

The Proposed Engineering Laboratory
at the Kansas State Agricultural College

By

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Outline.

1. Value
2. Misunderstanding of the term.
3. Wide field for development.
4. Several persons can work for one end.
5. Student not self-reliable.
6. Location and erection.
7. Equipments.
8. Total cost.
9. Plan.

After a great deal of labor, the Kansas State Agricultural College, was able to secure from the legislature of the State a fund which was sufficient to build a laboratory, but not large enough to supply it with the proper Engineering laboratory equipments.

When we consider what the true meaning of a laboratory is, its value cannot be overestimated, as a helper in developing the science with which it is connected. The science of Engineering has grown upon experimental data, and hence it is necessary that there should be a place equipped with expensive apparatus, in order that the experimental side of the science may receive its proper attention, and be carried out to proper satisfaction. If this is supplied, it not only furnishes a large field for the student, but also for the professor in charge, to carry out experiments and to make deeper research for facts, which will upbuild the science. All persons that have a fairly clear idea or understanding of science, are competent to understand such experiments, and to work at them until they get satisfactory results. The word laboratory is often misunderstood by some people.

They think it is expending money in equipments and instructors for which nothing will be brought out in return. This may have been the case in a few instances, but if the term is considered properly, it should be a place where scientific research is made, and the time spent there should be for the demonstration and establishment of facts. If the term is considered in this light, the laboratory becomes an important factor in the development of the student. It has a tendency to make him self-reliable. It becomes now necessary for him to do his own thinking. It leads him to enter deeper into his subject, and he is not satisfied until he has demonstrated facts which seemed impossible to him before.

Now if we consider the important discoveries that have been made in the past, and the myriads of facts that yet lie hidden from the world, concealed until someone shall bring them to light by experiment, and also the wonderful influence it has on the student of science, we cannot help but think that all the money spent for this purpose, is well spent, and its return is of inestimable value to the world.

It is probable that there are principles underlying this science that would remain unsolved for years, perhaps ages, if it were not for the laboratory, because in a laboratory an aggregation of persons can attack the same subjects, and all working on a certain plan, can proceed to demonstrate a problem which would be too difficult for one man alone to undertake. In such a case, there can be but little doubt, because each individual has his work before him, where he can plainly see and know his results. If he tries his experiment several times, and the results are the same each time, he has a perfect right to establish a fact in regard to that experiment. There is, perhaps, one drawback to the student who works in the laboratory, and that is, it seems to be human nature for one not to completely rely upon himself. For example, a man takes up an experiment, which has been worked out previously, and of which he knows the results. If now his results do not exactly agree with the one known, there is a tendency on his part to vary the result, in order to make it agree, rather than giving it several more trials. This point must be guarded against very

earnestly, and all that is necessary to overcome this is a determined mind on which you are not afraid to rely.

The benefits of such a laboratory have been pointed out and having shown that the cost for building and equipping is a wise and valuable investment, I will next consider its arrangements and equipments in detail, as it is intended to be at the K. S. A. C. Laboratory.

First, in regard to its location and erection. This building is to be a part of the shops, that is, it is bounded on the south by the engine room, on the east by the proposed machine shop, and on the north by the blacksmith shop.

This would be an almost ideal location, as there is plenty of access to light and air, and since it is in the rear of the shop it is a place where there is not a great deal of attraction.

Thus there would be no tendency to distract the mind of the student from his work. Neither is there such outer disturbance, such as is caused by vehicles, or heavy jarring, which would interfere with carrying on experiments.

The cost of its erection will be very small, considering that three of its size are supplied by other buildings; and this being true, it is very easy to

transmit power to it. All that is required is an extension of the two line shafts, the one from the engine room, and the other from the machine shop. But perhaps the most serious question, and one that should be considered carefully, is the interior arrangement. This should be done in such a manner that every experiment can be carried out to its best. It should be divided into several compartments, each compartment being set aside for a certain line of research.

Now I shall take up the equipments. This is perhaps one of the most important considerations in regard to the laboratory, for two reasons. First, as the equipments cost more than any other factor connected with it; and secondly, without equipments a laboratory would be valueless. When equipping a laboratory, the cost should not be considered too closely, because it is an absolute necessity that all instruments used should be of the very highest and standard grade, in order that the inaccuracy of the instrument need not be considered. There are several objections to poor instruments. First, there is loss of time, because you have to make allowances which are often unaccountable. Second,

because your results will not be an accurate one, and if the student is aware of this fact, he does not exercise as much care as he would when he felt at perfect liberty to depend upon his instrument. Third, because they are usually short-lived, and hence it becomes necessary to replace them, so in the long run a purchase of a genuine instrument is the cheapest and the most satisfactory. In the classroom, models of machines are often employed and do very well to illustrate a certain mechanism, but in the laboratory, they are entirely out of place.

Following is a list of some of the most important equipments, together with brief discussion, in which the attempt be made to point out their significance and their respective costs.

I. A 100,000 pound testing machine, automatic and autographic. This is a machine for finding the amount of resistance which materials offer to applied forces under different circumstances. It is usually operated by hydraulic power. Cost is about \$1200.

II. A cement testing machine. This is machine used in finding the ultimate tensile.

and compressing strength which is possessed in cements. This is an important machine, because the strength of cement must be very closely considered when designing any kind of masonry. The cost of this machine is about \$200.

III. Forson testing machine. This is a device to measure the elastic resistance to twisting which is possessed by bars or shafts. Cost is \$900.

IV. A 20,000 oil testing machine. This is a machine to determine the effect that oil has do with reducing the friction when various loads are applied. Cost, \$300.

V. Alden's absorption brake, 50 H.P. This is a device which measures the power given out by engines and motors, and consuming it as it does so. Cost, \$300.

VI. Keip's cast iron test. This is a machine used in testing cast iron in order to find out its ultimate tensile and compressive strength. Cost about \$75.

VII. Prony brakes. This is a friction brake to determine the mechanical effect produced by a shaft, or any other revolving mechanism. Cost, \$100.

VIII. Traction dynamometers. These are machines in which may be measured the work done by forces. This is done by means of the spring, of which deflection may be measured. Cost, \$100.

IX. Indicators. These are instruments for ascertaining the pressure of the steam in the cylinder of the steam engine, and the expansion during the double stroke of the piston. Cost about \$100.

X. Planimeters. These are instruments for measuring the areas of plane surfaces of any shape by merely following the outline of the figure. Cost, \$25.

XI. Watermotor. This is an inverse of a reciprocating pump, and since the friction is the same at all pressures it becomes a very efficient engine where high pressure is used. Cost, \$50.

XII. Pressure Gauge. This is a gauge to measure the pressure of a fluid, either in motion or at rest, in square inches at the part of the liquid to which it is communicated. Cost, \$50.

XIII. Viscosimeter. This is an instrument for measuring the viscosity of the various lubricants. Cost, \$25.

Now there are many more things necessary to be added to this list, that do not need to be described in detail, but will simply mention them and give their cost_x

14. Extinctionometers-----\$100.
15. Calipers-----25.
16. Slide-rules-----15.
17. Calculating Machines-----35.
18. Thermometers-----25.
19. Hook Gauge-----25.
20. Standard weights-----50.
21. Hydraulic wires, tanks, etc. 500.
22. Pilot tube-----35.
23. Water wheels-----100.
24. Scales, counters, watch, pendulums,
and small accessories---400.
25. Calorimeter-----50.
26. Reducing wheels-----50.
27. Taschometers-----50.
28. Gas Engine-----400.
29. Centrifugal pump-----75.

30. Last of all, but not least, is a very important matter to consider when equipping a laboratory, and that is the library. This does not need to be very elaborate, but should contain books that would aid in carrying out experiments,

and also a vast number of books of reference. It should be a part of the laboratory, and should have all the requirements that are necessary to make it a comfortable and agreeable place.
Cost, \$800.

The total cost of all these equipments amount to about \$6,435. The above list does not include all things that are necessary, but is probable all that have any great significance as to their costs. The minor articles that may be required will be important to the laboratory, but the cost will not be very great. We can feel safe in saying that the engineering laboratory at the K. A. S. A. can be properly equipped for \$7000, expressed in round numbers.

To give a clear idea of the situation, I shall draw a plan of the building, in which I will show the arrangements of the line shafts, and the interior arrangement in general.

The line shafts which enter from the engine room are on the floor, and extend through about one-half of the building. On these shafts are numerous immovable pulleys, and at the extreme south end of one, there is a large cone pulley containing five steps. The diameter of the smallest step being 2 ft., second step, 2 ft. 6 inches; third, 3 ft.; fourth, 3 ft. 6 in.

fifth, 4 ft. The purpose of this is so that a machine may be attached to it and be run at varying speeds. This will be very convenient in making experiments where speed will have to be taken into consideration. The second line shaft, as stated before, will enter from the proposed machine shop. This will be fastened to the ceiling and run through the width of the laboratory. It will also be supplied with the proper pulleys to drive the various machines which will be attached to it. The machinery and instruments will be so arranged that they will not interfere with each other in any way.

Now, since the mechanical department has received a fund large enough to erect this building, we sincerely hope that it will not be long in the future, when everyone will see the benefits that may be derived from a laboratory, and will do all within their power to work in the direction of securing enough money from the state, in addition to that which has already been granted, to thoroughly equip an Engineering Laboratory at the Kansas State Agricultural and Mechanical College, where it will be utilized to the greatest advantage. Its value will be inestimable to the student who will have

have the privilege of utilizing such an opportunity. This thesis, being only a proposition, we wish it would not be taken amiss, but on the other hand be taken up again, and be demonstrated by a more satisfactory result, - which will be the laboratory itself.

