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Van Hagan

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SEVEN YEAR TESTS SHOWING THE EFFECT OF AGE AND CURING CONDITIONS ON THE STRENGTH OF CONCRETE.

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In the issue of the Wisconsin Engineer for February, 1915, there were recorded results of a considerable number of tests on concrete showing the relation of strength to age for three common storage conditions. Inasmuch as results of long-time tests of concrete are rare, additional results of tests made on specimens seven years old furnish the incentive for the following communication. The scope of the entire series of tests and the methods employed in making, testing, and curing were fully outlined in the previously mentioned article. Only a resumé of these factors and the new results will be entered here.

Program:—The entire program of experiments includes crushing tests on 1:2:4 and 1:3:6 concrete cylinders varying in age up to twenty years. Besides the concrete specimens, neat cement and 1:3 standard sand mortar test-pieces are also being tested. The three curing conditions are:

1. Storage in a water tank at a temperature of 60° to 70° F.;
2. Storage in a cage out of doors;
3. Storage in a cellar where the range in humidity varies from 50 to 75 percent and the range in temperature varies from 35° to 70°F.

Making and Testing of Specimens:—Atlas Portland cement of standard quality, Janesville sand, and Madison crushed limestone, varying from ¼ inch to 1¼ inch in size, were the materials used in making the concrete. Each batch was mixed in a

No. 0 Smith mixer for a period of three minutes. Sufficient water was used in gauging the concrete to produce a wet mixture which could be readily moulded and puddled with an iron rod, but which showed no excess water when allowed to stand in the wheel-barrow. Before being subjected to the various storage conditions concrete specimens were cured three days in moulds. After being marked, measured, and weighed, they were then stored in a sprinkling chamber where they were wet twice a day for eleven days. Neat cement and mortar test-pieces were mixed and moulded in accordance with standard practice. They were then stored for one day in a moist closet and thirteen days in the water bath before being subjected to the above mentioned curing conditions.

Care was taken to distribute the times of testing of the cylinders so that no two test-pieces from the same batch would be broken at the same age. Five concrete and three or four mortar specimens were tested at each time interval. Concrete specimens were brought into the laboratory one week before testing; they were weighed again on the day they were broken. Other test-pieces were broken immediately upon removal from storage, with the exception that the frozen specimens were thawed before testing.

Data:—In Fig. 1 are shown the strength-age curves for the neat cement and 1:3 mortar specimens stored under the various conditions. The continued decrease in the compressive strength of the neat specimens since the four-year test is quite pronounced. However, the tensile strength of the neat cement specimens appears to be practically the same at seven years as at four years. Likewise, in the portions of the diagram showing results for 1:3 mortar specimens it appears that the compressive strength of these test-pieces has decreased slightly since the last report, whereas the tensile strength, under all curing conditions, remains about the same.

In Table 1 are given in detail the data for the seven-year tests on the concrete cylinders. Fig. 2 shows strength-age curves for the same data. From this figure it appears that there has been no great change in strength of any of the mixes under the different curing conditions since last report.

Summary:—As stated in the previous report, the more pronounced variations in the strengths of the neat cement test-pieces are due largely to the embrittling of the specimens with age. Furthermore, neat cement specimens stored in air are

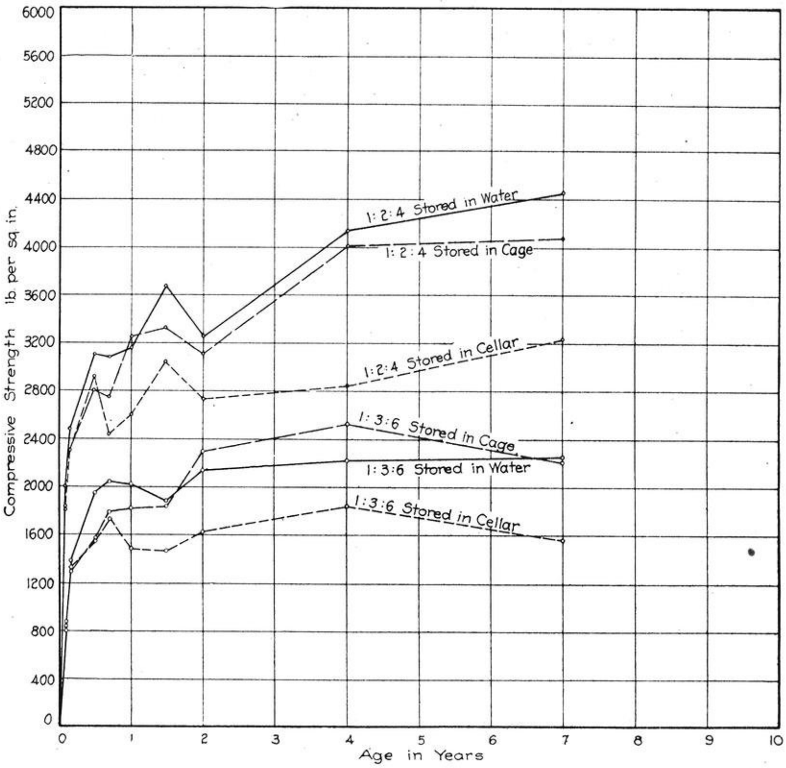

FIGURE 1.

Strength-age curves for neat cement and for 1:3 mortars cured under various conditions.

probably much more weakened, due to surface defects (cracking and crazing), than the mortar or concrete test-pieces stored under similar conditions. In many of the neat briquettes broken after long storage in air, cracks from $\frac{1}{16}''$ to $\frac{1}{8}''$ deep were discernible. As a result of such cracks the cross-section of a specimen is considerably reduced, and its strength may be quite non-uniformly distributed. This non-uniformity in resistance is

TABLE 1.

The Effect of Age on the Compressive Strength of Concrete Subjected to Different Curing Conditions

Materials: Atlas cement, Janesville sand, and Madison limestone (1¼ in. to ¼ in. in diameter).
Mixing: All materials were mixed in a No. 0 Smith mixer ¾ min. dry and 2¼ min wet.
Specimens: The cylinders were 6" in diam. and 18" high. Fifteen specimens were made from each batch of concrete and were numbered consecutively.
Curing: All specimens were cured in molds for 3 days and sprinkled for 11 days. They were cured as indicated. The storage water for the water-cured specimens was renewed about once every month; its temperature varied from 60°F. to 70°F.

MIX:- 1:3:6 Water :- 10% of dry weight of materials

Specimen No.	Age: Years	Age: Months	Specific Weight When Tested lb/ft.³	Percent Weight Lost in Curing	Maximum Load lb.	Ultimate Strength lb./in.²	Average Percent Error of Mean	Average Ultimate Strength lb./in.²	Ave. Weather Conditions for Last Week in Cage: Percent Humidity	Temperature Degrees F.	Percent Cloudiness	Total Precipitation - in.
SPECIMENS CURED IN CELLAR												
263	7	0	141.2	2.08	46650	1625						
308	7	0	142.9	0.70	55800	1960						
353	7	0	141.4	2.29	42150	1460						
398	7	0	142.5	3.84	36310	1270						
443	7	0	139.4	3.23	42360	1470	12.12	1556				
SPECIMENS CURED IN CAGE												
258	7	0	145.0	2.92	59520	2090			73	68.8	60	.32
303	7	0	145.5	2.47	73075	2565			73	68.8	60	.32
348	7	0	145.2	2.27	68780	2430			73	68.8	60	.32
393	7	0	144.8	2.28	58020	2045			73	68.8	60	.32
438	7	0	143.3	1.37	56755	1965	10.04	2217	73	68.8	60	.32
SPECIMENS CURED IN WATER												
268	7	0	149.5	0.00	60620	2140						
313	7	0	149.0	-0.68	60470	2125						
358	7	0	148.3	-1.60	74160	2590						
403	7	0	149.0	-0.91	56950	1990						
448	7	0	146.5	-1.14	68880	2390	8.64	2245				

MIX:- 1:2:4 Water :- 9.1% of dry weight of materials

Specimen No.	Age: Years	Age: Months	Specific Weight When Tested lb/ft.³	Percent Weight Lost in Curing	Maximum Load lb.	Ultimate Strength lb./in.²	Average Percent Error of Mean	Average Ultimate Strength lb./in.²	Ave. Weather Conditions for Last Week in Cage: Percent Humidity	Temperature Degrees F.	Percent Cloudiness	Total Precipitation - in.
SPECIMENS CURED IN CELLAR												
38	7	0	142.3	2.56	95000	3360						
83	7	0	145.0	2.49	96000	3390						
128	7	0	144.2	2.93	74000	2592						
173	7	0	146.6	1.81	69900	2472						
218	7	0	148.0	1.80	124500	4420	17.67	3242				
SPECIMENS CURED IN CAGE												
33	7	0	145.5	1.15	112800	3990			73	68.8	60	.32
78	7	0	145.0	1.37	125200	4385			73	68.8	60	.32
123	7	0	147.1	2.01	100500	3480			73	68.8	60	.32
168	7	0	146.5	0.68	104700	3680			73	68.8	60	.32
213	7	0	148.4	0.68	139100	4905	10.89	4085	73	68.8	60	.32
SPECIMENS CURED IN WATER												
43	7	0	151.1	-1.14	114100	4040						
88	7	0	150.0	-1.59	135300	4755						
133	7	0	150.8	-0.45	121500	4270						
178	7	0	150.4	-1.36	119100	4185						
223	7	0	152.0	-1.35	145600	5135	8.45	4472				

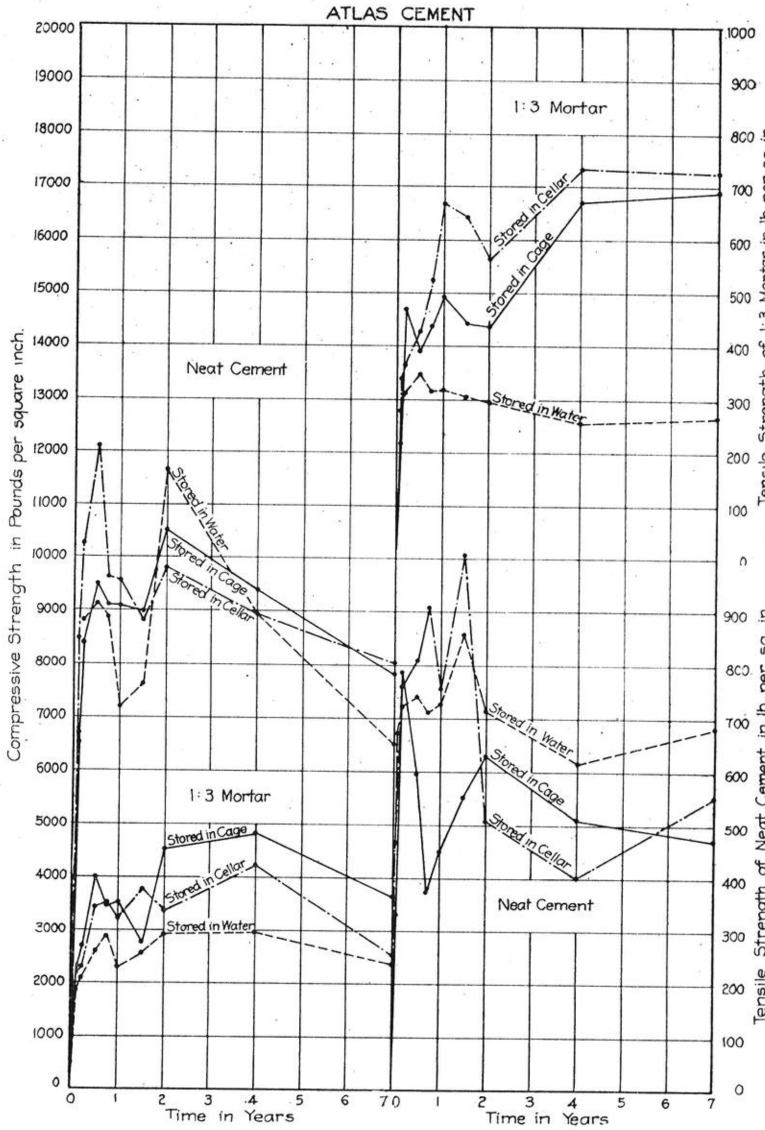

FIGURE 2.
Strength-age curves for concrete cured in various manners

equivalent to an eccentricity of the load, the weakening effect of which is well understood.

Although only one brand of cement was used in making these tests, yet from the average slopes of the strength-age curves it does not appear that there is any cause for fear of disintegration of well-made concrete when it is cured under conditions comparable to those existing in these tests.

The major portion of the strength of concrete appears to be secured at an age of six months to one year. How much increase in strength will result thereafter appears to be dependent primarily upon how thoroughly the concrete is saturated with water. At an age of seven years, water-cured concrete is slightly stronger than concrete cured out of doors and considerably stronger than concrete cured in the cellar. The strength-age curves for concrete indicate that the effect of differences in the humidity of the storage condition is much more pronounced at an age of seven years than it is at an age of six months. The data emphasizes the importance of maintaining a high water content in the concrete at all ages if maximum strength is to be secured.

DUST EXPLOSIONS AND THEIR PREVENTION

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The explosiveness of carbonaceous dusts has always been a serious menace to all industries in which such dusts are liable to be produced. It is therefore very desirable that engineers, especially those in charge of industries handling organic materials, should have a definite understanding concerning the liability of such explosions and the relative inflammability of the different dusts.

Nearly all carbonaceous materials that are capable of being very finely ground and suspended in the air may, under certain conditions, form an explosive mixture. Materials which are in themselves explosive are naturally highly dangerous when suspended as a dust, as for example, picric acid, gun powder, or gun cotton. But also carbonaceous materials, which in their compact form are very stable and burn with difficulty, may form very explosive mixtures when suspended as a dust in the air.

Fatalities and great losses of property due to dust explosions have occurred in cereal mills, grain elevators, grain separators, sugar, starch and dextrine factories, paper-tube works, rag-chopping machinery, dye works, pitch and asphaltum mines, and many other industries. (1)

Even an instance of an explosion of soap dust is on record. One of the two most disastrous grain dust explosions in this country occurred in 1878 at Minneapolis and resulted in the complete destruction of the Washburn flour mills. (2) The second occurred in 1913, when the Husted mills at Buffalo (3) were wrecked. As the result of this last explosion a co-operative investigation between certain milling interests and the Bureau of Chemistry followed. This co-operation later resulted in the formation of a special division of the Bureau of Chemistry for the investigation of grain dust explosion.

In general, grain dusts are more inflammable than coal dusts, but explosions of the latter have been of the more frequent oc-

* The figures in parantheses correspond to the references at the end of this article.

currence and have resulted in the greater losses. This is because the conditions under which coal mines are operated favor the production and ignition of dust clouds. The long flame from blow-out shots and the overcharging of blasting powders, combined with the continual production of dust clouds, are the chief causes of the numerous explosions in coal mines. The most disastrous explosion on record resulted in the death of 1,100 men in a coal mine at Courrieres, France, in 1906. In 1907, 1148 men were killed by coal dust explosions in the United States alone. (6). Stirred by these great disasters the Bureau of Mines undertook a complete investigation of this serious problem (5), (17).

Dust explosions proceed in two phases: the phase of ignition, and the phase of propagation. Ignition is the initiation of the combustion of dust particles by some external source of heat. Propagation is the extension of that combustion throughout the entire dust cloud. The intensity of temperature required for ignition depends upon the relative inflammability of the dust. The inflammation of dust is produced by heating the dust particles up to the temperature at which they will combine with the oxygen of the air. The heat evolved by this combustion in turn raises the temperature of the next layer of dust particles until they also are ignited. This process is repeated with each succeeding layer of dust. If the heat evolved in combustion is insufficient to heat the next layer of dust particles up to the ignition temperature, the flame will die out without producing the typical dust explosion. If, however, conditions are suitable, the dust flame will continue to travel at an ever increasing velocity until a maximum velocity is attained. The wave of maximum velocity constitutes the true explosion. It is termed the "explosive" or "detonating" wave. Professor H. B. Dixon (6) states that in detonation, inflammation of the dust particles results from the compressing of each layer of dust particles and air so suddenly that it is raised beyond its ignition temperature by the heat of compression.

The explosion of dust is almost identical with a gaseous explosion. Dust explosions are generally more dangerous and more apt to cause inflammation of surrounding property than gaseous explosions. In both cases the rate of inflammation depends upon the inflammability and concentration of the combustible material. In dust explosions the fineness of dust is an additional factor which affects the rate of inflammation. The Bureau of Mines (5) reports an average velocity of 2,273 feet per second as the rate of inflammation of coal dust. M. J. Taffanel (7), of the Lievin Experiment Station of France, reports a velocity of 3,300 feet per second. The velocity of a grain dust explosion wave is, in all probability, much greater. Compared with these figures the maximum velocity of flame propagation for mixtures of hydrogen and oxygen in the ratio of two volumes of hydrogen to one of oxygen is 9,250 feet per second, and for mixtures of carbon monoxide and oxygen in the ratio of two volumes of carbon monoxide to one of oxygen, 5,510 feet per second (8).

The initial rate of flame propagation in a dustcloud is usually very low. W. M. Grosvenor (9) reports a starch explosion wherein the initial wave proceeded only 40 feet in twenty seconds. Inflammation may also proceed for long distances without resulting in a typical explosion. Ignition of coal dust may proceed slowly for 20 to 50 yards and then die out.

The factors affecting the inflammability of a dust are its chemical composition, degree of fineness, physical structure and concentration, the proportion of oxygen in the surrounding atmosphere, temperature, pressure, relative humidity, and the circulation of air.

The affinity of the combustible material for oxygen is the primary factor affecting the inflammability of a dust. In general the greater the proportion of combustible volatile matter in a given dust, the greater will be its inflammability. If the volatile matter is high in carbon dioxide the inflammability will be low. R. V. Wheeler (10), of the British Explosions in Mines Committee, reports that tapioca dust, though containing only two percent ash, is not very inflammable because there is over thirty percent of carbon dioxide in the volatile matter of the dust. The higher the percentage of ash the less will be the explosiveness of dust. Dusts containing over thirty percent ash usually are not considered dangerous. The ash seems to dilute the combustible material as well as to absorb the heat of combustion.

The greater the percentage of moisture the less will be the explosiveness of a dust. Samples of grain dust, dried at 107°C ignite at a lower temperature than do undried samples (11). The greater the degree of fineness of a dust the greater will be its explosiveness. If a carbonaceous material is coarse and fibrous, dust is not apt to be generated in sufficient quantity to prove dangerous. As a rule the greater the relative humidity of the surrounding atmosphere the less will be the inflammability of a dust; on the other hand, the liability to explosion by the discharge of static electricity is greatly favored by a damp atmosphere. Flame propagation is also favored by high temperature, high pressure, and air currents. In addition rapid circulation of air aids in keeping dust in suspension.

There is a certain concentration of dust particles below which a mixture of dust and air is not inflammable. This critical concentration has thus far not been determined. Taffanel (12) found that as low as 0.023 of an ounce of coal dust per cubic foot of air was sufficient to produce an ignition. The Bureau of Mines (5) produced an explosion of coal dust with only 0.032 of an ounce per cubic foot. A higher concentration of dust is required for ignition than for propagation. When once a detonation wave has been established, the flame may be propagated through much lower dust densities. Likewise, other conditions being the same, there is a definite concentration of oxygen below which an explosion cannot be initiated. This critical concentration is but little less than the normal oxygen content of air. On this account dust explosions are comparatively rare and in most mills and factories are not of sufficient liability to warrant any large expenditures of money for preventative measures. According to the Bureau of Mines (5) the minimum critical oxygen concentration for a coal dust explosion is 16 percent. Dr. H. H. Brown (13), Chief Chemist Division of Grain Dust Explosions, U. S. Bureau of Chemistry, concludes from his experiments that grain dust explosions cannot be initiated in an atmosphere containing less than 12 percent of oxygen, and that for elevator dusts this percentage may be increased to 14 or even 14½.

The intensity of heat required to initiate a dust explosion will depend upon the inflammability of the dust. Under some circumstances mere friction in moving parts, or a discharge of static electricity is sufficient cause for an explosion; under other circumstances an explosion cannot be initiated even with continued heating by an electric arc. Some of the causes of disastrous industrial explosions are the discharge of static electricity, the sparks from grinding machinery, the heat from the friction of moving parts, the open flame of a lantern, lamp, candle or match, the sparks from electrical machinery, and the presence of foreign materials.

The discharge of static electricity has been the greatest source of danger. In the year 1914, 166 explosions occurred in grain separators of the Pacific northwest, chiefly as the result of the discharge of static electricity, generated by the moving parts of the separator. (14) An unusually high percentage of smut in the wheat produced a highly inflammable dust during threshing. In one case the simple friction of flour as it passed down a wooden chute produced an electric discharge sufficient to cause a violent explosion. Sparks from the striking of teeth in a grinding mill are stated to have been the cause of the great dust explosions in the Minneapolis mills in 1878. (2) In other cases the mere heat of friction, such as from a hot bearing, has been sufficient to ignite a dust cloud. Such a condition resulted in a violent explosion of the dust of picric acid. The open flames of lanterns, and even matches, have produced explosions in starch, dextrine, and sugar factories. Sparks from electrical machines and the overheating of electric wires have produced similar explosions. The presence of foreign materials such as stones, iron scrap, or hard lumps has caused sparks or overheating in grinding mills, sufficient to cause an explosion. The presence of foreign chemical materials has often proved dangerous. Some chemists claim that dextrine prepared with nitric acid is much more liable to form explosive dusts than when prepared with muriatic acid.

An investigation as to the relative inflammability of different dusts was started as early as 1878 by S. F. Peckham. (2) The results obtained by different investigators are not entirely comparable, because in each investigation different methods and types of apparatus were employed. The three principal methods of attack pursued in these investigations are first, the determination of the minimum temperature at which a dust cloud may be ignited, second, the determination of the pressure prduced by the explosion of different dusts, and third, the determination of the minimum oxygen concentration sufficient to propagate an explosion. The results of all three methods show that the dusts which have proven to be most dangerous are the dusts of corn meal, wheat, starch, dextrine, and sugar. As the result of his investigations, R. V. Wheeler, (15) divided dusts into three classes based upon their relative liability to inflammation, viz.:

1. Dusts which ignite and propagate a flame readily, and therefore require for ignition only a small source of heat such as a match.

2. Dusts which are readily ignited, but which, for the propagation of flame, require a source of heat of large size and high temperature, such as an electric arc, or of long duration, such as a Bunsen burner.

3. Dusts which do not appear to be capable of propagating a flame under any circumstances likely to be obtained in a factory, because (a) they do not readily form a cloud in the air, or (b) they are contaminated with a large proportion of incombustible matter, or (c) the material of which they are composed does not burn rapidly enough.

According to this classification Wheeler divides dusts as follows:

Class I

sugar	grain (flour mills)
starch	malt
dextrine	maize
cocoa	rape seed
rice meal	corn flour
sugar refuse	flour
wood flour	oat husk

Class II

rice milling	leather
castor oil meal	dead cork
offal grinding	saw dust
grist milling	oil cake
corn meal	bran
mustard	shellac composition
copal gum	

Class III

spice milling	grain cleaning
cotton seed	tobacco
cotton seed and soya bean	bone meal
sack cleaning	charcoal
Russian rape seed	foundry blacking

The investigations of Brown (16) show that the order of inflammability of dusts coming under Class I is as follows:

Lycopodium, sticking smut of wheat, yellow corn meal, dextrine, wheat starch, white dextrine, canary dextrine, tan bark, corn starch, wheat-elevator dust, wood dust, oat and corn dust from unloading stations, sugar, gluten feed, oat dust from feed oats, dark canary dextrine, potato flour, rice starch, corn-elevator dust, wheat flour, fertilizer dust, tapioca flour, Pittsburgh coal, cocoa, and cork.

This order of inflammability can not be taken as absolute because the relative inflammability is greatly influenced by the source of the dust as well as by the details of the apparatus employed in testing.

The following precautions have been recommended as tending to prevent explosions: the removal of foreign materials; the use of electric lights only; the location of fuses, motors, and starting boxes in dustless rooms; the construction of receiving bins as small as practicable; the use of exhaust fans; and the grounding of all metallic moving parts upon which static electricity is apt to accumulate. In grain separators the liability of dust explosions is practically eliminated by a complete system of grounding. (14) By this method all moving parts are connected with copper wires and united to a common iron core imbedded in moist earth. Dust clouds in grain separators can be practically eliminated by the use of fans placed so as to exhaust the dust from the cylinder of the machine. In the extinguishing of flames resulting from an explosion the use of automatic chemical fire extinguishers and carbon dioxide tanks has proven effective. In these methods the release of the inert gases is brought about by the sudden opening of a valve effected whenever an intense heating is produced. The most positive means of preventing dust explosions is by the use of an atmosphere containing less than the critical concentration of oxygen. Such an atmosphere may be produced very readily and very economically, especially in grinding rooms, elevators, reels, and driers, by diluting the air with carbcn dioxide or washed flue gases.

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RECENT DEVELOPMENT OF MUNITIONS MANUFACTURING MACHINES

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At the beginning of the war in 1914, the United States, although by far the greatest industrial nation in the world, was not prepared to cope with the tremendous demands made by the Allied Nations upon her manufacturing facilities. Her factories, with few exceptions, were not prepared to manufacture munitions of war in the quantities demanded, nor within the time limits set. On account of the tremendous prices and premiums offered, however, existing equipment was utilized as much as was possible. The improvements made during the early part of the war were, therefore, for the most part, merely better ways and means of adapting present equipment to the special needs of munitions manufacture. As the war progressed, and the demand appeared to be more permanent, better methods of manufacturing and special machines were developed.

The most recent developments of munitions machines have been made in order that the machines might meet three general requirements that have grown up since the war, that is, standardization, simplicity combined with rugged construction, and readiness of manufacture. The first has been met by adapting, as much as is possible, the standard makes and sizes of machines to the manufacture of various munitions of war, because these machines were available in large quantities, and a large number of manufacturers were already prepared and equipped to manufacture them. The second requirement has been met by building special machines to perform specific operations which could not be performed with ease or facility by existing standard machines. These machines, however, have, in almost all cases, been of an extremely simple design of the semi-automatic type, and of very rugged construction, being, as a general rule adapted merely to the performance of a single operation. The third requirement has been met by entirely new designs, using existing materials and structural parts to make the completed machine with the least expenditure of money and time. The general tendency seems to be away from the extremely complicated, automatic machinery such as is used in automobile manufacture. This can be explained, however, upon the ground of the greater simplicity and standardization of the product, and by the fact that sufficient time was not available for the design and development of complicated machinery.

Recent developments at the Gisholt and Steinle plants illustrate these tendencies to a marked extent. The standard turret lathes manufactured by both firms have been standardized as much as possible. A new thread-milling machine and a field-gun lathe have been developed by the Gisholts along extremely simple and rugged lines, while the Steinle company has designed a new naval-gun lathe that is a radical departure in every way from existing practice and methods, and is an attempt mainly to secure extreme rapidity, ease, and cheapness of construction.

The standard turret lathes manufactured by both of these firms have not been modified to any great extent, and as their details are well known there is no necessity for describing them here. One marked advance has been made by Gisholt in an attachment for the carriage, by means of which the nose of a projectile may be turned. This consists of a tool-post mounted upon a table on the carriage, so that it can swing about a pivot located in the proper position. This table has a sector of a gear wheel on the side near the tailstock which meshes with a pinion. This pinion is driven thru suitable bevel gears by the feeding mechanism. The tool is fitted with a depth adjustment similar to that on the compound rest of an ordinary lathe. With this arrangement a better projectile nose can be formed than with any system employing templates or cams to operate the cross and longitudinal feeds at the same time. The main thing that both of these firms have sought to do with these two standard lathes, has been to turn them out fast enough to satisfy the demand, since the new aeroplane engine industry is making almost as heavy a demand upon this type of machine as is the projectile industry.

The thread-milling machine which has recently been introduced by the Gisholt Company represents quite a departure from existing types and methods. It has been made to bore, face, and cut the thread in the nose of a projectile, without rechucking. Thousands of shells have been rejected because the thread which holds the time fuse in the nose of the projectile was not concentric with the outside or with the bore of the projectile. It was this fault which this thread-milling machine was designed to eliminate. The machine consists of a heavy bed, similar to an ordinary lathe bed of the semi-cabinet form, at the head end of which is a heavy head-stock carrying a large hollow spindle. A long collet chuck, the end of which is supported by a steady-rest, is fastened to this spindle. The spindle does not of itself do any driving, nor carry any torsion, since the collar of the collet chuck has teeth cut in its rim which mesh with a pinion. Provision is made also by means of worm gearing so that the spindle can be driven at a speed of one revolution in from two to fifteen minutes. The purpose of this will be shown presenly. There is no tail stock on this machine, but a heavy carriage of the usual form is mounted upon the Vs. This carriage carries a large square tool post having four holes for boring bars, as well as the thread milling attachment. This attachment consists of a small spindle supported by plain and thrust bearings and mounted on the carriage parallel to the axis of the machine. A small one-horse-power motor is mounted upon the cross slide for driving this spindle. The cutters consist of several V-milling cutters, formed together into a single tool, and mounted upon the spindle. The number, spacing, and size of the cutters corresponds with the thread to be cut. The diameter of the cutters is, however, considerably smaller than that of the hole in which the thread is to be cut. This cutter is then fed in by hand to the proper depth in the side of the bore, and the headstock spindle started at a very slow rate of speed by means of the worm gearing previously described. At the same time the carriage is fed forward in the usual manner by a lead screw. At the end of one revolution of the main headstock spindle the entire thread has been cut. This amounts to practically the ordinary milling operation of making threads with the exception that a number of milling cutters corresponding to the number of threads is used, and instead of the spindle revolving as many times as there are threads, it revolves only once. Thus much time is saved. In addition, since the entire operation of facing, boring, and thread cutting is performed on one machine, without rechucking, the concentricity of all is maintained. This machine is made to take shells as large as sixteen inches in diameter.

For some time the Gisholt people have been manufacturing a gun lathe of their own, but since they secured a government contract for the production of heavy field artillery, this machine has been improved and is being built in larger numbers. It is not, however, a very radical departure from existing machines for this type of work. The bed plate is made in several sections of the cabinet type, and it has a total overall length of from fifty to seventy feet, depending upon the size of gun. The sections are accurately milled on the ends, and the Vs planed. The ends of the sections are then scraped by hand to an accurate fit and bolted together, flanges being provided for this purpose on the sides. After bolting together, they are accurately dowel-pinned so that when erected in the machine shop they will preserve their relative position. After doweling, the Vs are carefully scraped by hand with precision straight edges as references. This machine carries two carriages, each driven by an independent motor, and equipped with back rests to neutralize the distortion of the work caused by the pressure of the tool. The spindle is also driven by an independent motor. This machine in all its essential parts has not departed from standard practice, but is built upon principles which have been established by practice as sound and correct.

In direct contrast with this machine is the new Steinle naval-gun lathe which is a radical departure from anything that the writer has any knowledge of, and is a very ingenious solution of an extremely difficult problem. A few months ago when the Steinle firm set out to secure a government contract, they were confronted with an almost insuperable obstacle, namely that it was practically impossible to obtain any large castings from the foundries within a reasonable time. And without a large number of heavy castings for gun lathe beds it was impossible to build or even promise to build the gun lathes required. The Steinle designers got around that "almost," however, in a very ingenious way, and in such a way that when the plans were taken to Washington they met with the immediate approval of the naval engineers. Although this lathe has not yet been built, the writer has had the good fortune to be permitted to examine closely the plans and drawings of the machine. The essential feature of this lathe is in what would on the ordinary machine be the bed plate, but which in this machine should more properly be called the skeleton. This skeleton consists of four, six-inch ground steel rods, about fifty feet in length. These rods form the long sides of a box framework, and are spaced about three feet apart. They are supported at intervals by heavy castings, about a foot in length which are rigidly fastened to a reinforced concrete base. Thus a long rigid framework is provided and the polished rails or bars take the place of the Vs. The headstock is mounted upon one end of these long bars and the tailstock a short distance from the other end, while the carriages are mounted between the two, and have four-inch holes thru which the bars pass. Thus the pressure of the tool is taken evenly by the four six-inch bars and any deformation is reduced to a minimum. The gun barrel is held in the head and tailstock by means of hollow, sliding 'catheads,' so that any expansion of the gun due to the heating will not cause distortion of the machine. The rough boring bars are fed in from each end, one thru the hollow spindle of the headstock, and the other through the tailstock. Not only does this give greater speed, but the bars can each be shorter than in the conventional lathe and floor space is conserved. The head is driven by a mechanism essentially like that of the standard Steinle turret lathe, consisting of a geared head which permits of a large number of gear ratios between the spindle and the driving wheel. Each carriage is driven by an independent motor. The writer has no knowledge, at the present time, of the precise method by means of which the boring bars are fed in. It is rumored, however, that the Steinle people are developing a radically different boring bar which will speed up production considerably, although no details were learned. This machine has been designed to build the barrel and tubes for a five-inch naval gun, the entire barrel of which is about twenty-one feet in length. Just exactly what the machine will do in actual work cannot be determined at the present time. Whether this elimination of the bed plate of the conventional lathe will be successful or whether distortion will take place because of the tremendous strains of present day cutting speeds, can only be determined by a trial. It bids fair, however, to remove one of the very difficult obstacles which are confronting the allied nations today.

EXPERIENCES IN A CENTRAL STATION STUDENT COURSE

WILLARD S. WILDER, e '18

In the spring of 1916, The Milwaukee Electric Railway & Light Company organized a course for the practical training of electrical engineering students. The possibilities of such a course in training for work in the public utility field were conceived by the management of the company, after observing the difficulties which many engineering students are confronted with, in choosing the class of work to be undertaken upon graduation from college and in recognition of the value of summer work from both educational and financial standpoints. As stated in the Company's outline of the course, "In making this offer the Company has in mind the mutual advantages of an arrangement which will provide practical summer employment helpful in engineering studies, and which will, at the same time, enable the Company to recruit its increasing supervisory forces from the trained bodies of engineers completing the course successfully."

Since the course, which continues over a period of a year and one-half, has been in operation but 15 months, it is impossible to see what disposal is made of the graduates; but in all probability, the Company will offer to such men satisfactory positions should they care to remain in its employ.

The value of the course to the men pursuing it, is readily deduced from the following outline of the six divisions or periods comprising the course:

First Period—three months.

- (a) Meter repairs.
- (b) Meter testing.
- (c) Instrument calibration.
- (d) Electrolysis surveys.
- (e) Voltage surveys.
- (f) General testing.
- (g) Motor repairs.

Second Period—three months.

Work in Drafting Room, embracing—

- (a) Tracing electrical layouts.
- (b) Drafting details of station layouts.
- (c) Drafting general station layouts, including power station and substation work in progress at the time.

Third Period—three months.

Work as groundman or timekeeper in the Overhead Division, embracing—

(a) Timekeeping required to segregate the work in accordance with the requirements of the Railroad Commission.
(b) Work as groundman, driving trucks, handling material and, in general, becoming acquainted with the Company's practice in overhead work.
(c) Pole climbing.

Fourth Period—three months.

Work in the Station Maintenance Division, embracing—

(a) Power station and sub-station repairs.
(b) Station wiring.

Fifth Period—three months.

Work in the Sales Department, embracing—

(a) Commercial plant tests.
(b) Motor applications.
(c) Steam heating investigations.
(d) Motor sales.
(e) Industrial reports.

Sixth Period—three months.

Distribution engineering, embracing—

(a) Laying out line extensions.
(b) Drafting details of overhead construction.
(c) Design of transformer installations for large customers.
(d) Laying out details of underground construction.
(e) Valuation of company's property.

A college graduate, after spending 18 months as outlined in the course, will have a very good idea of the phase of the work he wishes to follow and will have a training supplementary to his college career that should give him a valuable start in the central station field.

The wages paid are sufficient to enable anyone without dependents to live comfortably; and the training received will, in the long run, make the total financial gain of the men pursuing the course greater than they would have obtained had they accepted some of the flowery offers made them upon graduation from college. The monthly salary paid the students, which varies with the time of starting the course, is shown in the table below:

Division	End of Freshman Year	End of Sophomore Year	End of Junior Year	End of Senior Year
1 ..	$55.00 per month	$57.50 per month	$60.00 per month	$65.00 per month
2 ..	60.00 "	60.00 "	65.00 "	67.50 "
3 ..	65.00 "	67.50 "	67.50 "	70.00 "
4 ..	70.00 "	70.00 "	70.00 "	72.50 "
5 ..	75.00 "	75.00 "	75.00 "	75.00 "
6 ..	80.00 "	80.00 "	80.00 "	80.00 "

"Upon completion of the course," the Company states in its prospectus, "increases beyond that point (the sixth period at $80 per month) will depend upon the opportunities afforded and the ability of the men." Because of the graduate's training, an effort will no doubt be made to provide opportunities that will enable the Company to keep such men in its employ.

The manner in which the students have been treated is very fair, and I could not ask for better treatment than I received this summer in the department of Meter & Testing.

In some parts of the course, particularly in work with the outside construction gangs, the students have the opportunity of associating, under actual working conditions, with laborers with little or no book education. Any one contemplating an executive position will, undoubtedly, have to know such men and appreciate their viewpoints in order to be able to handle them successfully. The Company reports that students who are willing to pitch in with such men and do their share, asking no special privileges and showing by neither word nor action that they consider themselves above such work in any way, become real friends with their fellow employees. Those who adopt other methods have a hard road.

During my course in the Meter & Testing Department, I found that the engineers who have charge of the work were always willing to spend as much time as was necessary to explain the subject to me completely. One of the engineers told me that he was glad to be able to explain anything he could to the students and that he was more than repaid for his trouble by the apt manner in which the college students grasp new subjects.

The work I did during the first period was of a varied nature, as the outline of the course indicates. I was started on the test board testing direct current watt-hour meters and was changed to alternating current meters after two weeks' time. Knowing very little about measuring instruments, I purchased a copy of Jansky's "Electrical Meters," which I studied evenings; and with the practical training received with the Company, I obtained a course in electrical measuring instruments which was as thorough as I could have obtained had I elected such a study at the University. In addition to the work on the test board, I was called upon at various times to make drawings of meter installations and to do work on the meter inventories, which gave me information regarding the operation of the department.

After working around the office for about a month, I was sent outside to test meters on the customers' premises. While this work gave me no experience in electrical lines, I had many interesting dealings with customers who knew nothing regarding electricity. Because electrical power is not easily measured by simple devices familiar to the average individual, most people are very skeptical regarding their meters and generally think they are running faster than they should. At one place where I visited, I was greeted by a small but determined woman, with the question, "Now, what do you want?" I explained that I had come to test the meter. She then told me her story, taking care that I did not have an opportunity to say one word in defense of the Company. Her neighbor, who burned more lights than she, had a smaller bill; so this woman complained to the Company, who sent up a "flatiron man" to look over the meter. The method of making a rough check on the accuracy of the meter by observing revolutions of the disc with a given load, which was undoubtedly used as a preliminary investigation by the "flatiron man," evidently had not appealed to the customer, who had driven him away from the premises and warned him not to return. When she saw the instruments I carried, she expected that I knew something about the meter and that it would be properly repaired. The slight turning of the meter disc during the test made her fear that her bills would be too large, but I explained that I had marked the dial and would turn the hands back where they were when I started the test. Upon completing the test and finding the meter about 2% slow, I informed her that the meter was running all right and that the slight adjustments I had made were simply to make it run well for another two years. These results being contrary to her expectations, and being unable to hold her own in any other way, the woman politely informed me that I would say the meter was running correctly, even if it were not, because that was the way all these big companies did business. That was simply a polite way of calling me a liar; so I told her that the Railroad Commission of Wisconsin would test the meter for her, free of charge if it was found to be in error, and charging her in case the instrument was correct. I then explained how the electric bill could be checked by counting the wattage of the lamps used and multiplying them by the number of hours they were burned and the rate for electricity. A rough check on her lights in this manner showed that the bill for the month, which by the way was only $1.20, was very reasonable. With that I left for my next stop, leaving, I hope, a satisfied customer in place of a dissatisfied one.

After about two weeks of testing meters outside, I was transferred to electrolysis work, where I spent a great deal of time testing the rail bonds on the street railway system. The bond-tester that I employed, which was a direct reading instrument, requiring a six foot pole to be laid across the joints, was a constant source of curiosity to everyone. At first I attempted to explain my work to any one who inquired; but this grew too tedious, and I simply told people that I was testing the rail bonds. As most people associated the word "bond" with a loan to a company, they could not see how my work had anything to do with bonds, but, not wishing to show their ignorance, they would leave without asking further questions. One gentleman was smart enough to notice that it was the joints of the rail that I was testing. But he thought my test was for mechanical defects; for he told me that it was a good thing I was going over the tracks, for only a week before, a car had run off because of a poor joint. Another old gentleman, who knew that the rails carried return electricity from the cars, explained to me a plan of his that he considered very ingenious. Living on a "V" formed by two streets upon which the street railway ran, he thought there would be enough stray current in the ground to enable him to bury a copper plate in his front yard from which he would obtain enough electricity to light his house. This statement lead me to believe that the imagined grievances against the Company expressed by our electric service customer just mentioned were not in the class with the deliberately expressed intention of at least one of the consuming public to beat the Company. He did not know enough about electricity to let such details as the necessity of two conductors for an electric circuit bother him. In fact, most people thought that one wire was enough for any electric circuit, and that the trolley wire alone carried the current for the street cars. They were amazed to learn that there was electricity in the rails, and I had always to explain that a person could not get shocked by stepping on the rails. Other phases of my work in electrolysis were the taking of readings to ascertain difference of potential between rails and water mains, overall potential drops, and potential gradients.

The voltage surveys consisted of a study of charts showing the distributing system of the Company and the taking of potential charts at various points in the system, in order to keep up the voltage on the lines. The setting and repair of feeder regulators took me into the power station, so that I had a splendid opportunity to see the generating equipment.

Possibly the most interesting work of all and the work in which I would like to have received further experience, came under the heading of "general testing." My experience in this line consisted of running a test on an electric furnace installed at a local steel company, which was very interesting and afforded an opportunity to study a modern steel foundry and furnace.

My last two weeks with the Company gave me an excellent opportunity to study the power and substations. My work at this time was to assist the station instrument tester, whose duty it was to keep all station switchboard instruments in repair. The work generally required only the attention of the tester, so that I had a great deal of time to study the station and equipment.

From the few experiences I have mentioned, one can readily see that the summer has been very profitable to me, and it is no wonder that I am very enthusiastic over the course. While the work in itself was new, and one could not help learning a great deal by doing the tasks laid out before him, my total accumulated knowledge during the summer was many times that taught by the work. Wherever I went, I kept my eyes open and noticed everything, taking great care to seek an explanation for everything I did not understand. I asked questions of everyone and generally obtained a satisfactory answer, although at times my questions may have been amusing to any one experienced with electrical work. I was working with men who had business of their own to attend to, and they did not look around trying to find something new to teach me, as is the case at college. I soon adopted the plan of never letting any puzzling thing leave my mind until I had it satisfactorily explained; a plan that has been a means of vastly increasing my knowledge of electrical engineering.

Taking the course, as I did, after my junior year, I was better able to master any problem confronting me than I should have been if I had started sooner in practical work. On the other hand, an early start in practice makes the studies at school more profitable, because the individual is better able to grasp the descriptions in the text books. I think that the best time for one to start such a course as this would be after the second year at college for then one is just beginning the study of electrical engineering and will have enough theory to enable him to know a little bit about the work he is doing.

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A QUESTION OF LOYALTY

Each campus publication has recently been requested by the Student Life and Interests Committee of the faculty, to insert in the contract with the manager of the publication, a paragraph binding him not to publish any statements or articles of questionable loyalty. The manager of the Wisconsin Engineer is not under contract; but a special statement, in the form desired, has been signed by him and sent to the committee.

Binding ourselves not to publish anything disloyal is not, however, wholly satisfying. The Engineer, speaking for itself and for the students, faculty, and alumni of this College, desires to state that, not only will Wisconsin Engineers refrain from being disloyal, but that they are whole-heartedly behind the government of the United States in the fight that is upon us. Be disloyal? Take a good look at the Honor Roll.

A CHANGE OF EDITORS

This issue comes before you with a new name heading the editorial staff. Walter E. Blowney has taken up the responsibilities of the editorship in place of Robert B. White who has withdrawn from the University to enter the aviation service. The retiring editor carries with him the best wishes of the Staff.

L. F. V.

OUR ALUMNI SUBSCRIBERS

Ever since the Dean's annual letter went out to the alumni carrying with it our solicitation, a steady stream of subscriptions has been flowing in upon us. We take this opportunity of welcoming our new subscribers, most of whom are also old ones, and thanking them for their ready response. It was not unexpected, but it is soul-warming just the same. The Engineer has had the hearty support of the students and the faculty and now it has behind it a goodly portion of the alumni. United we stand.

KEEP ABREAST OF THE TIMES

In this time of crisis, the engineer, as much or more than any other student, should keep up with the times;—should keep himself thoroughly informed regarding current events. Never before in the history of the world have things happened so rapidly as they are happening today. Never before have undertakings of such magnitude been pushed to completion in such a short time. Wherever we look, whether it be in the world of engineering, science, economics, or politics we find tremendous changes, tremendous experiments being made, and tremendous results being achieved. Under the magic touch of the engineer, stimulated by the pressure of the war, new machines are being built, factories of great size and capacity are springing up overnight, aeroplanes of unheard of size and speed are sweeping the skies, and all the genius of the engineering profession is being turned toward one object. Tremendous advances are being made in science; chemists are making explosives of stupendous power; they are producing substitutes for leather, butter, meat, rubber, fertilizers, and a thousand things that for centuries we had obtained directly from nature. In the realm of economics, great experiments in financing, in administration, and in governmental control are being tried. In the field of politics and government, we find one of the largest nations in the world struggling to throw off the yoke of despotism and autocracy and to establish a free democracy of, by, and for the people. All of which merely goes to show the urgent necessity that we, as citizens of the world first, and as engineers second, keep fully abreast of the times. We, of the engineering college, with our heavy schedules and more or less outside work, often think that we have not time to watch closely the doings of the world as shown by the newspapers and the periodicals. When we realize the rising importance of the engineer, however, and the high place which he is coming to occupy in every phase of the world's work, we begin to see that we not only should but must keep abreast of the times. G. B. W.

REPORT OF THE DAM AT AUSTIN, TEXAS

In the University of Experience, called in common parlance the School of Hard Knocks, Failure is the Great Teacher. He is a strict disciplinarian and correspondingly unpopular; but his classes are always full and there is no difference of opinion as to the effectiveness of his teaching methods. All men who are doers of deeds, sooner or later sit at his feet in humbleness of spirit and learn wisdom. Some sit there many times and long; but some there are who cannily take his teaching by correspondence. To the latter we recommend one of this teacher's recent lessons,—the story of the Austin Dam, for it is a lesson full of suggestion to one who is wise enough to learn and profit by the mistakes of others. The story is interestingly told in a report, just off the press, made by Professor Daniel W. Mead of this College to the officials of the City of Austin, Texas. Copies of this report are available in our reading room. The report as a report is an admirable piece of work, comprehensive, yet concise, and so worded that it is intelligible to the layman to whom it is addressed. At the same time it contains the technical detail which makes it possible for another engineer to satisfy himself as to the correctness of the writer's conclusions.

The City of Austin, with a population of less than 15,000, in 1890 daringly undertook to construct, at a cost of $1,600,000, "the greatest overflow dam that had then been built across a large and torrential stream." Faulty foundations and an unusual rainfall united to wreck the structure in 1900. The loss was a serious blow to the city which, nevertheless, undertook to reconstruct the dam. This period of its history is unusually instructive. It illustrates the dangers inherent in half-baked plans, loose specifications, and methods of financing that rest entirely upon the resources and integrity of irresponsible promoters. As matters now stand the promoters have faded away, leaving the bond-holders to their fate; the contractor who rebuilt the dam is bankrupt; and the structure is uncompleted and in a condition that makes great expenditures still necessary. The authorities are now seeking for the way out. The final chapter in the story of the Austin Dam is in the process of being written.

LECTURE COURSE ON THE GREAT WAR

Every Engineer who can possibly arrange his schedule satisfactorily should take the *Lecture Course on the Great War* which is being given at the University during this second semester. The course includes two lectures each week, and one credit hour is given. No notes or examinations are required. The lectures will be given at 4:30 on Mondays and Wednesdays.

WITH THE COLORS.

It is desired to leave a record, as complete and accurate as possible, of the response made to our Nation's call in this hour of need, by the students, the faculty, and the alumni of the College of Engineering. We most earnestly hope that you will give your assistance and coöperation toward this end. Bits of news, extracts of letters, photographs, and material of a similar nature will be welcome and should be given to some member of the Staff, or dropped into the mailbox of THE WISCONSIN ENGINEER, addressed to WITH THE COLORS. Letters and photographs will be returned undamaged.

By LOYAL S. BAKER

HONOR ROLL (SUPPLEMENTARY)

ALBERS, WALTER L., E. E. 3, Aviation Ground School, Champaign, Ill.

BRUE, H. N., c '11, 2nd Lieutenant E. O. R. C., Ft. Leavenworth.

CHISHOLM, W., Instructor in Pattern Making, has been granted a leave of absence to enter an aviation school.

COTTER, CHESTER O., m '17, 1st Lieutenant.

DONALDSON, CHASE, E. E. 4, who enlisted in the regular engineers has been transferred to the R. O. T. C. at Camp Lee, Petersburg, Va.

HARRIS, JOHN W., C. E. 4, R. O. T. C., Camp Grant, Ill.

HAYDEN, CARL F., Ch. E. 4, has enlisted in the Chemistry Regiment of the Ordnance Department for overseas service.

HOMANN, FREDERIC A., scholar, Naval Experimental Station, 126 Montauk Avenue, New London, Conn.

JOHNSON, LEONARD M., E. E. 2, has been accepted for the aviation service and is preparing for ground school.

KERNAN, THOMAS, min. '16, Lieutenant in the E. O. R. C. now in France.

KEUCHEL, JOHN N., E. E. 2, Naval Training Station, Great Lakes, Ill.

KING, KENNETH J., M. E. 2, Unit 8, Naval Training Station, Great Lakes, Ill.

KING, RALPH, former student in civil engineering, 23rd Engineers, Camp Meade, Md.

KLENERT, SIDNEY F., U. S. Regular Army.

McGILVARY, PATON, e '16, American Aviation Detachment in Italy. Pat is said to hold some records there.

MEARS, G. S., c '12, Third R. O. T. C., Camp Grant, Ill.

MILLER, HARRY I., E. E. 2, enlisted in the Navy as electrician, a few days prior to the holidays, but started his service with a three weeks furlough. He expects to be transferred to the Radio Detachment.

PADDOCK, RYCHEN M., Ch. E. 2, Aviation Section, Signal Corps.

PETERSON, ARTHUR, Min. E. 4, R. O. T. C., at Camp Custer, Mich.

PIERCE, R. C., Instructor in Hydraulic Engineering is in the Aviation Section at San Antonio, Texas.

POND, STUART A., E. E. 2, has enlisted in the U. S. Regulars.

POTTINGER, CLARENCE A., E. E. 4, 2nd Class Mechanic, Aviation Corps, Great Lakes, Ill.

RICHARDS, JERRE T., c '95, Major, 507th Engineers.

RICHARDSON, GLENN C., M. E. 4, Aviation Service, France.

SACKET, WALTER H., c '06, Captain, Coast Artillery Corps, New Bedford, Mass.

SCHUSTEDT, FREDERICK N., c '17, who was a sergeant in the National Army at Camp Grant, has been transferred to the Aviation Section and is now at the ground school at Urbana, Ill.

SWENHOLT, HELMER, g '09, Captain, Engineers Corps, Camp Lee, Va.

TAYLOR, THOMAS D., Ch. E. 2, Jefferson Barracks, Mo.

WHITE, ROBERT B., M. E. 4, Aviation Section, Signal Corps.

ZWICKER, MICHAEL H., Ch. E. 2, Co. D, 30th Engineers, American University, Washington, D. C.

R. L. Wadsworth, with the Field Artillery in France sends some comments that are worthy of consideration by the men still here at school. He writes:

"At this moment, I'm doing pretty well. My course is ended, at the Field Artillery School of Instruction, and I leave tomorrow for a four day leave in Paris. Some place to spend New Year's Eve, eh boy? Have a good chance of stumbling into Johnny, Harry Craig, or Will Pridly. After this leave I report to the ——st Brigade for duty, and from the dope I have a good chance of being in the *front lines* by the time you're reading this. Can't beat that for a fast life!

"But to get to the gist of the letter. I have a couple of ideas on my chest (the old stuff) that I might suggest to you fellows. From the little experience I've had over here, it is easy to see that our new army is to be the most specialized organization. Even in artillery there are about twenty different kinds of special officers—aerial observers, liason, orientation officers, firing officers, supply officers, transportation, reading of aerial photographs, *camouflage,* etc.—no end of things. And this is only one branch of the service. Now, they are picking college men for about 95 percent of these jobs because they have the brains, the trained minds to get away with it. What our army needs, what they are asking for continually are for men like this—and two of the most sought for types are those who can speak *French* and who have had a little special training along some line. Here is the point. You men who are still at Iota can help the government and keep up the old place at the same time. For instance, if you are set on aviation, try to hunt out a simple course on gas engines, or perhaps on aeroplane construction. If you could all get a little something of that kind—thrown in with your regular course—it would help a lot when the time comes. As we get most of our specialist training from the French, a knowledge of French is the first aid in getting together on the proposition. And for any kind of work in infantry or artillery, a simple course on digging of galleries, propping earthwork, etc., would boost your stock about 100 percent. If they haven't such a course, tell Prof. they should install one. Another thing, there is a demand for men who speak *German well,*—for general intelligence, work, and questioning prisoners, I suppose.

"But you have to be over 21 to be of any use, for they don't want men younger—at least its impossible to obtain a commission. You men in college will have to furnish officers to replace the casualties among us fellows who are trying to hold down the job at present. Therefore, it's up to you to stay where you are and get all the training possible—but you constitute the commissioned *reserve,* the future timber, and you've got to keep on growing until you're of a size to be useful. Any one of you who lets the war fever get the best of him and goes flying off as some sort of a private, isn't doing his best by a good deal. Chances are that you will have plenty of time to get into things in the proper manner. Skill and brains are what count, and not any of the sword waving bravado. A real business proposition—but good sport, at that.

"I won't hold forth much longer. Would like to drop in some night for dinner and have Maggie's song after the dessert. And more than once I would have given a hell of a lot to be sitting in front of the blue room fire-place with the Vic tearing off a few of the old ones. This war game, with snow on the ground and the wind howling, is no bed of roses! C'est la guerre—and therefore can't be helped.

CAMPUS NOTES

When, between classes, the delectable co-ed congregates in vivacious bevies upon the front steps of the Engineering building, then do we realize the cataclysmic changes wrought by War. For about a month we have been all cluttered up with skirts and French instructors. Shades of Bob Connelly and the gang that used to hurl manly defiance at the Laws across the campus! We moved about with fair words and our hearts in our mouths and winning smiles spread over our well-scraped countenances, for ladies were present. And to add to our discomfiting, our honorable and ancient enemy, the law stude, left his haunts and hid away from us in the recesses of the great white building at the other end of State Street. Heaven knows we did our best to make it warm for him here: he, at least, might have stayed. Is there no limit to War's horrors?

The University was not affected directly by the recent closing order of Fuel Administrator Garfield. Classes were continued as usual, but with some rearrangement of class-room facilities. Although the University is well supplied with coal, it seemed desirable to conserve the supply as much as possible. To that end the Gymnasium, Lathrop Hall except the cafeteria, the auditorium of Music Hall, the north wing of University Hall, the Stock Pavilion, and the entire Law building were closed and the heat turned off. This was done about January 22 and the buildings remained closed until the beginning of the second semester. Some shifting of classes was necessary; the military department had temporary head-quarters in the Engineering building, and the Law School moved bodily to the third floor of the Capitol building. The estimated saving in coal was between 30 and 35 tons daily.

Winter isn't what it used to be. With the mercury doing the submarine act and not even its periscope showing, with the girls camouflaging pretty ankles in ugly but protective "galoshes," and with the steam radiators in the class rooms observing every day as heatless day, winter has ceased to be charming.

Still, as that University Hall optimist says, "Many are cold; but few are frozen."

Professor Van Hagan talked to the Engineers Club on January 25, upon the subject of Military Destruction and Repair of Railways.

The new Physics building was thrown open to public inspection on the evening of January 15. Opportunity was taken of the event to celebrate the completion of twenty-five years of service with the University of professors Ely, Snow, and Scott.

The New Physics Building

In spite of deep snow and cold weather the building was crowded all evening with interested visitors. The building is on Charter Street, just north of the Chemistry building. The basement, first, and second stories are occupied by the Department of Physics, the third story by the Department of Political Economy, and the fourth flour by the Course in Commerce. It ranks third in size among the university buildings and cost $180,755, exclusive of equipment.

To help meet the situation created by the fuel shortage the University has just issued a bulletin (Number 7, Volume VIII of the Engineering Series) on *Fuel Conservation by the Economical Combustion of Soft Coal.* This was prepared by Gustus L. Larson, Associate Professor of Steam and Gas Engineering of this College. The bulletin discusses the composition of coal;

the classification and characteristics of fuels; the principles of combustion; methods of firing, both for power plants and for domestic heating; devices for burning soft coal without smoke; and the smoke problem. The bulletin contains information of value to everyone who takes care of a furnace; it is especially welcome at a time when this section of the country faces the prospect of learning to use soft coal.

At the meeting of the Madison Section A. I. E. E. on January 17, Mr. F. A. Kartak spoke upon Field Testing Methods, and Mr. H. M. Crothers upon Field Experiences and Developments in Testing. The papers were prepared in connection with the work which the Standard Laboratory of the University has done for the Public Utilities of the State during the past few years.

Mr. J. Glaettli, instructor in Mechanics, left on January 19 for Washington. It is understood that he will be engaged upon the design of concrete ships for the Emergency Ship Building Corporation. He expects to be gone for two months.

That Mining Club is an awful pacemaker. What now? Oh nothing. Just dropped enough "malted milks" into Professor McCaffrey's mite-box to buy one of those fifty dollar Liberty Bonds. They did it in two months at that. Some thirst, boys, some thirst!

Professor Jesse Kommers, e '06, announces the arrival of a second son, William Jesse, on January 9, 1918.

The Chinese students are planning to give a course in Chinese during the second semester.

The annual Engineers' Dance was held Saturday evening, January 19, in the parlors of Lathrop Hall, under the auspices of the U. W. Engineers' Club, the A. S. M. E., and the Chemical Engineering Society. H. N. Shaw, W. S. Wilder, K. L. Seelbach, J. W. Williams, and J. A. Peachey made up the committee on arrangements. The chaperones were Mr. and Mrs. Kartak, Professor and Mrs. Price, and Professor and Mrs. Goddard. Contrary to the usual custom, attendance was limited to engineering students. The dance was entirely successful and was thoroughly enjoyed by all who were fortunate enough to be present.

Tau Beta Pi has announced the election of Ray E. Behrens, civil, Howard H. Fuller and Carl F. Kottler, electrical, J. Frank Roberts, mechanical, and Paul H. Schmidt, chemical. Behrens is high junior. At the initiation banquet, which was held at the Woman's Building on January 16, Mr. J. D. Mack, State Engineer, gave an entertaining talk about the early days of the college and its development; Dean Turneaure discussed the recent radical changes in the curricula of the various courses; and Mr. C. F. Burgess, former professor of Electro-chemistry, compared American and German chemical progress.

Pi Tau Sigma, the honorary mechanical engineering fraternity, announces the initiation of the following men: R. Miller, K. G. Shiels, and L. C. Rove from the 1918 class, and E. A. Gallun and G. B. Warren from the 1919 class.

On December 13, Eta Kappa Nu initiated the following Juniors and Seniors: A. C. McCullough, L. F. Seybold, L. P. Works, T. W. King, B. J. Blattner, W. E. Blowney.

The second semester officers for the student section of A. S. M. E. are: G. T. Moore, president; G. B. Warren, vice-president, W. G. Mantonya, scretary; K. L. Seelbach, treasurer; A. L. Goddard, honorary chairman.

The ruling of the War Department, under which a portion of the engineering students are to be allowed to remain in school for the purpose of completing their training, provides that the privilege shall be restricted to those students who grade with the upper third of the graduates of the last ten years. Acting under this provision, the faculty of the College of Engineering investigated the standings of the graduates in order to determine approximately what the scholastic limit should be, and then considered individually each man whose standings entitled him to consideration. The names of the men who were decided to be eligible are given below:

SENIORS

Civil Engineering Course

Camlin, W. J.
Conaty, B. M.
Dennis, C. E.
Kirch, L. A.
Nathan, W. S.
Vernon, J. R.

Mechanical Engineering Course

Fredericksen, A. F.
Miller, R.
Roberts, J. F.
Seelbach, K. L.
Wirka, R. M.
Yates, D. E.
Moore, G. T.

Chemical Engineering Course

Fahlberg, E. D.
Kleimenhagen, K. C.
Olson, V. A.
Schmidt, P. H.
Storer, R. M.
Williams, J. W.

Electrical Engineering Course

Call, L. L.
Conley, B. L.
Fuller, H. H.
Kottler, C. F.
Morse, E. B.
Nielson, A. C.
Pottinger, C. A.
Schneider, C. L.
Shaw, H. N.
Wilder, W. S.

JUNIORS

Civil Engineering Course

Balderston, W. J.
Behrens, R. E.
Buchholz, R. O.
Glaettli, H.
Hanson, M. M.
Huntzicker, Paul
Light, R. F.

Mechanical Engineering Course

Bellack, W. B.
Gallun, E. A.
Griswold, M. P.
Mueller, E. J.
Schmidt, E. W.
Stern, E. F.
Warren, G. B.
Williams, E. B.

Mining Engineering Course

Werba, E. O.

Chemical Engineering Course

Brenner, E. C.
Holmes, P. D.
Koehler, W.
Meisekothen, E. E.
Mertes, J. B.
Oberly, J. J.

Electrical Engineering Course

Blattner, D. J.
Blowney, W. E.
Brewer, R. W.
Flatman, G. J.
King, T. W.
Osman, R. T.
Lillesand, L. N.
Peters, L. J.
Peterson, L. L.
Svitavsky, R. I.
Wise, E. M.
Works, L. P.
Scott, K. L.

SOPHOMORES

Electrical Engineering

Day, H. P.
Hamilton, R. E.
Hantzsch, R. E.
Knoerr, R. R.
Radke, C. E.
Gray, C. R.

Chemical Engineering

Baumann, W. O.
Griswold, F. L.
Morice, E. K.
Spafford, A.
Velguth, W.

Mechanical Engineering

Gardner, A. O.
Timm, H. D.

Civil Engineering

Congdon, C. D.
Johnson, J. W.
Sherburne, L. R.

Mining Engineers

Emanuel, W. A.
Ray, O. A.
Slaker, D. V.

FRESHMEN

Anderson, C. J.
Crosswait, S. T.
Henry, E. E.
Holmes, F. M.
Linden, J. F.
Moeller, G. H., Jr.
Pesch, A. W.
Rasmussen, C. F.
Sternlieb, H.
Meyer, R. L.

GRADUATE STUDENTS

Gillette, P. C.
Short, R. D.
Frenzel, H. H.
Sweet, Howard
Reed, A. C.

Provisions have been made by the Signal Corps under which suitably qualified senior and junior engineering students may be registered in a special course in radio telegraphy, to be given by the Physics Department. Students admitted to this course will be permitted to enlist at once in the Signal Corps, and under this enlistment will be permitted to complete the year's work at the University, after which they will be taken into active service in the Signal Corps or will be discharged, at their option.

The following engineers, all senior electrical students, have been accepted: B. L. Conley, C. E. Schneider, H. W. Shaw, A. C. McCullough, H. W. Brock, L. L. Hall, W. S. Wilder, and C. W. Schmidt.

ALUMNI NOTES

By Walter S. Nathan

M. E. Allen, c '06, is a member of the firm of Bailey & Allen Company, structural steel and machinery. His address is 122 South Michigan Boulevard, Chicago.

H. H. Force, e '10, is celebrating the arrival of a son, Henry Bridge. Force is Chief Electrician of the Stanley Works, New Britian, Connecticut. His address is 80 Lincoln St.

D. S. Grenfell, ch '14, is located in the Research Department of the New Jersey Zinc Co., Depue, Illinois.

R. T. Herdegen, e '06, Vice President and Manager of the Dominion Forge and Stamping Co., Ltd., has changed his address to 630 Iroquois Ave., Detroit, Mich.

R. C. Johnson, c '17, was married December 27 to Miss Dorothy Dexter, '16. Bob, who is a Second Lieutenant in the Engineers, has been building some models of trenches at Battle Creek lately. In a recent letter he said that if he were ordered to dig to China he would do so without a word of protest.

J. E. Kaulfuss, c '08, is now Chief Engineer of the State Highway Commission of North Dakota with offices at Bismark.

Henry A. Lardner, e '93, E. E. '95, Vice President of the J. G. White Engineering Corporation is now located at 43 Exchange Place, New York City.

F. D. Lohr, ch '16, is Superintendent of the benzole plant of the Seaboard By-Product Coke Co., Jersey City, N. J.

A. C. Shape, ch '12, is now in the employ of a New York consulting firm doing work at the plant of the Titanium Alloys Co., Niagara Falls, N. Y.

L. C. Rockett, c '15, is located at La Crosse, and is Engineer in Division Number 5 of the Highway Commission.