear, especially when it is shrouded. He also knows that when nine heavy gears have been forced on to a heavy shaft it is no joke to move them if they do not all come just right. The work was well done by careful men and yet some of these gears touched bottom, some ran on pitch line, and some were quite a little beyond the line. But they all ran with equal and practically perfect steadiness.

This is the great advantage which the evolute tooth has over all others. We consider it of far more consequence than any question of crowding or theoretical efficiency. We say
that received by the pinions of a large plate mill, rolling a plate say 100 inches wide. Picture a 1500 H. P. engine running 100 revolutions per minute with a 30-ton fly-wheel. All the power of the engine and the momentum of the wheel is transmitted to the rolls through a small pinion coupled to the end of the engine shaft. When the plate enters the bite of the rolls, the entire load comes on instantly with almost explosive violence. It will average coming on full in about 1/50 of one second. Not only does the full 1500 H. P. come on instantly but it is regular practice to work it much harder than the full power of the cylinder. The plates are relatively quite short until nearly finished, and the work is intermittent so that it requires only from 1/3 of a second to 3 seconds each for more than half of the passes. The work is so hard while it lasts that the regulator is seldom seen in any position except clear up or clear down. In fact, the changes of speed are so violent, even with this heavy wheel, that special dash-pots are provided to enable the regulator to respond promptly and yet not pound itself to pieces.

The general practice in plate rolling is to work it down as fast as possible. That means to give it all the engine and fly-wheel can stand without getting stalled. Never mind if it does slow down to nearly half speed every pass. It will pick up again before the next pass. We have not figured just how much power would be given off from a 25-ft. 30-ton wheel running 100 revolutions per minute if slowed to half speed in one second. Neither have we figured how much would be given off if hauled up short in a single revolution as has happened several times without breaking the driving pinion. How large is this pinion that will stand such treatment? Twenty-one inches in diameter. It is needless to say that the ordinary cast-iron gears in common use would stand no such treatment. They would break about as fast as you could put them in.

But gears are not bought for the sake of breaking them and buying new ones, but to work. Now if rolling-mill gears are capable of doing so much more work, why are not common gears made more nearly like them? We have asked that question many times and have not yet received an answer.

Let us consider the strength of the tooth as it is affected by its three dimensions. A tooth is usually considered as a beam fixed at one end with a load at the other end, causing a transverse strain, or moment, $M$ equals $W f$, where $W$ is the force applied to the end of the tooth and $f$ is the length of the tooth. This moment or leverage of external forces is balanced by
that of the internal forces, \( M \) equals \( \frac{f}{b}bh^2 \) in
which \( f \) equals maximum working stress on the
metal, \( b \) equals breadth of face, \( h \) equals thick-
ness of tooth at base. Placing the two equa-
tions together we have \( M \) equals \( W \) \( t \) equals \( \frac{f}{b}bh^2 \),
solving for \( W \) we get \( W \) equals \( \frac{f}{b}bh^2 \). From
this equation we can at once see how much any change in any of the three dimensions of a
tooth will affect \( W \), or its capacity to transmit
power.

We will first consider the effect of increasing
\( b \), or the breadth of face of a gear. It will at
once be seen that the strength increases directly
as the breadth. That is encouraging. Then all
we have to do is to make the face broad enough
and we can transmit any amount of power.
Our formula says so and that formula is correct,
as far as any simple formula can be. But our
theory is not complete. It does not include
any limitations made necessary by the perversity
common to both men and inanimate things.
If all things were perfect and unyielding we
could use very wide face gears. But as nothing
is perfect, the practicable width of face is
directly dependent on the probable accuracy of
construction, and on the probable maintenance
of that accuracy, with emphatic emphasis on
the word "probable." On high-class machinery cut-
gears may be successfully used with very wide
face. We might mention some of the large
cold-saws used for cutting armor, and other
plates as an example. Bevel-gears are much more
difficult to set and hold properly than spurs and
it is useless to make them as wide face as we
would spur-gears on the same class of work.

There are many cases where we know the
shafts will be out of line as a regular thing.
Then all the strain must come on a single point
and a narrow face is worth as much as a wide
face and in fact may be worth much more, for
many a gear has been broken by the shaft getting
out of line and prying one end of a tooth off as
a result of the other end hitting on the back
side and forming a fulerum, thus giving a power-
ful leverage which would not have existed with
a narrow face.

In the case of the wide faced gears referred
to as driving the cold-saws, the shafts must be
exactly parallel. It is doubtful if they could
get out more than \( 1/5 \) of one degree without
causing serious trouble. But we know of a
machine using narrow face evolute gears, where
perhaps \( 10 \) H. P. is transmitted through a pair of
slow running pinions mounted on each end of
a revolving shaft which is carried by a frame
pi v o ted in the centre and the whole oscillates
like a see-saw. The pinions keep in mesh with
their mates and work steadily all the time
although they are constantly changing from
about 8 degrees out of line one way to about 8
degrees out the other way. Yet they are so
well designed for the work they have to do that
they give no trouble.

The second variable that affects the strength
of the tooth is \( h \) or \( h^2 \) which means that if we
can make our \( h \) twice as large, our strength will
be four times as much. This, or rather the
pitch with which it is directly connected, is the
generally recognized controlling element of
strength in a gear. If a gear proves too weak
for the work to be done, we always think of
using a coarser pitch. But there are limits to
this. If we keep the diameter the same, we can
increase the pitch only by reducing the number
of teeth, and this number must be kept high
enough to absolutely ensure that one tooth shall
engage a little before its predecessor has let go.
Millwrights will generally try to have two teeth
always in mesh. Another limitation is due to the
fact that low numbered gears have cut-under or
radial flanks and hence are much thinner at the
root than on the pitch line. This reduces the \( h \)
of our formula and consequently the strength of
the gear. The \( h \) is much less in a low numbered
than in a high numbered gear. In other words
a low numbered pinion is much weaker than the
higher numbered gear with which it may engage.

Another serious difficulty with low numbered
gears is their rapid wear. If one gear is one-
third the size of the other, we should expect it
to wear out in one-third the time. This start-
ing with a weak piece and then having it wear
rapidly is a serious matter which, however, can
be improved in several ways. In special gears,
if a small numbered pinion is to run with a rack
or high numbered gear, it is customary to in-
crease \( h \), or the thickness of the pinion teeth,
and correspondingly reduce the thickness of its
over-strong mate. Also, as we have previously
stated, evolute teeth average thicker at the root,
and hence stronger than cycloidal. With cut-
gears a decided re-enforcement can be made by
simply giving the smaller gear a much wider face
than its mate. This extra length does not in-
crease its bearing or wearing surface, but does
give a much larger breaking section and thus
increases its strength.

Cast gears may be still further strengthened
by shrouding, or filling up the spaces between
the overhanging ends of the teeth with solid
metal. This renders it almost impossible for a
whole tooth to tumble out with a clean break,
for it must shear off each end and break across
the bottom in order to get out. When the pin-
ion is relatively small, it is usually shrouded to
the top of the teeth, when both gears are about
the same size the shrouding may come nearly to
the pitch line on each gear. Millwrights say
the shrouds must never run together, even if they are carefully turned to the pitch diameter, for the gears will not be perfect and the pitch circle will quibble with the arc pitch. This shrouding adds much to the strength of gears. It is not uncommon to put an additional shroud in the centre of the gear face, in which ease it is usual to revolve one-half of the gear through one-half of the pitch and thus gain the steadier action due to having twice the number of teeth in contact at once.

This style of gear is much used for rolling mill pinions, and other hard work. Although what is known as the "herring-bone" is perhaps more often used. In this type the teeth are not parallel with the axis but are spirally inclined on each side toward the face where they meet forming a V. These "herring-bone" gears have at least one decided advantage over all other forms. On all other styles with straight teeth, if they are out of line, we get contact in but one point. And the strength of the gear is dependent upon the support given that one point. But with a "herring-bone" gear you will see that if it hits on one side and not on the other, the angularity of the pressure will slide the gear endwise until it does bear. Thus, by leaving a little end play to one gear we are absolutely sure it will bear on at least two points, and thus be twice as strong as a straight tooth if out of line. These "herring-bone" gears, when well designed, probably make the strongest gear in use. They are also the most expensive in common use, but their cost is fully justified by their service when extremely hard work is required.

But there is one way of increasing \( h \) and the tensile strength without changing the pitch. It is described in many treatises on gears, but we seldom see in use the so-called thumb teeth.

When a pair of gears are to transmit power in always the same direction, it is obvious that one face of the teeth do all the work, while the other side has nothing at all to do. Then the question arises why not make the working face such as to give the smoothest action, and make the other face such as will give the greatest strength to the teeth. It is usually recommended to use an evolute working face with as large a working angle as convenient, and for the backs use an evolute with with a considerably smaller working angle, bracing it back like a ratchet tooth as much as possible without getting the point of the teeth too thin. It is obvious that the strength of a tooth can be doubled in this way. It seems a little strange that they are not more often used for special work. A fine example of this style of tooth is seen on the powerful Whitworth pumps for supplying the new $1,000,000, 10,000-ton press which has just been set up at Homestead. Here there are two vertical steam cylinders about 45' dia. by 4 ft. stroke, with two pinions about 4 ft. dia. on the main shaft. Each pinion meshes into an 8 ft. gear on each side and each gear has a shaft with two cranks, thus driving eight 5' single acting pumps capable of working up to 8,000 or 10,000 lbs. a sq. inch.

We now come to the third variable, \( l \), or the length of the tooth measured radially from the rim out. Turning back to our formula \( W \) equals \( \frac{2}{3} bh^2 \) it will be seen that the strength varies inversely with \( l \). The longer we make \( l \) the weaker we make the tooth, but on the other hand the strength cannot be increased indefinitely by reducing \( l \) to 0, for two reasons, first, the length and number of teeth must bear such relations to each other as to ensure at least one tooth being in full contact at all times. second, if the tooth be made very short, the shearing stress exceeds the transverse stress, and the value of \( W \) becomes limited to the shearing strength of the tooth. The shearing strength of the tooth equals \( f. b. h. \). Placing this equal to the transverse strength we get \( f. b. h. \) equals \( \frac{2}{3} bh^2 \) which reduced to \( l \) equals \( \frac{b}{h} \). With very short teeth, \( h \) would equal \( \frac{1}{2} \) the pitch and our equation would become \( l \) equals \( \frac{b}{h} \). But there is an error here. We have assumed \( f. h. \) or the strength of the metal, to be the same under transverse as under shearing strain. But with cast-iron the compressive resistance is much greater than its tensile strength, so that with a transverse strain the neutral axis does not come in the centre of section, and hence the transverse strength for cast-iron is nearly twice its tensile or shearing strength. This would change our formula from \( l = \frac{b}{h} \) to \( l = \frac{b}{h} \) or \( .16 \) \( P \) as giving approximately the length of tooth which would be about as likely to slide as to break off, with a load on the end of the tooth. But the ordinary length of teeth averages about \( .70 \) \( P \), or four times as long, and hence four times as weak. While it is impracticable for several reasons to make the teeth as short as \( .16 \) \( P \) yet on the other hand we have never been able to learn a satisfactory reason for going so near to the other extreme as to make the tooth length \( .70 \) to \( .75 \) of the pitch. Of course for small cut-gears on the diametral plan, the absolute simplicity of the calculations necessary to their use is ample reason for the proportions adopted. But the advantages of using the diametral system rapidly disappear as the size increases.

For gears using arc pitch there is no recognized standard length of tooth. As we have said, they average about \( .70 \) \( P \), though many gear-makers use an even longer tooth, as we know from expensive experience.

We have already called attention to the great
strength of rolling-mill pinions, and mentioned four factors: involute teeth, broad-face, shrouding and herring-bone teeth.

There is another important factor, short teeth. They are made about .55 P, and make an altogether different looking tooth from one that is .75 to .80 P long. If this is the practice which gives such excellent results on the very hardest-worked gears why is it not good practice on other heavy gears? Why must we have the teeth longer and weaker? We cannot see! Not for wear, surely, for the wear increases so rapidly as you go each way from the pitch-circle that very little is gained by going far. This strengthening of the gears by making the teeth shorter commends itself commercially. It costs nothing to make them so, while to make either a shrouded or herring-bone gear costs decidedly more than a plain gear, both for the patterns and the moulding.

Let us consider the question of patterns and moulding. The draftsman may make the most perfect drawing of the very best gear. That is as far as he can go. The drawings are handed to the pattern-maker and the pattern-maker and moulder will generally manage to combine in such a way as to get a more or less unsatisfactory result. Not because they do not understand their business, but because very few of them are fitted to do such work as accurately as is desirable. The regular full wooden pattern does not and apparently cannot be made to produce first-class gears. Large iron patterns are too costly and besides are so heavy to handle as to cause the moulder serious trouble.

We recently recommended a prominent manufacturer to order a lot of machine-moulded gears. He hesitated, saying, "I don't know about that. We think we have the best pattern-maker in the United States. As good a foundry as any one, if not a little better. Let us go down and see the pattern-maker." When he had found him he appealed to his pride, saying; "They have recommended us to go outside and buy a lot of cast-gears. Can you not make as good gear patterns as anybody and have we not as good a foundry?" The answer was emphatic, "Yes, sir, I have made a great many gear patterns and do not know anyone who can do better, neither do I know of a better foundry, but we are not fitted up to make good gears. You had better get them machine-moulded." 

In making the so-called machine-moulded gears a pattern is made of only a small segment of the rim, including say three teeth. This is attached to the rigid arm of a sweep set in the solid ground. These three teeth would be rammed up, the segment withdrawn, and advanced one or two teeth and accurately locked in its new position by means of a large iron index plate. By this method many important results are obtained. The pitch is as accurately uniform as would be possible in a gear cutter using the same index plate. The sweep is very stiff and will spring only a trifle and even this may be allowed for as the entire circle is treated uniformly. An incidental advantage is the cheapness of the patterns or forms, costing perhaps one-eighth as much as a full wooden pattern. This renders it much more feasible to have special gears made exactly as we want them without undue cost. Then the cost of the castings is little if any more than much poorer gears made from patterns.

We recently had a quotation less than 3½ for the best charcoa1 iron bevels double-shrouded and about 2½ for plain gears in common iron. Of course, if you have your own patterns and put them in with your other work your foundryman may not charge extra, but we have never seen a gear from any foundry to equal the work turned out by the Robert Poole & Son Co. of Baltimore, or the Walker Mfg. Co. of Cleveland. Recently, the Farrell Foundry Co., of Ansonia, and the Union Foundry, of Pittsburgh, and some others, have fitted up to do this work. The nicety of the work made by the two first-named companies is surprising both as to nicety of finish and accuracy of shape. We have in mind a very light bevel-gear rim 10 ft. outside diameter with an 8 ft. 6 in. hole, made in halves. When put on the boring-mill this was found to lie flat within 1/32 of an inch, and also to be a true circle within the same narrow limit.

These gears will run at very high speed with little if any more noise than ordinary cut-gears. The manufacturers claim them to wear longer besides being much stronger than cut-gears. This does not appear unreasonable, for it is well known that the scale or skin of cast-iron is altogether the hardest, strongest and finest part of a casting. They certainly are much stronger than cut-gears from the same metal.

But right here we would call attention to the fact that the strongest gear is not necessarily the most durable. The gear may be very strong but brittle and go to pieces after but a short life on account of crystallization induced by the continuous jarring. Or, what is much worse than hard work, the pouting gears get when running idle at high speed and the blows come first on the one side of the tooth and then on the other. For hard high-speed work the toughness of charcoal iron renders it much more suitable than the cheaper and more brittle grades. But these gears while much better than from wooden patterns will still break at
most unexpected and expensive times if the long teeth are used.

The next move with many parties has been to put in steel gears, that is, steel castings, but still they are not altogether happy with the result. They cost much more, say, three times as much and then they seldom, if ever, come, clean or true. They start off with a howl and begin to chafe or cut the first thing, and generally keep on cutting until they wear out. But they give much less trouble from breakage, and we can better afford to replace them occasionally even if their cost is high, rather than have them break down at most unexpected and exasperating times, as is the case with long tooth iron gears.

But we are fully convinced that short evolute tooth gears, machine moulded, made from charcoal iron will average giving better satisfaction at less expense provided that the gears be so held that there is a reasonable prospect of their remaining about where they belong. It is always well to get the two shafts tied together absolutely and have all strains self contained, if possible. Then we can go home and sleep in peace without dreaming of broken gears.

**Glee Club Concert.**

The first concert of the W. P. I. Glee, Banjo and Mandolin Clubs is only a memory, but a decidedly pleasant one. There was a fair and enthusiastic audience, but the concert deserved a far larger one. With sufficient advertising the hall might have been filled and the Base­Ball Association might have made some money as well as the Athletic Association. The programme, which was very neat, was the only source of revenue for the former association, and the students should remember the favors of the advertisers.

Pres. Fuller, Profs. Cutler, Conant, Hayes, Kendrick, and Bird, and Instructors Coombs, O'Regan, Viles, and Rice, were present.

The performances of the clubs were highly creditable and very encouraging. Considering that this was a first appearance, the concert compares favorably with any that has ever been given in Worcester. It was noticeable that the Glee Club improved with each successive appearance, and great credit should be given the members for their work. Mr. Heald deserves much praise for creating so good a club.

The Banjo Club has improved wonderfully in its one short year of existence.

The Mandolin Club is least in point of numbers, but rendered its selections very well, and deserved far more applause.

The Concert was opened promptly at 8 o'clock by the Glee Club. "In Absence" was their first selection, and this was followed by a humming song as an encore. The Mandolin Club, under Mr. Wheeler's leadership, played a march, "Le Turco," in an excellent manner. Mr. Peck for his solo chose "The Quaker." Had Mr. Peck been more confident of his own ability he would have done better.

The "W. P. I. March" by the Banjo Club, also under Mr. Wheeler, was much better than the preceding numbers. However, the time in parts was far from perfect. As an encore they gave "The Happy Coon."

In the fifth number the Glee Club showed much improvement. The parts in "Jay Bird" were well carried throughout, and the piece sung with snap. Mr. Lamson's voice was particularly effective. As an encore they gave "Jolly Old Sow."

Mr. Heald's voice is a very pleasing, but not a very strong one, and was shown to good advantage in his solo "Sailing across the Sea." Mr. Wheeler's solo on the banjo was excellent. It is doubtful if it has ever been surpassed in this city. His encore "Yankee Doodle," with variations, was very difficult. It is his own composition.

The Glee Club reached its climax in "Once Uppone a Tyme." They were obliged to return and sing a third stanza. The "Spanish March" by the Mandolin Club was beautiful and deserved an encore, if anything on the programme did. Mr. Burdick's solos, "Hungarian Love Song," and the "Armorer's Song" from Robin Hood, which he gave as an encore, were far and away the most artistic efforts of the evening. Mr. Burdick has a rich, sweet voice, and the songs suited it admirably. "Boston Rockaway" was deserving of the applause it received. The "Greenway Guards Patrol," given as an encore, was the best thing the Banjo Club did. The time was excellent.

The pieces throughout were well chosen and well given. The general excellence of the concert was a surprise to all present. The style of the Glee Club might be criticised. The members watch the leader in a manner which is very noticeable. They make too much effort in singing, the facial expression of some being disagreeable.

**A Communication.**

*Editor W P I:—*

There is a pleasing custom in vogue at colleges and institutions like our own of garnering any "break," "bull," or *lapsus linguae* that can be found, and preserving it for posterity in the columns of the college paper. I notice in the
last W P I, under the caption "Technicalities," an alleged "bull" that I fully recognized as perpetrated by myself. It is true I did say, "I suppose chilled-iron was made by chilling the iron before it was cold," and in so doing chose the language that expressed with precision and exactness just what I desired to say.

Perhaps it may not be altogether out of place to venture an explanation, since it touches upon an extremely interesting and useful branch of our metallurgical study. Possibly no one can fully explain the phenomena, but it is nevertheless true, that some irons are so constituted that castings made from them will assume an extreme density and hardness if the molten metal is allowed to come in contact with a metallic surface in the mould. At the works, where I spend my spare hours, we have a small cupola erected for doing work of this sort, and it has been my privilege, during the past year, to charge and run it in making chilled-iron dies for wire-drawing. The operation is somewhat as follows: selected brands of iron are introduced into the cupola, alternating with layers of coal, and the charge melted. If for dies, the metal is then cast into a cast-iron mould whereby all sides of the finished product are brought in contact with metallic cooling surfaces.

Perhaps the most striking illustration of this chilling effect is to be found in making chilled rolls. These rolls are substantially plain solid cylinders with ends of a smaller diameter. Here it is desired to chill only the body of the rolls. For this purpose a cast-iron collar is introduced into the mould, enveloping the space in which the body is cast, leaving the ends to come in contact with the sand. The iron is then poured and, after a suitable interval, the flask is opened. Note the effect. The entire roll as it appears to the eye is a bright cherry-red. Judging from appearances it is alike throughout, yet part of it is literally "chilled," notwithstanding it is still red hot. It is to this phenomena I referred when I spoke of "chilling the iron before it got cold," an expression fully justified as descriptive of the true conditions of the case.

Your reporter, however, is evidently laboring under the delusion that iron cannot be chilled without being made cold. If he will make an appointment at our works some day I will be pleased to show him red hot chilled-iron. As to its "chill" or hardness, he can put it in the lathe and while the ends will readily turn under an ordinary tool, the body, which was cherry-red precisely like the ends, will be so hard that only very hard Stubbs' steel will touch it, and then only by running the lathe at a slow speed. As to its heat, he can test it by picking it up with his fingers. If he does, he won't write any more squibs for the W P I for a while.

RAFLH L. MORGAN, '95.

THE FIELD SPORTS.

At this writing the prospects for an interesting field-day are most bright and any one who attends is sure to get his money's worth between the sports and the Tech-Aggie game. The entries closed Monday, April 30th, with 293 men in the events. Such a list on paper looks most excellent, but whether the total number of men that score up for the word will number more than an even hundred or not is rather doubtful. This practice of entering in several events in which one has no idea of starting is decidedly overdone, and it would have been a good plan for the directors to charge an entry fee of one dollar to those not finishing in half the events in which they are entered. Were this done the entry list would have much more significance than it now has. One has only to look at the first event to see that there is at least one man entered purely as a joke and the directors would have been justified in refusing the entry.

The final standing of the classes is causing considerable discussion among the students, although it is generally conceded to lie between '94 and '95. Setting aside all class feeling, '95 on her last year's work and her showing in training should win and have something to spare. Ninety-Seven is as yet an unknown quantity, but she may beat out the Sophomores for third place owing to the fact that most of the '96 men will be playing in the ball game.

In the hurdles Lungren, Gallagher and Field are all good men and their chances are in the order named. Ninety-five should at least win one and be well placed in the other of the hundred and two-twenty yard dashes. Allen, Killam, '95, Stone, O'Connor, and possibly Gallagher, are the ones to back, unless a dark horse should appear.

It would not be surprising to see one of the lower classes win the mile run with either Brown, Young or Lungren. Clapp, although green, is a good man, but probably will not start.

The two-mile bicycle race appears to be any one's race, with the chances, however, slightly in favor of Higgins.

There is little doubt but that the 880 should go to '94, Gallagher being the winner. For the place it is hard to pick a man, but Davenport, O'Connor, Whittall and several others are all good.

The mile walk will lie wholly between Tilden and McFarland with the chances decidedly in favor of the Junior. Unless some man, as yet
unknown to fame, appears there will be no one who can finish a good third to them.

The 440-yard dash has 30 entries, but it is doubtful if half of the men appear for the word. Gallagher, if not too tired from the half, should make an excellent showing. Allen is also good, as is O'Connor. Then there is Harrington and a host of others who are liable to make it hot for the winner.

The two-mile run is another of those events that will not belong to any one until the tape is crossed. Howe, on the form shown in Clinton, should make the winner jog right along.

The class team race promises to be one of the most hotly contested events on the programme. Practically, '94 and '95 are the only teams in the race, and on paper '94 should win and have a few lengths to spare. Ninety-Seven will probably bring up the rear.

The running high jump would doubtless go to Zaeder, but if he does not compete Whipple may win first place. This event is a hard one to pick the winner.

In the field events the first is the pole-vault. Leland has been doing well in practice and should make a creditable showing. Then there is Whipple, Gallagher and Sibley, all good men.

Throwing the hammer will go to Brigham, and it looks as though '95 would win two if not three of the prizes in that event.

Brigham is also good for the shot, but there are lots of dark men in the event, and if Zaeder does not compete the place will be in doubt until the event is over.

Stone, '95, Whipple and Zaeder are all good in the running broad. Whether the judgment of the writer is of value or not can be better seen after the events are over; in the mean time don't swear by this list as being absolutely correct.

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**THE TECH-ACADEMY GAME.**

The game at the Oval, Saturday, April 28th, between the W. P. I. and Academy teams resulted in a walk-over for Tech, notwithstanding the fact that the nine felt rather doubtful of victory before the game. Many of the students, however, believed we would win, but never for a moment thought that such a defeat would be administered to the Academy boys. Still it was a game with a preparatory school and should not be taken as a criterion for judgment regarding the team that represents the Institute this spring. The large score was due, both to timely hitting on the one side, and poor fielding on the other.

Martin was again in the box and evinced the same excellent control of the ball that he did at Amherst. His delivery is a peculiar one and completely puzzled the Academy batmen. Gordon started in to pitch for our opponents, but after a few innings went behind the bat, Clark coming in from short to pitch. He was no improvement and so Gordon and Clark changed places, in which way the game was played out.

A large attendance from the two institutions made the management happy and the coffers richer. A detailed account of the game would be uninteresting, the appended summary showing how the game was won:

**THE WPI.**

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*Atkins out on bunted foul as third strike.

**Worcester Academy.**

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**W. P. I.**

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**AFTER THE GAME.**

The team played a snappy and determined game.

Philpot had several narrow escapes from errors.

Zaeder's coaching kept the audience laughing.

Not a peep from the Academy supporters after the third.

We hear that the Academy man who made the run, although in training, had pie for supper.
One or two of the Academy players, and especially Edmans, incline to dirty work.

MacAleer's umpiring was at times rocky, but his decisions offset each other.

Gordon showed poor judgment in attempting to score from second on a sacrifice.

W. Hodgkins made an excellent catch in left garden.

Cullen would have made a double play unassisted had not two men been out.

The base-running of our team is decidedly poor. Lack of practice in that direction is evident.

Zaeder had his eye on the ball. Three three-baggers, a single and a sacrifice is good enough for any one.

THESES SUBJECTS.

Below we print what we believe to be a complete and correct list of the theses subjects of the class of '94. As stated in the last W P I, in which were the Chemists and Civils subjects, the list is not official, but has been made only by interviewing each man individually.

Chemistry Course.

Ernest A. Bickford, Garbage Disposal in Cities.

Clarence W. Eastman, Examination of Moulding Sands.

Edgar A. Pratt, Volumetric Determination of Phosphorus in Iron.

Harry S. Whitney, Determination of Metallic Sulphides by Mercuric Cyanide.

Civil Engineering.

Harry C. Boyden, Design of Three-Hinged Arch for Roof Truss.

Warren E. Brooks, Investigation of a Bridge.

Herbert P. Linnell, Warren A. Scott, Measurement of Effluent at Sewage Works.

Shepard B. Palmer, Construction of Plant of Aspinook Co.

Elliott W. Peck, Design of a Bridge.

Henry W. Pope, Design for Water Supply for Southboro.

Otis D. G. Rice, Stand-Pipe and Pumping Station.

Mechanical Engineering.

John C. Abbot, the Manufacture of Woolen Yarns.

Chas. M. Allen, Water-wheel Tests.

M. Clifford Allen, Edward L. Burdick, Effect of Superheated Steam in Cylinder Condensation on a Compound Engine.

William J. Baldwin, Auxiliary Marine Engine.

George W. Bishop, William J. Sperl, A Surface Condenser.

Charles U. Chambers, Design of Steam Plant for Electric Light Station.

E. Walter Davenport, Charles F. Perry, the Building and Testing of a Triplex Pump.

Walton B. Fuller, Investigation of Strength of Beams.

John M. Gallagher, Frank E. Killam, Triple Expansion Engine Test.

Harry T. Goss, Marine Boiler Design.


Henry N. Smith, Cable Conduction in Cities.


H. Joseph Knight, The Manufacture of Leather Belting.

Electrical Engineering.


Charles A. Burt, Design of a 50 Kilowatt M. P. Dynamo.

Arthur L. Clark, A Phase Indicator.

Harry L. Cobb, John W. Soars, Jr., Design of a 50 Kilowatt M. P. Dynamo.

Clifton H. Dwinell, Charles G. Harris, Magnetization Curves.

Alfred B. Grout, Design of a 50 Kilowatt M. P. Dynamo.


Lewis A. Howland, Design of a 50 Kilowatt M. P. Dynamo.

Leslie Killam, Test of a 500-volt Motor.

Frank M. King, Fred W. Sawyer, Test of No. 10 Dynamo.

Andrew A. O'Connell, Design of a Dynamo.

Elwyn P. Smith, Design of a Dynamo.

Henry F. Walker, Design of a Dynamo.

NELSON B. HALE, '94.

The death of Nelson B. Hale, '94, was a source of profound regret to all who knew him. The deceased entered the Institute in Sept., 1891, with the Civils and remained with them, one of the brightest and most capable men in the class, till the end of their Junior year, when failing health forced him to leave. The cause of his death was consumption, which was no doubt hastened by his close application to work when not in fit condition.

He always took an active interest in the welfare of the Institute, and by his upright character and sterling qualities he won at once the affection and respect of all those with whom he came in contact. In addition to his studies at the Institute, he entered quite extensively into the study of natural history, and was an active member of the Gypsy Moth Committee during the summer of '92. He was also a prominent member of the Historical Society at the Insti-
The design of a 65 T.P. bi-polar dynamo, also the investigation of a smaller dynamo of the same type.
La Ora
Sugar Machinery
Rive - standpipe & pumping station for town of Smithton.
Thesis Subject:

Cable Tractions in Cities

George T. Smith
THE WPI.

In Worcester a few minutes before midnight.
In Chapel, Thursday morning, Doctor Fuller conducted a memorial service, which was largely attended by the students. Our President spoke very feelingly of the high esteem in which the deceased was held by all, and expressed his sympathy for the bereaved relatives.

The class of '94 appointed a delegation of ten to attend the funeral, which took place from his late home on Chadwick street, Thursday, April 26th, Rev. Austin S. Garver officiating. The class sent a beautiful wreath of roses in the form of an open book. The following resolutions were drawn up by the committee:

Whereas, in His judgment, God has seen fit to remove from our midst, our friend and classmate, Nelson B. Hale; therefore,

Resolved, That we, the class of '94, of the Worcester Polytechnic Institute, keenly feel the death of our beloved classmate, and desire to express our sorrow in the loss of a fellow-student and companion.

Resolved, That we extend our sympathy to his bereaved family and friends.

Resolved, That a copy of these resolutions be sent to his parents, and that they be published in the WPI and the Worcester daily press and placed upon the class records as a tribute to his memory.

E. L. BURDICK,
G. W. BISHOP,
E. W. PECK,
Committee.

THE CONCERT AT SPENCER.

About twenty-five members of the Glee, Banjo and Mandolin clubs went to Spencer, Friday evening, May 4th, and there gave a concert in the Town Hall. It was the first public appearance of the clubs and they made a favorable impression upon the audience, consisting of forty-two persons and about six hundred empty seats. The programme, which is printed below, was finely rendered but the applause was meagre, Mr. Burdick's solo being the only number to receive an encore.

The concert was over at half-past nine, and the clubs left Spencer a half-hour later, arriving in Worcester a few minutes before midnight.

PROGRAMME.

1. "In Absence." GLEE CLUB. Buck
   2. March, "Le Turco." MANDOLIN CLUB. Tocahen
   3. Glee, "The Quaker." GLEE CLUB. Jackson
   5. Glee, { "Warning." GLEE CLUB. Jungst
      { "Jay Bird.
   6. "Sueno de Amor." MANDOLIN CLUB. Romero

7. Solo, "Sweet Marie." MR. HEALD.
   8. "W. P. I. March." INTERMISSION.
   9. "Once Upon a Time." GLEE CLUB.
   10. "Spanish March." MANDOLIN CLUB.
   11. Solo, Selected. MR. BURDICK.
   12. Glee, { "Spin, Spin." JUNGST
      { "Superstition." GLEE CLUB.
   13. Selected. BANJO CLUB.
   14. Glee, { "Under the Almond Tree." BUSSE
      { "Serenade." GLEE CLUB.

A PRESENTATION.

Mr. Coumans, our Assistant Foreman in the shop was very pleasantly surprised Friday, April 26th. His departure for New York being gladdened by a substantial present from his shopmates and the students.

As soon as we learned of his intended change a committee was appointed, and in a very short time the necessary funds were at hand. Friday being Mr. Coumans' last day with us, he was conducted by Mr. Mitchell to Prof. Gladwin's room where the students and employees had filled the room to its fullest capacity. As Mr. Coumans entered, A. W. Clement, '95, stepped forward and speaking of the esteem and respect in which he was held, presented him with a handsome gold watch. Much surprised, Mr. Coumans replied in his usual witty and pleasant manner.

He will enter Woodstock College of Toronto next fall, and the best wishes of his many friends go with him. Mr. Coumans has been assistant foreman in the shop for the last five years, and had become very popular from his fine workmanship and his interest in the athletics.

A NEW UNIVERSITY MAGAZINE.

A new University Magazine is to be published shortly. Its purpose is to give graduates a full and reliable account of college news, together with general literary matter. It is hoped that this will absorb the two monthlies now published under the same name, and thus produce a really superior paper. A stock company, to be called the University Press Company, has been formed, with a capital of $50,000. Five thousand shares at $10 apiece will be on sale and it is expected that the colleges will secure 300 to 400 shares each. Graduates of Yale, Harvard, Columbia, Cornell, and Amherst have already bought.
stock. The magazine is to be printed on paper of superior quality, in good print, and with many illustrations; it is to be sewed instead of riveted and will be, altogether, very handsomely gotten up. There will be a department of general college news and also articles by prominent men all over the country. The editor-in-chief will be Mr. J. S. Wood; Mr. Walter C. Camp will have charge of the athletic, and Prof. F. T. Austin of the scientific department. In addition to the editors there will be an advisory board of representatives of the various colleges of the country. The first issue will appear in June.

Shares at $10 each may be obtained by sending checks, together with the name and address of the sender, to Mr. Henry G. Chapman, 56 Wall Street, N. Y.

A SUMMER SCHOOL OF MINING.

A Summer School of Mining will be held by the M. I. T. this summer for five weeks during June and July. The headquarters will be at Capleton, a short distance from Montreal, and in close proximity to copper, silver, and sulphur mines. The work will be practical instruction in mining, ore dressing, and surveying, both surface and under ground, and is naturally of interest to all men pursuing a technical education. The party are to live in tents and in true camping-out style, thus affording, at an outlay of less than one hundred dollars, a pleasant vacation, combining pleasure with practical knowledge and experience.

BASE-BALL AT M. I. T.

The largest ball score on record was made a few weeks ago in the game between Williams and M. I. T., in which the former won 60 to 1. "Mike" Sullivan, if we mistake not, with whom our nine has a slight acquaintance, was in the box and pitched under the name of one of the regular M. I. T. pitchers. The result is but deserved, and the sooner this practice, now too often done, of "ringing in" professionals and ex-players under the name of a respectable and legitimate player is stopped the better for every branch of college athletics. The Tech is to be congratulated on the fearless stand they have taken regarding their own team, as shown, not only in an editorial, but from its news columns, from which article we take the following:

"That a college athletic management should, in the face of the existing sentiment at home and abroad, have the effrontery and dishonor to carry a professional on their team, and, what is worse, attach to him the name of a reputable player now in college, seems well nigh incredible. . . . A college cannot be expected to win in all branches of athletics, especially when the curriculum is severe, as at the Institute; but when an organization puts a team on the field, calls it a 'Varsity team, and with a manager and eight substitutes goes to play a strong team of one of the smaller colleges, and is defeated sixty runs to one,—the most crushing defeat on record,—then it is time for that organization to immediately disband, and not bring the college to such disgrace."

ALUMNI NOTES.

'80. Lowell E. Blake died recently in Vera Cruz, Mexico, where he was employed in railroad work.

'90. A. J. Reubold has recently been promoted from the position of foreman of the American Gas Co. of Peru, Ind., to that of superintendent with the same concern. This place was made vacant by Woodward, '85, who has accepted an important situation with the company's plant in New Rochelle, N. Y.

'92. Roscoe N. Clark has left his position with the engineering corps of the P. and R. Railroad.

'92. F. E. Hammond, employed by the American Bridge and Iron Co. of Va., has been spending the past month with friends in this city.

'92. Geo. F. Freed was married to Miss Mae Blanche Watkins of Seneca Falls, N. Y., on the 18th ult.

'93. F. H. Metcalf is with the H. C. Fish Co. of this city.

'93. Howard A. Coombs, assistant superintendent at the Builders' Iron Foundry, Providence, R. I., was in the city last Sunday.

'93. A. C. Comins was one of the speakers at the last meeting of the Harvard Union. The question was: "Resolved, that the Norwegian system for controlling the liquor traffic should be adopted in Massachusetts." Mr. Comins upheld the negative side of the question.

A. F. Newton is suffering from nervous prostration.

Ex-'96. S. W. Putnam, Jr., is pitcher on the Freshman ball team at the Massachusetts Institute of Technology.

TECHNICALITIES.

Go to the two-ring hippodrome at the Oval this afternoon.

Merrill B. Chase, '94, left the Institute last week, owing to poor health.

The weekly meeting of the Y. M. C. A. was held last Tuesday, Dr. Conant leading.

The members of the musical clubs had a group picture taken at Schervey's, Tuesday noon.
Hon. P. Emory Aldrich of the Trustees spoke to the Senior Political Economy class last week on Law and the Referendum.

The first meeting of the conference committee proved one fact, namely, that we have fine material in the Institute for a debating society.

The annual meeting and banquet of the N. E. Intercollegiate Press Association will be held at the Bay State House, on the night of the intercollegiate sports.

The Freshman Mechanics have commenced moulding and casting. Mr. Williams who has been in charge of the casting for the last three years is again in charge.

M. C. Allen started from the 20-yard mark in the Harvard games, last Saturday, and won fourth place in his heat in 51 1-5 sec., but did not get a place in the finals.

Dr. Kimball spoke to the Juniors last week regarding the election of Electricity in place of Shop Practice next year. About 30 "Elects" can be accommodated next year.

A. W. Howe, '95, won the first of a series of cross-country runs held under the auspices of the Clinton-Lancaster Athletic Association, at Clinton, this State, on Saturday, April 28th.

In mineralogy a Junior recently informed the class that the bead was violet or dark blue when red (hot). Another Sophomore in chemistry remarked, "After a while a drop of sand will be formed."

The meeting, May 3d, was led by Bryant '95, who gave a short account of the recent convention at Amherst, and also briefly outlined to those present the aims of the organization for the coming year.

The officers of the Y. M. C. A. connected with the Institute met in the Y. M. C. A. rooms Sunday afternoon, April 29th, and discussed plans of work, etc., for the ensuing year. A profitable and interesting meeting was enjoyed by all present.

Those who are training for the sports have not only had the privilege of the Oval, but they have also witnessed there some very exciting (?) ball-games between the Worcester and other teams, in which the score generally runs up in the tens and twenties.

Dr. Almon Gunnison led chapel exercises a week ago Monday morning. He also spoke a few words regarding the singleness of purpose a student should have while attending the Institute. His remarks were heartily applauded. Judge Aldrich was also present.

The tennis courts are in splendid shape and a number are availing themselves of this opportunity for practice. The proposed Tournament has not yet been definitely decided on, as it was thought advisable to wait till more enthusiasm is awakened among the members regarding the matter.

Last Saturday afternoon Instructor Viles consented to dress up in a suit and give the ball team some much-needed practice in sliding bases. Fully an hour's practice was indulged in, partly in sliding head first and partly in sliding feet first. Some of the players, however, did not show that attention and interest in Mr. Viles' coaching that they should have.

Overheard in recitations:

Instructor in Chemistry.—"How would you pass any given amount of CO₂ into a solution?"

Sophomore.—"By passing it through a meter."

Prof. in ditto.—"This compound costs—well, I don't know how much a pound—ten cents a hundred pounds."

Student in laboratory practice.—"Shall I dilute this acid?"

Instructor.—"No, take it straight."

In order for the candidates for positions to the Intercollegiate team to make the team, it will be necessary that they qualify in the events according to the table given below.

<table>
<thead>
<tr>
<th>Event</th>
<th>Distance</th>
<th>Time</th>
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<tr>
<td>Dash</td>
<td>100 yards</td>
<td>10 4-5 sec</td>
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<tr>
<td>Dash</td>
<td>220 yards</td>
<td>24 3-5 sec</td>
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<td>Hurdle</td>
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<tr>
<td>Hurdle</td>
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<td>Run</td>
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<td>Run</td>
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<td>Hurdle</td>
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<td>Run</td>
<td>1 mile walk</td>
<td>7 min. 45 sec</td>
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<td>Bicycle</td>
<td>2-mile bicycle</td>
<td>6 min. 30 sec</td>
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<td>Hammer</td>
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<td>Jump</td>
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<tr>
<td>Jump</td>
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<tr>
<td>Vault</td>
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<td>9 feet</td>
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TO JULIA MARLOWE.

What rare delight to see thee once again,
After the lapse of months that seem like years;
To see thy Rosalind and Imogen
Now radiant with smiles, now sad with tears!

In thee we see youth, beauty, art, all blend
To make a charming picture for the eye.
We gaze enraptured to the very end,
And all too fast the fleeting joy goes by.

Oh, may the unrelenting hand of Time
Be slow to rob thee of thy matchless grace!
Success attend thee in whatever clime!
Youth's happy smile be always on thy face!

—Tuftonian.
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