The M. A. C. Record.

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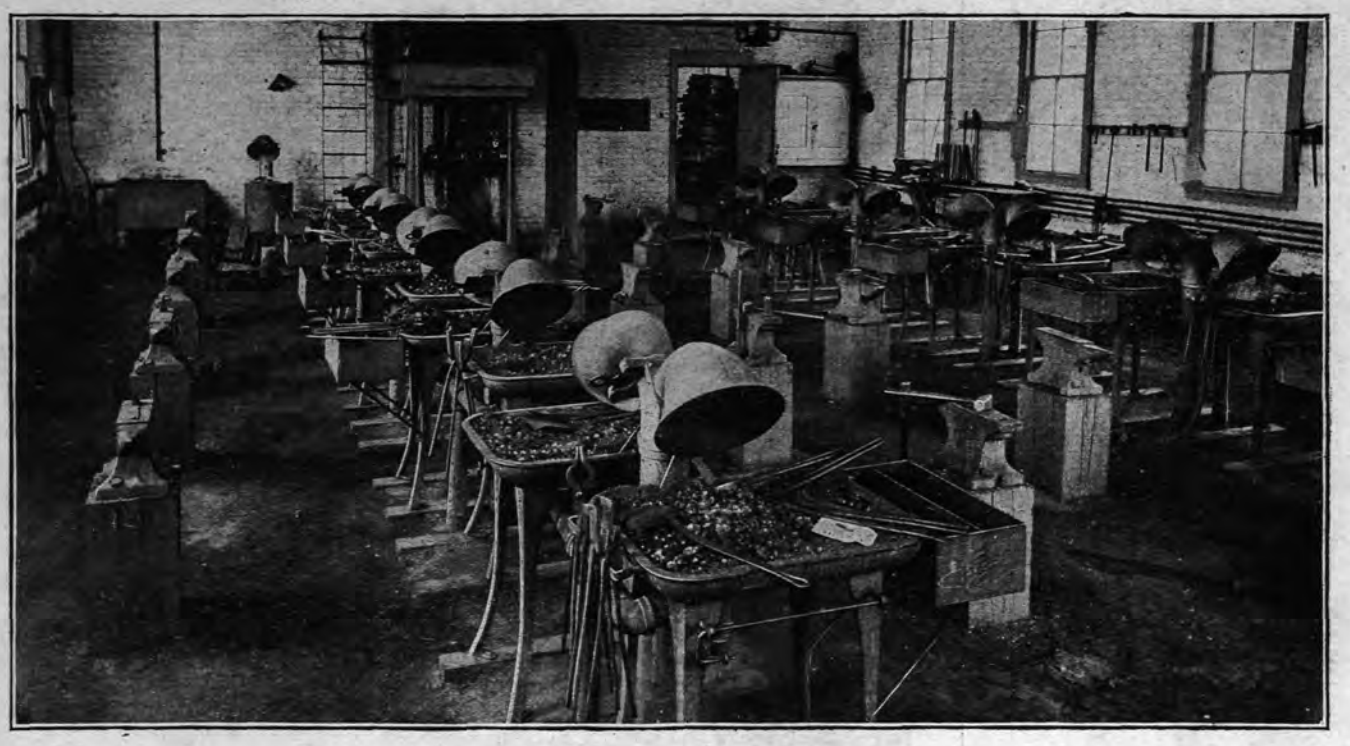


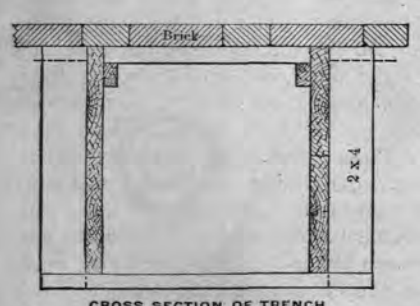
GENERAL VIEW OF FORGE SHOP.

SOME DATA RELATING TO FORGE-SHOP DESIGN.

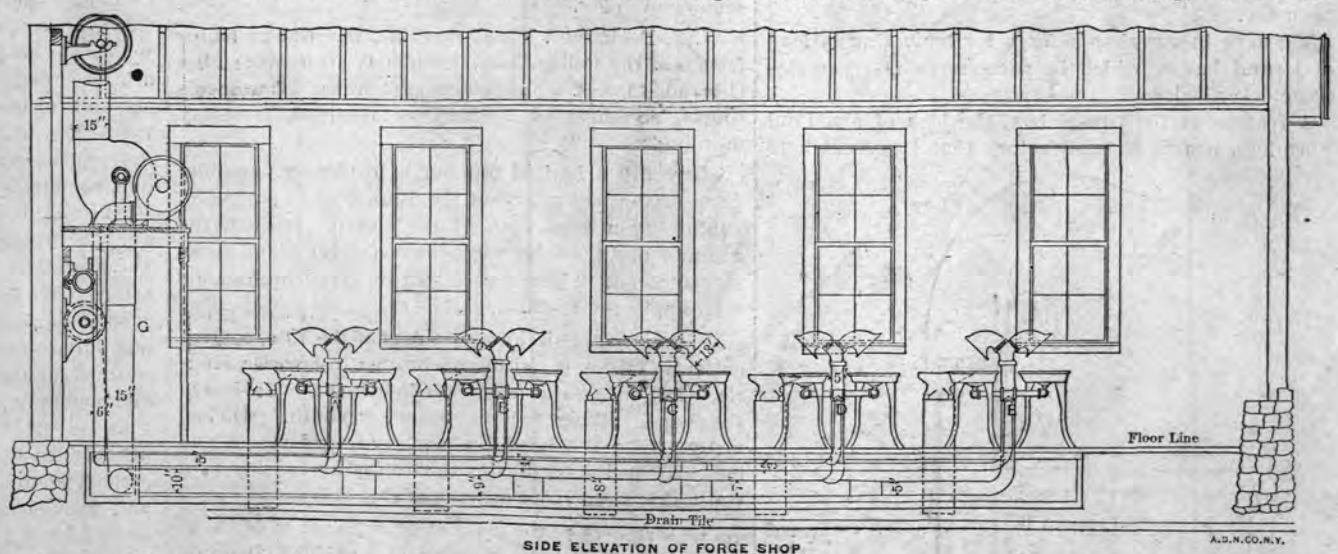
PROF. PAUL M CHAMBERLAIN.

The above is the title of a paper presented before the American Society of Mechanical Engineers at the New York meeting, 1895. The data were obtained from our own forge shop and were undertaken because of the scarcity of such record. The paper describes the arrangement of the plant and the reasons of the choice of arrangement which will not be repeated here except to call attention to the cuts and the fact that absence of overhead pipes makes the view of the instructor and the passage of light unobstructed, the first a very important consideration in a school shop, and the second important in any shop. The data sought may be stated thus: Required the amount of air necessary to support the combustion of a pound of coal in the forge and the amount of smoke, gases and air to be removed for each pound of coal consumed, to insure a clear atmosphere in the room. Incidentally, the distribution of the heat was traced, to show what disposition could be made of it for heating purposes. The detailed readings and computations may be found in the original paper Volume XVII of the *Transactions*, but for the present purpose the general results only will be given.

For the test the fires were put in prime condition, and the blower and fan regulated in speed so as to give just the right amount of blast to make the fires burn well, and the proper amount of suction to remove all smoke and gases. The amount of draught or speed of the current in the pipes and the temperatures were observed in various places in the pipes, the coal weighed and the revolutions per minute of the blower and fan observed. For every pound of coal consumed it was found that 287.6 cubic feet, at 131.66 degrees or 18 pounds of air was required, and 2263 cubic feet, at 252 degrees or 126.1 pounds of smoke, gases and air, exhausted. Of the entire theoretical heat value of the coal, 43 per cent was found to pass through the smoke stack. The velocity of flow in the pipes was found from the fundamental formula of falling bodies $V = \sqrt{2gh}$, air flowing into a vacuum being analagous to a falling body. The measurement of h was obtained by connecting a U tube to the pipes and noting the difference of pressure as shown by the different levels of water in the tube, measured in inches, and the height of a column of air at the given temperature calculated therefrom. For example, if the water at a temperature of 62 degrees showed a difference of level of one inch, the difference of pressure inside and out would be .577 ounces per square inch. A column of air one inch square and one inch high at 252 degrees, weighs .0005 ounces; for a column which would weigh .577 ounces we would require a column 92.7 feet high.



CROSS SECTION OF TRENCH



SIDE ELEVATION OF FORGE SHOP

This substituted in the formula would give us $V = \sqrt{2gh} = \sqrt{2 \times 32.2 \times 92.7} = 77$ feet per second, which multiplied by the area of the pipe in square feet would give the cubic feet handled per second.

The paper was discussed by Messrs. Fritz, Hutton, Snell, Weil, Green, Suplee, Woolson, Levan and Kent, who brought out good and bad features of the design as it compared with their experience. The "author's closure" of the discussion will present the points of criticism as briefly as could otherwise be done.

The experiments which this paper records were undertaken to determine the amounts of air and smoke handled per pound of coal in forging operations, and incidentally to trace the disposition of the heat, very little of which, as is well known, being used in heating the work. To make the data comparable with other conditions, a description of the plant was desirable.

The selection of blower and exhaust fan for such work is a simple matter when it is known how much air must be supplied and how much mixed air and smoke taken away. Within certain limits it is, from the financial side, the one usually considered, a question of saving in power by using the larger machines and pipes, versus the interest and depreciation on the greater first cost.

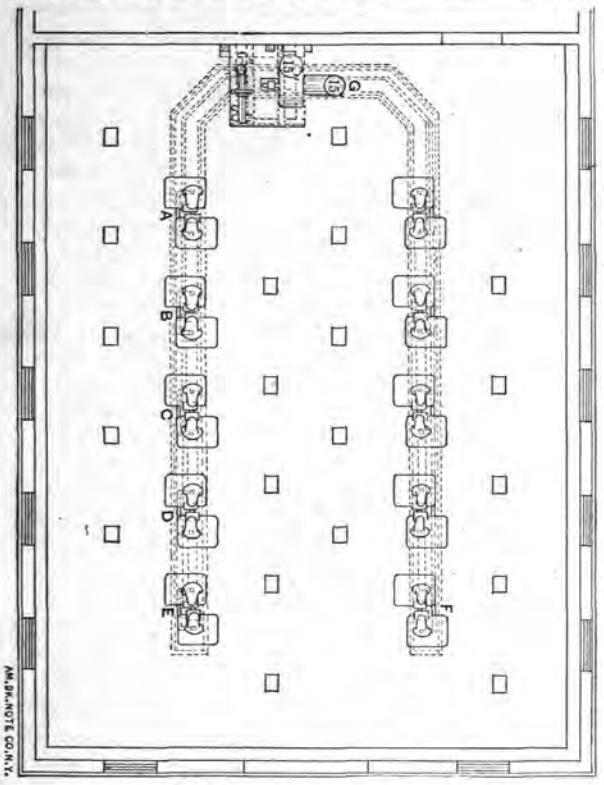
The design is not presented as a model of perfection in this or any other respect, but was, with the data and money at our disposal, the best we could contrive, and has proved satisfactory.

The machines used are handling the work without great loss of efficiency, as calculated by the Sturtevant Blower Company's tables, and it is doubtful, according to calculations I have recently made, whether an increase of efficiency by using larger machines would counterbalance the interest on the increased cost. While the design was for a school shop, I believe the down-draft feature, doing away with suspended hoods and pipes, would be appreciated in many of the regular business shops.

The cast-iron hoods are more expensive than those made of wrought iron, but are, I believe, economical, as wrought iron is very short-lived under the direct action of the gases and cinder from a forge fire.

A number of the speakers have condemned underground pipes, but our experience with them, in this instance, has been very satisfactory. With proper design they may be made quite as accessible as overhead ones. The objection urged against underground blast-pipes becoming clogged by reason of the precipitated moisture, does not hold in a case where the smoke-flues occupy the same trench. This may be readily seen by noting that, the air in the blast was raised from 80 degrees to 131.66 degrees between the blower and forges.

In reply to Prof. Hutton's question, I would say that when the plant was designed, it was expected that it would be necessary occasionally to remove the trench covers at the extremities of straight runs of pipe, and introduce a sweeper operated by either a chain or wire. With two years' use this has not been found necessary, the velocity of the air being such as to carry along with it pieces of coke even as large as a hickory nut when thrown within the hood. It would



PLAN VIEW OF FORGE SHOP.

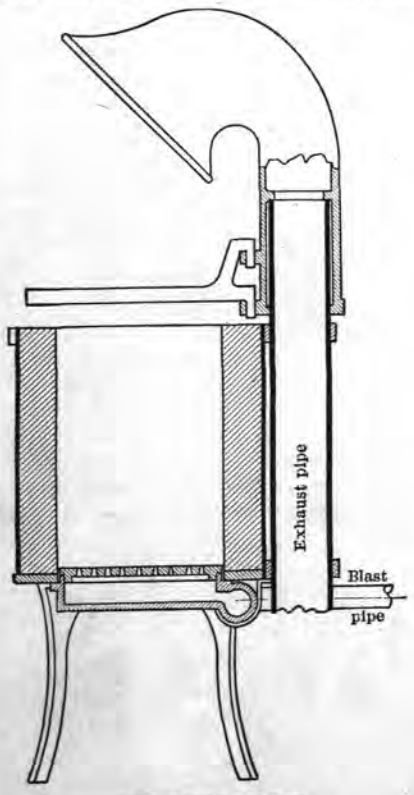
be interesting to know how low a velocity of exhaust would be sufficient for this self-cleansing process, for in a down-draft arrangement such a point would limit the area of the pipe for any given quantity of air handled.

My observation of smoke exhausting from an open fire will not enable me to agree with Mr. Snell when he says that the work done by the exhaust fan exceeds that of the blower only by the introduction of gas due to the consumption of coal and the expansion of air supplied by heating. In the case in hand the exhaust fan is speeded as low as it will thoroughly carry away the smoke and gases; and we find the ratio of exhaust to blast to be eight to one. Mr. Snell's statement would hold only with a closed furnace.

The forges described by Messrs. Woolson, Suplee, and Kent are without doubt superior for commercial purposes, but would not, I am inclined to think, so well answer the purpose of instruction as the ordinary open fire.

We have in our shop a forge for tempering in lead and sand baths, which in some respects resembles those described.

A feature of the tuyere box, the idea of Mr. Paul Theadore, proves so satisfactory that I present here



TEMPERING FORGE.

a sectional view of it. The blast-pipe is connected to the tuyere box, which is also the bottom of the furnace, by means of a hinge, and the bottom may be dropped at any time without disconnecting the blast-pipe. The top can be lifted out and the box cleaned very conveniently.

Department of Mechanical Engineering.

AT THE COLLEGE.

Mr. and Mrs. K. L. Butterfield are camping at Bay View.

Mrs. F. C. Kenney is visiting at her former home in Coldwater.

J. C. Nichols, '98, received a visit from his mother and aunt last week.

W. D. Groesbeck, '92 *m*, visited M. A. C. friends Friday and Saturday.

T. L. Hankinson, '98, received a visit from Chas. Robertson, of Hillsdale, last week.

The Feronians spent a pleasant day picnicking at Pine Lake last Saturday. The band boys did likewise.

Prof. Babcock was again called to his home last Tuesday afternoon, this time by the sad news of his father's death.

Prof. F. B. Mumford, '91, of the Missouri Agricultural College, arrived at M. A. C. last Friday for a stay of a few days.

The Museum was crowded all day Thursday, the most interest being centered in the case of tropical butterflies.

Mrs. John Corbin and Mrs. Bert Harris, of Eaton Rapids, were guests of Prof. and Mrs. C. D. Smith's last Thursday and Friday.

The practical course for women, to be inaugurated next term, is very generally approved by correspondents and by the press.

Dr. Kedzie was called to the funeral of his sister at Adrian last Tuesday. Mrs. Kedzie was the mother of William K. Kedzie, '70.

Mr. George Hoppough, Smyrna, father of Carl N. Hoppough, '99, took advantage of the picnic last Thursday to visit his son.

One farmer who has lived near the College for over thirty years, made his first visit to the grounds at the time of the Odd Fellows' picnic.

Prof. C. D. Smith read a paper on Bacteria in milk before the third annual conference of the Michigan health officers in Ann Arbor last week.

Pliny M. Lyman, one of Bancroft's young farmers, has been engaged to fill the position left vacant by E. S. Good's appointment as clerk to the president.

The sub-faculty and freshmen played an interesting game of ball last Saturday, in which the freshmen won. Score: 8 to 3. Next Saturday the sub-faculty and seniors will play.

W. F. Pack, with '81, Centreville, dropped in on his friends at the College last Wednesday afternoon. Miss Gertrude Clewes, a prospective student for the women's course, accompanied him. They returned Thursday morning.

There are a limited number of copies in pamphlet form of the last report of the Botanical Department, containing a good map of the Botanic garden, the common and the scientific names of every plant therein contained. These copies will be given to students who apply for them.

Dr. George T. Fairchild, president of the Kansas Agricultural College, is visiting his brother-in-law, Dr. Kedzie. On Sunday afternoon he conducted the services in the chapel, taking for his theme, "Youth." He had many good and helpful things to say for the young, and he spoke feelingly of the thirteen years of his own youth that were spent in work at this College.

The members of the class of '93 who are at M. A. C. have decided to have a picnic at Leadley's Park on Saturday afternoon, August 8, and to invite the other members of the class to come and participate. They will partake of the class song (with the bones picked out), warmed-up toasts left over from the '93 banquet, and several new and palatable dishes. For this once the members are urged to subordinate to the will of the committee any individual preferences they may have for Macatawa Park, Grand Ledge, Belle Isle, or the Tunnel, and join the "machine" for a good time. Expenses of the day will be met by a class tax.

The cucumbers hanging from the vines supported by the rafters of the greenhouse of the Experiment Station, are a sight worthy of comment. At the close of the season for using the greenhouse, some cucumbers were planted for illustrating the manner of pruning and management in other particulars. Several methods of managing the vines are there well illustrated, and they are as complex as those applied to pruning in grapes grown under glass. The sorts tested are white spine, cool and crisp, improved long green, Chinese climbing. These vines are very thrifty and the large crop of suspended cucumbers is a novelty to all who have little knowledge of growing vegetables in greenhouses.

Said a professor to a RECORD editor: "Did you ever notice how much the average family meal depends for its relish and completeness on the products of the dairy? No doubt the farmer appreciates the fact more than the city-bred or even those in the country, whose business is not farming or to whom the table is only a necessary adjunct to comfort. The thought struck me forcibly the other day as I sat at dinner. The meat course was chicken, fried, and served with a gravy that was half milk. The mashed potatoes were made delicious by the addition of a little milk. The corn was prepared in milk, as is proper. A bit of cream cheese figured as part of the meal, not to speak of the pat of butter that stood at each plate. The day being warm, glasses of iced milk provided liquid refreshment not to be approached by tea or coffee; and finally part of the dessert was ice cream, again largely a product of the dairy."

I. O. O. F. PICNIC AT M. A. C.

The sixth annual picnic of the Grand River I. O. O. F. Picnic Association was held at the College last Thursday. Nature could not have been more bountiful in the bestowal of her gifts than she was on this eventful day. The lawns were never nicer at this season, and the day was just warm enough to make the cool shade acceptable.

All the forenoon the crowds kept pouring in by wagon loads and carriage loads from the adjacent country and towns and by car loads from Williamston, Webberville, Mason, Holt, Eaton Rapids, Dimondale, Charlotte, Olivet, Grand Ledge, Sunfield, Lake Odessa, Ionia and other towns, so that by noon the shade of every clump of trees had its party of picnickers; while in the groves north and west of College Hall, where tables and chairs had been provided, several hundred brothers and sisters, united by the mystic bonds of F. L. T., partook of their repast with such thorough enjoyment that the spirits of the "Good Samaritan" and of "Jonathan and David" must have looked down with approval.

After luncheon the guests assembled in the grove and listened to an excellent program, which consisted of music by the Williamston band and speeches by President Snyder, L. M. Patterson, Grand Master H. N. Wilder, President of the D. of R., Mrs. A. F. Carpenter, and others. President Snyder, in his address of welcome, spoke as follows:

"Ladies and Gentlemen:—As the representative of this College, I am glad to welcome you to this campus, which for real beauty has no equal, we are told, in all this broad land. These trees and shrubs have had the skillful care of a specialist for nearly half a century. You will find among their number many whose native homes are far beyond the seas, but here they live, seemingly enjoying their forced exile.

"We invite you, and expect you, to look through our Laboratories, our Library, Museum, and other buildings. In all these places you will be cordially received. We have an equipment of which you as citizens of the state can justly feel proud. But, the campus, laboratories, farm, and buildings are worth only so much as they can be made to minister to the needs and demands of the citizens of this commonwealth. This College is of a peculiar type. It is based upon the primal idea that education, as far as the state is concerned, should mean the preparation of young men and women for service, and not for leisure; that it should have a close connection with some of the important sections of the state's activity rather than to deal only with those other sections, where law, medicine, and literary culture each plays its important part. It appreciates the fact that the great bulk of humanity must earn their bread by the sweat of their brow, and it does not hold out to its students alluring prospects which so often end in disappointment and disaster. It does not teach that education assures either character or success, but that both are won by self-sacrifice and faithful effort. We believe that the education that best fits its recipients for earning a comfortable living, respectably and honestly, insures to the family the best parents, to the community the best citizens, and to the state the best patriots. It is a question whether in our modern public high schools, good as they are, the tendency is not to lead pupils away from work rather than to give them a taste for it. A little

learning of this kind is a *dangerous* thing; and just enough to make a boy think that he is better than his father, who is an honest carpenter, or blacksmith, or mason, or farmer, is a *fatal* thing. It were better to have stopped short with him before he arrived to that high degree. This College holds and teaches that honest toil is just as honorable as any profession and that success in the one is just as hard to secure as success in the other.

"And to the ladies, I am glad to say that in the future you will find here a place where young women can secure an education which will fit them for assuming the cares and responsibilities of life. A course of study which does not begin with Rome and its musty records, but with the home, that place above all others most dear to the American heart; a course of study strong in science, modern language, literature, music and art, yet withal centered around the home, thus preparing young women for the realities of life which they are destined to meet later on.

"Again, let me welcome you to this delightful campus, to its beautiful walks, refreshing shades, and fragrant flowers; and when you come to depart may it be with as much satisfaction as we feel at being honored with your presence."

L. M. Patterson, of Protection Lodge, responded in the following words:

"Mr. President:—On behalf of the Odd Fellows and Daughters of Rebecca assembled here today, I wish to extend our sincere thanks for the royal welcome that has been tendered us on this occasion. We feel greatly pleased and highly honored by being allowed to hold our annual picnic in this the most beautiful spot in the state of Michigan. We feel proud of our M. A. C. We feel proud of the men who have charge of the instruction in this, one of the grandest institutions of its kind that exists in the world today. The influence of the M. A. C. reaches not only throughout the state, but also throughout the United States. Men of almost every vocation in life are proud to point back to the time spent in this institution and realize that it was here that the foundation of their success in life was laid.

"We the Odd Fellows and D. of R. of Michigan wish you God speed in your noble work and pledge you our hearty support. We are here today, representing a society that is in harmony with education, with religion, with everyhing that is for the uplifting of man and placing him in a higher sphere of usefulness. The history of the I. O. O. F. is in common with the history of our great republic. We have grown up with the nation, and, under wise laws and a free government, we have become a mighty factor in shaping the destinies of mankind.

"Anything that makes a better man makes a better husband and father, a better citizen. We are here today representing a society that has for its object the uplifting of mankind, one that assists its members to become better men and better women, more loyal to their country and more devoted to their God. Our past is filled with many noble deeds and many acts of charity. Many a needy one has been assisted, many a sick and despondent one has been encouraged, many a brother has been made a better neighbor, a better citizen, a better man by being associated with those who practice F., L. and T. It is wonderful what a stimulant these pleasant social gatherings are for all those who attend them. There grows out of them a more fraternal feeling, a closer sympathy and a stronger bond of fellowship. While they cultivate the highest social qualities and tend to an intellectual development not possible to be gained in any other way. Sisters and brothers, I trust that when we have spent this pleasant day together we shall return to our homes feeling that we belong to a society that is far more important than we had at first supposed.

"May we not return to our homes from this pleasant occasion without a deep and solemn conviction of the responsibilities that rest upon us as Odd Fellows and as citizens of this great republic.

"This great fraternal organization, this grand old country of ours, this glorious liberty, these free institutions of government are ours; ours to enjoy, ours to preserve, ours to hand down unsullied to our children. Generations past and generations to come hold us responsible for this sacred trust. Our brothers from behind admonish us with their anxious fraternal voices, humanity calls out to us from the bosom of the future, the whole world turns hither its solicitous eyes. All implore us to act wisely and faithfully in the relation which we sustain. O, may this, our beloved order, live for ever, and to continue to grow in every good work and every good principle, until time shall be no more and the whole human race shall be gathered into one grand universal brotherhood.

"With our dia lems bright
And our failings forgiven,
May we all meet at last
In the grand lodge of Heaven."

In the business meeting which followed, it was voted to hold the next annual meeting "at the best place on earth, the Agricultural College." Votes of thanks were extended to the College and the present officers of the association, and the following officers were elected for next year: President, Henry Whiteley, Lansing; vice-presidents, for Ionia county, G. E. Warring and Clara Miner; Clinton county, S. W. Rose and Mrs. Susan Hall; Shiawassee county, H. A. Middaugh and Hattie Lindley; Eaton county, Mr. and Mrs. E. W. Spencer; Ingham county, Mr. and Mrs. Edward Herre; secretary, V. N. Hoag, Grand Ledge; treasurer, F. A. Taber, Grand Ledge.

At 3:15 o'clock the battalion of cadets gave an exhibition drill, after which the I. O. O. F. and Mapes teams played an interesting game of ball, which resulted in a score of 14 to 11 in favor of the I. O. O. F.'s.

We are glad that this representative gathering of farmers and business men enjoyed the day so well as to make up their minds to come again, and we hope to make your visit next year as enjoyable as this has been.

OUR ARBORETUM.

DR. W. J. BEAL.

To a person accustomed to a new country, a term still applicable to Lansing and vicinity, it may seem strange to go into the "woods" where the trees are arranged in straight rows. This artificial forest was begun in 1875—twenty-one years ago, on a piece of land consisting of about two acres, located next to the road north of the College and the north entrance, just where it is likely to be seen on one side and on one end by all the passengers who visit the College, after the Lansing street railway is extended onto the campus. Unfortunately for the visitor, the trees are of different ages, so mistakes are likely to be made in estimating the relative growth and value. Sixteen years ago, this area included 215 species of trees and shrubs, and probably contains about that number today.

Usually the trees of any single species are planted in contiguous rows or in blocks constituting parts of several rows.

With my present knowledge of the subject, were I to begin planting at the present time, the trees of some one kind would be mixed with those of one or more kinds. Trees like those of black walnut, chestnut and white ash will not produce tops thick enough to shade the ground sufficiently to keep out the grass, while box elders, beeches, arbor vitæ will endure much shade and prevent the growth of grass. After possesing a knowledge of all kinds of trees as to their capacity to endure the light, a planter will mix the shade-enduring trees with those which are impatient of shade. The shade-enduring kinds are called "nurses" and are planted for the purpose of protecting the other kinds, such as have been mentioned. Through the rows of walnuts, chestnuts, and white ashes, one can see without obstruction for ten or fifteen rods, except in some instances where there has sprung up a mixed growth of trees and shrubs to be mentioned later, while the rows of sugar maples, beeches, box elders, and a few others obstruct the view quite completely.

The trees were nearly all started by planting the seeds and nuts, before drying, just where they were expected to remain. In cases of chestnuts and some others, the nuts were collected or purchased in autumn and mixed with twice their bulk of sand and buried in boxes a little below the surface on a dry knoll. Early in the spring the sprouting nuts were planted. These rows were cultivated for five or six years, much as we cultivate corn. A few were trimmed a little; in all cases some thinning was done from time to time.

Giving the results of any measurements of the height and diameter would be quite misleading in many cases, because of differences in the soil, space occupied, and for several other reasons, still such measurements may be worth mentioning.

For planting for timber on sandy loam which is not very rich and productive, I am at present very favorably impressed with the common locust, considerably scattered in thin places among other trees which have grown to a height of ten to fifteen feet or more. The largest of a few planted as small suckers in the spring of 1880, now have a circumference of 27 to 34 inches, three feet from the ground. They have grown in good shape for timber and would make nice and very durable fence posts. Chestnuts planted in the spring of 1877 now have a circumference of 27 inches. They are clean and straight and tall; with more room at the end of the row one tree girts 36 inches. White pines promise well. A few set in 1880 when about a foot and a half high, now measure 17 inches in circumference three feet above the ground. They are very pretty and in some cases have shot up three feet per year. Norway or red pine has done well. Baswoods from seeds sprouting in 1876, twenty years ago, girt 24 to 33 inches. The land is not just adapted to white ash, but trees from seeds coming up in 1876 now measure 18 to 22 inches around and are straight and nice. White oaks from acorns sprouting in 1878, are now 14 to 16 inches around. They are pretty trees, though not large for the age of 18 years. Still, knowing the great worth of the timber, I should plant some white oaks.

After these trees, mixed together in planting, had attained a height of eight to twelve feet with cultivation in the rows, I should put in box elders to shade the ground. If these began to overtop the other trees I should cut them off more or less.

It is interesting to the student of nature to observe the great variety of trees, shrubs and herbs that now occupy much of the ground between the rows of trees. The seeds for this growth were sown mostly by the wind, by birds, and possibly by squirrels. Let me name them as prompted by a report made in 1886: Three kinds of oak, black cherry, sugar maple, beech, American elm, bitternut, hawthorn, sassafras, two dogwoods, white ash, spiræa, blue beech, gooseberry, several kinds of willow, two kinds of grapes, Virginia creeper, catalpa, white birch, box elder, three kinds of poplors, hazel, ironwood, prickly ash, viburnum, elder, raspberries, honeysuckle, and probably several others.

Botanical Department.

The best thing that can happen to the average young man who has just graduated, is to have to shift for himself in some good, hard, ordinary work. Students of books too often learn to feel that they are going through a process that transfuses their common clay into some rich porcelain that will not bear ordinary use. We don't want our schools and colleges to make costly and delicate pottery, but to mold and fashion plain, ordinary, everyday implements to be employed in some useful service. Now, if the young graduate has to do something common, something that "anybody can do," it may tend to eradicate any exaggerated notions he (or she) may have absorbed in regard to abilities, purpose, and equipment.—*Grange Visitor.*

Mrs. Nellie Kedzie, Professor of Domestic Science in the Kansas Agricultural College, refused the offer of the same position in the Ohio University, although it carried with it a salary of $1,750 per year. How many bright women are straining their eyes and rounding their shoulders over Latin dictionaries and Greek lexicons for less than $600 per year?

President Eliot of Harvard has submitted a proposition to the board of overseers which, if granted, will make it possible for students to finish their regular course in three years instead of four.—*Ex.*

The graduate students at Cornell have decided to wear caps and gowns, following the old usage as to cut of gown and color of hood to distinguish degree and college of the wearer.—*Ex.*

A teacher having asked his class to write an essay on "The Results of Laziness," a certain bright youth handed in as his composition a blank sheet of paper.—*Ex.*

"He who brings the best and cheapest will find approval in welcoming purchasers and remunerative prices."—J. Sterling Morton, Secretary of Agriculture.

The Faculty of Boston University has decided to allow work on the college papers to count for English in the regular course.—*Ex.*

There are only ten universities in Russia; the largest one is the University of Moscow, at which only 1,600 students are enrolled.

The M. A. C. RECORD comes to us in quarto form. It is a well edited and most valuable publication.—*Grass Lake News.*

The M. A. C. Record.

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For various reasons THE M. A. C. RECORD is occasionally sent to those who have not subscribed for the paper. Such persons need have no hesitation about taking the paper from the post-office, for no charge will be made for it. The only way, however, to secure the RECORD regularly is to subscribe.

The following article on "The Women's Course at the Agricultural College," is from the pen of one of Michigan's noble daughters, for many years well known to the public and especially to the farmers of the state. We are glad to know that she so heartily endorses the policy of the College.

In way of explanation we might add that the modern cooking kitchen is already being equipped, and by the opening of the fall term, few schools in the country will be so well prepared to lead students into the secrets of improved cookery.

As this is a College, and not a mere training school, it was not thought best to give the girls simply a year's training along practical lines, as "Beatrix" so forcibly suggests. The object is to make good women as well as good housekeepers; to give young women the advantage of a liberal education as well as the advantages of practical training. The desire is to do as much for the young women of the State as we are doing for the young men of the State. For this, as well as for other reasons, it was thought best to make the courses of study of equal length and leading to the same degree. If a young woman can spend only one year in college and desires to give her whole time to technical work, she can enter as a special student and secure for herself just such a course as has been so happily suggested.

The point made by the writer of the article, that there will be a demand for teachers of domestic science, is well taken. The demand at present cannot be supplied, although very liberal salaries are offered. At the meeting of the National Educational Association held at Buffalo last week, public inquiry was made for such teachers or where they could be obtained. The demand will be still greater in the future. Only a few schools of the country are preparing young women for this work, and they are already unable to furnish teachers for the new schools being opened in so many of our large cities. The graduates of the Kansas Agricultural College were employed at once, some of them receiving as much as $1,200 per year.

THE WOMEN'S COURSE AT THE AGRICULTURAL COLLEGE.

Detroit *Free Press:* The State Board of Agriculture has been frequently importuned, in recent years, to open the doors of the Agricultural College to the farmer's daughters as well as to his sons, and to institute a women's course which should offer to girls a special training in household science and domestic economy, that should be to them what the agricultural instruction of the College is to young men. There have been several good reasons why the Board has not felt it expedient to yield to the pressure, but these reasons have been overborne, and at a late meeting (June 8) the women's course of study, was outlined, subject to such modifications as time and experience may make necessary.

I am indebted to the courtesy of Hon. C. W. Garfield for a tabulation of the course as arranged. It provides the essentials of a fairly liberal education, coupled with branches belonging more especially to agriculture, and rural life, together with cooking, which has place in the three terms of the freshmen year, and household economy, sewing, and cutting and fitting, in the sophomore; in the junior and senior years pomology, dairying, kitchen gardening, poultry raising and floriculture are elective. It will be seen that these studies are selected with especial reference to the needs of girls who expect to have to do with rural life, hoping to give them a valuable training in those lines which will be most serviceable to them in after life. Mr. Garfield writes me: "Domestic economy and household science in its broadest sense will be the leading special feature of the course, and if the evolution into a higher and nobler plane of existence is largely dependent upon skill in cookery and well managed households, we shall try to do our part in the 'evoluting.' It is not intended to train the girls to be skillful farmers, but rather to give them training along lines of general usefulness, with the privilege of attaining special skill in gardening, floriculture, poultry raising and dairy work, if they so elect."

Dr. Snyder, the new president at the College, is anxious to have the course in domestic economy as perfect as possible. He wants a model kitchen, managed by a competent instructor; this feature may—undoubtedly will—be added in time, should the new course prove attractive to young women. The question that now arises is: How many will present themselves next fall, desirous of an opportunity for special instruction not to be gained elsewhere, to my knowledge, in the state?

I am glad to see this new departure taken by the College authorities, though I confess I could have wished for a different plan. What I have hoped to see inaugurated at the M. A. C. is a short, thorough, special course in cookery, domestic science, household hygiene, food nutrition, sewing, cutting and fitting and dairy work. A course in which a young woman might graduate in one year and leave with a thorough knowledge of the best methods of preparing all kinds of foods, of food values, of all sorts of household processes, and something about the care of children. We educate our girls expensively and instruct them in all sorts of ologies they'll soon forget, and let them become mothers ignorant of the first principles of the care—moral or physical—of the babes born to them. A girl after a year's thorough training in such a practical, thorough course as I have outlined, ought to be fitted to be a gracious wife, a competent housekeeper and an intelligent mother. I know of no institution, this side of Boston and Philadelphia, where such training can be obtained. And I hoped our College might in time see "the aching void" and fill it with a course that would not only attract, but also be within reach of the daughters of farmers in moderate circumstances, who often cannot afford the expense of a four years' course. Such a course would draw from the cities, too—or at least, it should.

There is a great necessity for better knowledge on the part of women relative to nutritive values of foods and the most economical methods of preparation, a necessity that becomes more apparent as times grow harder and wages wax less and less. Half the average income of the wage-earner in this country is spent for the one item of food—food that is bought and cooked by women whose idea of economy is to go without what they have not money to buy, who don't know what "nutritive value" means, and who spoil the food which costs so much by improper methods of cooking. There is no way of remedying these conditions save through educating the young; the present generation is beyond reach. If we can teach the children, we provide a means for the spread of "the gospel of good food."

There is at present evidence of a reaction toward a more practical form of education. And when that reaction comes, it is highly probable that household science and domestic economy and plain, downright, bread-making and beefsteak-broiling will be taught in lieu of bacteria hunting in our public schools. There will be a great call for teachers, for, at present, you can find a thousand women who can teach French and German, music and drawing, to one who could give a practical demonstration in cooking. I have been asked to furnish information on a great many recondite topics during my fifteen years of newspaper experience, but I was never so thoroughly disconcerted and at a loss where to look as when, some three years ago, I was requested to recommend a person competent to conduct a series of culinary processes in public. The graduates of the women's course at the M. A. C. may find vocations awaiting them at the conclusion of the four years of study, for philanthropists and sociologists in looking for the causes of improvidence, poverty and vice, are learning that good food, nutritious and well cooked, lies pretty close to the beginnings of respectability, and that a man whose physical being is disordered through mal-nutrition is already supplied with the impelling power toward viciousness.

So I am glad to see the College take up domestic economy in the new course with a view to making it and its branches a special feature. Such work was at one time a great attraction at the Kansas Agricultural College; it ought to be equally popular in Michigan. Combined as it is here with other branches of education, it should be regarded as a special privilege, and Abbot Hall, the most attractive dormitory at the College, which has been set apart for the reception of the girls, ought to have a good contingent of earnest young women who will not scorn the instruction which the College alone, in all their native state, can offer them.

BEATRIX.

THE ANALYSIS, ORIGIN, AND MANUFACTURE OF FERTILIZERS.

L. H. VAN WORMER, '95

The law relating to the collection and analysis of commercial fertilizers has been given in a former article, and need not be repeated here. The collectors, this year, obtained samples of nearly seventy different brands of fertilizers. The fertilizer is ground fine and sifted through a sieve having meshes 1 m.m. (1-25 in.) in diameter. They are now put into closed glass cans and are ready for analysis.

While there are about thirteen elements that are necessary to plants, there are only three for which the farmer can afford to pay more than a nominal price, viz.: Phosphorus, nitrogen and potash. In the analysis, we estimate only the amount of these three. As the estimation of each element is a process entirely distinct from the others, I will describe each process by itself, beginning with the process for nitrogen.

In making an analysis the first thing is to prepare the reagents, or chemicals, which are used in doing the work. After getting fairly to work a person can analyze about sixteen samples per day. The fertilizer is first boiled with strong sulphuric acid. Strong lye is then added and the nitrogen in the form of ammonia is distilled off and estimated. Each fertilizer must be analyzed twice in order to check errors. The difference in the results of the two analyses must be less than one-tenth of one per cent; otherwise another examination must be made. The value of nitrogen is about 16 cents per pound, so a difference of one per cent would make a difference of 32 cents per ton in the value of the fertilizer. Suppose a firm sold a thousand tons in a year, this would make a difference of over $300.

In farm manures this nitrogen is the most abundant of the valuable elements. It is there in the form of ammonia, commonly called "hartshorn," because it was first obtained from the horns of the hart. All animal tissue contains nitrogen and so ammonia can be obtained from all parts of the hart as well as from the horns.

To furnish this constituent, the manufacturer uses a great variety of substances. In some of the higher-priced fertilizers, the nitrogen is furnished by some of the salts of ammonia or by the nitrates. These nitrates are commonly called saltpeter, and are obtained from western South America. The usual source of nitrogen is some one or more of the following waste materials, viz: scraps of meat, blood, bones, hair, hoofs, fish scraps, etc. The settlers of Plymouth were taught, by the Indians, to fertilize their fields with fish. In 1875, over two million dollars worth of fish known as "menhadden" were used for fertilizer.

Phosphorus forms a compound with oxygen and it is the weight of this compound which is estimated. The fertilizer is boiled with strong sulphuric acid, after which the phosphorus is separated and weighed as a compound of phosphorus, magnesium, and oxygen. This takes from six to eight hours. By analyzing a number at a time, an analyst can average about one per hour.

The phosphorus of fertilizers is obtained principally from calcium phosphate, a mineral found in large quantities in Canada, in South Carolina, and in Florida. In South Carolina and Florida are hundreds of square miles of territory underlaid with a layer of phosphate rock, varying in thickness from a few inches to several feet. In the form in which this rock is found, it can be dissolved only by the strongest acids, and so would be of little use as a fertilizer. The phosphate is dug out of the ground and shipped to the fertilizer works, where it is ground up and treated with sulphuric acid to make it soluble. After treating with the acid it is dried, pulverized, and put into sacks. It can now be sold as a superphosphate, or mixed with other materials to form a mixed fertilizer.

We now come to the third element of value in a fertilizer, viz.: potash. This is dissolved out of the fertilizer by boiling water, then separated and weighed as a compound of platinum, potash, and chlorine. Each complete analysis requires from two and one-half hours to four hours. However, as the largest share of this time is a process of waiting, one person can analyze eight or ten samples at the same time. In this way ten to fifteen analyses can be made in a

day. At least two analyses are made of each sample. If the two results do not agree within one-tenth of one per cent further examination is made.

In Saxony, on the plains west of the Elbe river, are situated extensive deposits of salt. From here comes the world's great supply of potash. This region was worked for centuries as a source of common salt, without any knowledge of the presence of the more valuable potash salts. Whether or not there is a similar bed of potash underlying the salt regions of this country can only be determined by a thorough examination.

Before closing I wish to call attention to one source of potash which is frequently overlooked, viz.: hardwood ashes. On an average, good ashes contain over five per cent of potash. Considering that the ashes contain five per cent of potash, this one element, contained in one ton of ashes, would be worth $4.50. In addition to the above, all ashes contain some phosphoric acid, and some ashes have shown as high as ten per cent of potash.

Department of Chemistry.

POISONED BRAN FOR GRASSHOPPERS.

G. C. DAVIS.

Grasshoppers have been very numerous in places on the College farm this season, and we took the opportunity to try a field experiment in the use of poisoned bran. We have known for several years by laboratory experiments, that the hoppers are fond of sweets, and that Paris green will kill them when taken with food, but "the proof of the pudding is in the eating," instead of the sampling.

With every peck of bran, two quarts of black cooking molasses were mixed. To this was added enough Paris green to give it a green tinge—from one to two ounces. The mixture was then dropped over the ground in bunches, about the size of a small hen's egg, and perhaps five or six feet apart each way.

The second day the effect of the poison began to show, as a dead grasshopper could be found here and there in the grass. By the fourth day the hoppers were decidedly fewer than when the poison was applied and fewer than where no poison was placed. Many dead hoppers were found in the poisoned sections, and for several rods bordering the sections, but beyond this no dead ones were found. A conservative estimate of the dead would be from a quarter to a third. Judging by the absent ones, the estimate would be about one-half. The bunches of bran were still moist in spots.

Unfortunately for this experiment, the hard rain of July 4th came the following day and dissolved the bunches of bran, washing the most of them with the Paris green into the ground.

A similar experiment was tried previous to this with London purple, but with a natural result. The poison evidently was worthless, as a dead hopper could rarely be found, although much of the bran was eaten.

The disadvantage in using poisons is in the liability of poisoning stock that may eat the bran while feeding. If one is careful in placing the bunches, he can gather what is left of them at the end of a week or two. A dashing or continued rain will also place the poison beyond the reach of stock. The poisoned bran can no doubt be made a valuable aid in protecting limited areas under certain circumstances.

Experiment Station.

H. L. Rosenberry, '81, since 1883 an M. D. from Starling Medical College, O., recently visited this College. He fully appreciates the training he received at M. A. C. It gained for him one year in the medical course. He is much interested in sanitary matters, and has helped to set the ball in motion in two or three towns where he has lived. He is now a health officer in Wausau, Wis., a town of 11,000 people. He visited his alma mater in the interest of that city to see what was going on here regarding tuberculosis in the dairy. The problem is of great importance to every citizen of the United States and the doctor knows of no place petter prepared to make these investigations than the M. A. C. He expressed himself as much pleased with the work undertaken by Dr. Grange and Prof. Smith. He said: "My College training here has been of inestimable value to me even in my professional work, and I trust that it may be even more valuable in the future than in the past. The College has been worth all the labor and money it has cost if it should go out of existence tomorrow. I am proud of its growth, and proud that I am an alumnus of an institution which is doing such valiant service for the state and nation."

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Aside from the State Board of Agriculture given above, the following are the officers of the Experiment Station:

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T. T. Lyon, So. Haven.....In charge of Sub-Station.
R. L. Taylor, Lapeer.....In charge of Apiary.

SUB-STATIONS.

Grayling, Crawford county, 80 acres deeded.
South Haven, Van Buren county, 10 acres rented; 5 acres deeded.

OFFICIAL DIRECTORY.

Sunday Chapel Service—Preaching at 2:30 P. M.

Y. M. C. A.—Holds regular meetings every Thursday evening at 6:30 and Sunday evenings at 7:30. S. H. Fulton, President. C. W. Loomis, Cor. Secretary.

Natural History Society—Regular meeting second Friday evening of each month in the chapel at 7:30. L. R. Love, President. J. W. Rigterink, Secretary.

Botanical Club—Meets first and third Friday of each month in Botanical Laboratory at 7:30. C. F. Wheeler President. B. Barlow, Secretary.

Dante Club—Meets every Wednesday evening at 7:30 in Prof. W. O. Hedrick's office, College Hall. Prof. A. B. Noble, President.

Students' Organization—S. H. Fulton, Vice-President. H. L. Becker, Secretary.

Columbian Literary Society—Regular meeting every Saturday evening in their rooms in the middle ward of Wells Hall, at 7:30. F. N. Jaques, President. T. A. Chittenden, Secretary.

Delta Tau Delta Fraternity—Meets Friday evenings in the chapter rooms on fourth floor of Williams Hall, at 7:30. A. C. Krentel, President. J. M. Barnay, Secretary.

Eclectic Society—Meets on fourth floor of Williams Hall every Saturday at 7:30 P. M. W. R. Vanderhoof, President. W. Newman, Secretary.

Feronian Society—Meets every Friday afternoon at 2:30 in U. L. S. Hall. Miss Bertha Baker, President. Miss Ellen Vaughn, Secretary.

Hesperian Society—Meetings held every Saturday evening in the society rooms in the west ward of Wells Hall at 7:30. W. T. Barnum, President. D. J. Hale, Secretary.

Olympic Society—Meets on fourth floor of Williams Hall every Saturday evening at 7:30. C. A. Jewell, President. F. J. Kling, Secretary.

Phi Delta Theta Fraternity—Meets on Friday evening in chapter rooms in Wells Hall, at 7:30. C. K. Chapin, President. J. W. Michen, Secretary.

Union Literary Society—Meetings held in their Hall every Saturday evening at 7:30. J. T. Berry, President. F. V. Warren, Secretary.

Tau Beta Pi Fraternity—Meets every two weeks on Thursday evening in the tower room of Mechanical Laboratory. E. D. Partridge, President. J. H. Steele, Secretary.

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M. A. C. Grange—Meets every two weeks in the Columbian Society rooms. G. H. True, Master. H. W. Hart, Secretary.

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NEWS FROM GRADUATES AND STUDENTS.

Mrs. Jesse B. Baker, '90, is visiting at the College.

Orel S. Groner, '94, has been elected principal of the Manistique schools.

Miss Emma Churchill, with '96, is spending the summer at Kewaunee, Wis.

Mrs. Howard E. Weed is visiting her parents, Mr. and Mrs. G. W. Freeman, Lansing.

A. C. Bird, '83, is a delegate to the Republican state convention from Oakland county.

Gerrit Masselink and Clay Tallman, '95, are on their way to Buffalo, N. Y.—a bicycle trip.

Dr. Eugene D. Millis, '82, of Fowlerville, was among the Odd Fellow visitors last Thursday.

Miss Nancy McArthur, with '96, has been elected preceptress of the Millington high school.

Mrs. L. A. Clinton, Ithaca, N. Y., with her two children, is visiting her parents, Mr. and Mrs. H. S. Seage, corner Ottawa and Chestnut street, Lansing.

C. M. Conner, '92, has recently been made assistant in agriculture and a member of the Experiment Station staff in the Missouri Agricultural College.

It is currently reported in Portland that J. W. Perringo, '94 *m*, will be offered the position of superintendent of the new electric light plant at that place.

Instead of teaching next year, E. M. McElroy, '93, expects to take a course at the U. of M. He is spending his summer vacation at his home in Kalamazoo.

F. J. Free, '88, gave a pleasant party in honor of his sister on Monday night of last week. Recitations and music formed a part of the entertainment. The Partridge brothers rendered several selections on the guitar and mandolin.

A. C. McKinnon, with '95 *m*, writes that a lot of M. A. C. boys were at Bay City the Fourth. Among the number were J. B. Dimmick and Chas. S. Beard, with '93 *m*; M. F. Loomis, with '94 *m*; R. L. Clute, '96; Geo. R. Snyder, '98; and Geo. D. Miller, and C. J. De Land, '99.

This is what comes of being born lucky and of graduating with '93: "Elmer B. Hale, county school commissioner, purchased a suit of clothes at Oppenheims & Sons, last week. Monday he was notified that he held No. 1417, the number that drew the $100 bicycle." —*Ionia Sentinel.*

Charles F. Baker, '91, recently assistant entomologist of the Experiment Station, Fort Collins, Col., writes us: "I have received the appointment of entomologist to the A. and M. College, Auburn, Alabama. It is an infinitely better place than I had here." Prof. Baker was at one time instructor at M. A. C. We know that he possesses unusual ability as an entomologist. Recently he has given considerable attention to botany.

L. A. Bregger, '88, assistant superintendent of Graceland cemetery, Chicago, acknowledges from the Professor of Botany, the receipt of the report for 1895, containing a map of the Botanic Garden with list of names of the plants; and regrets that he had not got more from the garden while he was a student here. In his present business a thorough knowledge of our hardy wild plants is of great value, not only for planting in the cemetery, but to add zest to rambles in the woods or along the byways of the straggling village. "I care more now for a little touch of wild nature than for a whole greenhouse full of bedding plants." He closes: "Our boy, 'John,' 6 months old now, is getting along finely, as bright and lively a youngster as can be found."

Prof. Henry Thurtill, '88, of the University of Nevada, spent a few days at the College last week. He felt a little lonesome going about among the students and finding that not one was left of the many that once took mathematics under him as assistant professor in the years from '88 to '92. He speaks enthusiastically of his own institution and her prospects after the democrats win this next election. He reports Prof. F. H. Hillman, '88, as working hard and with good prospects for bringing great benefit upon his state through his work for the Experiment Station in entomology and botany. Prof. R. H. McDowell, '74, is working hard and with a persistency that should win success. "Three of us, all men from M. A. C., are working together in the same College at Reno, Nevada."

"The success of the farmer of the future depends more upon mental than upon manual effort."—J. Sterling Morton, Secretary of Agriculture.

View from President's House of west half of the M. A. C. campus. Six fine laboratories, as well as many other handsome buildings, are not represented.

Pure air, wholesome food, pleasant surroundings, fine equipment, moral and religious environments, kind and competent teachers, courses of study suited to the age in which we live and designed to meet the requirements of active life—these are a few of the advantages offered by the

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