# The Wisconsin engineer. Volume 32, Number II November 1927

Madison, Wisconsin: Wisconsin Engineering Journal Association, [s.d.]

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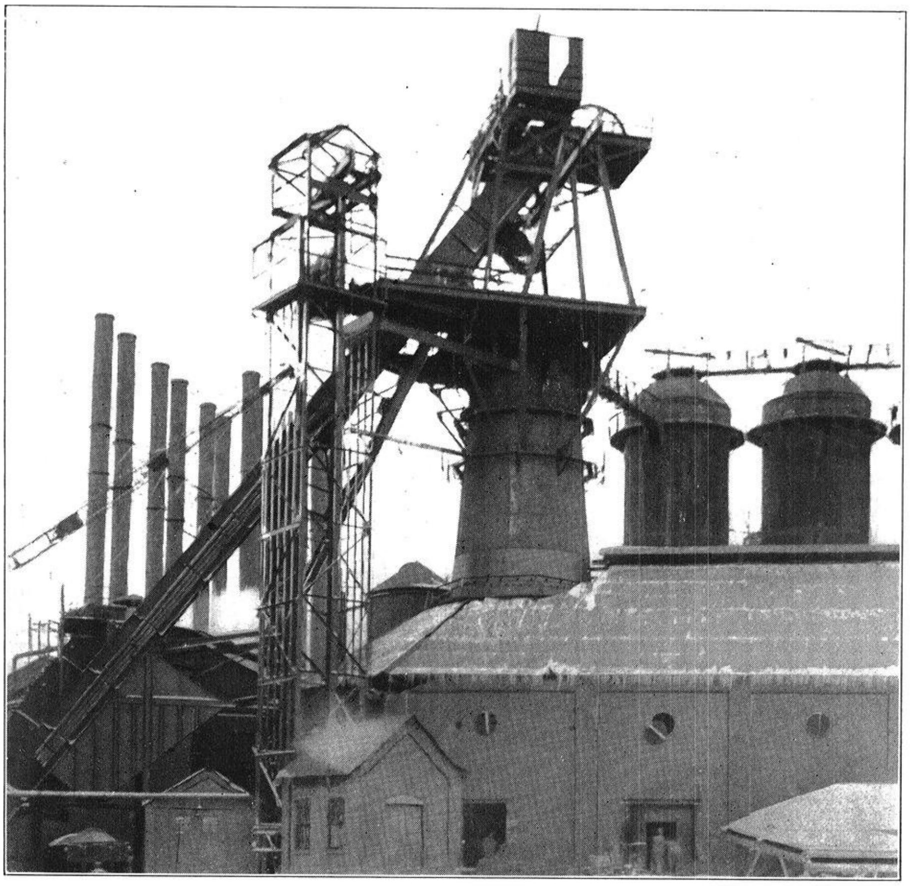
# The Wisconsin Engineer

MEMBER OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED

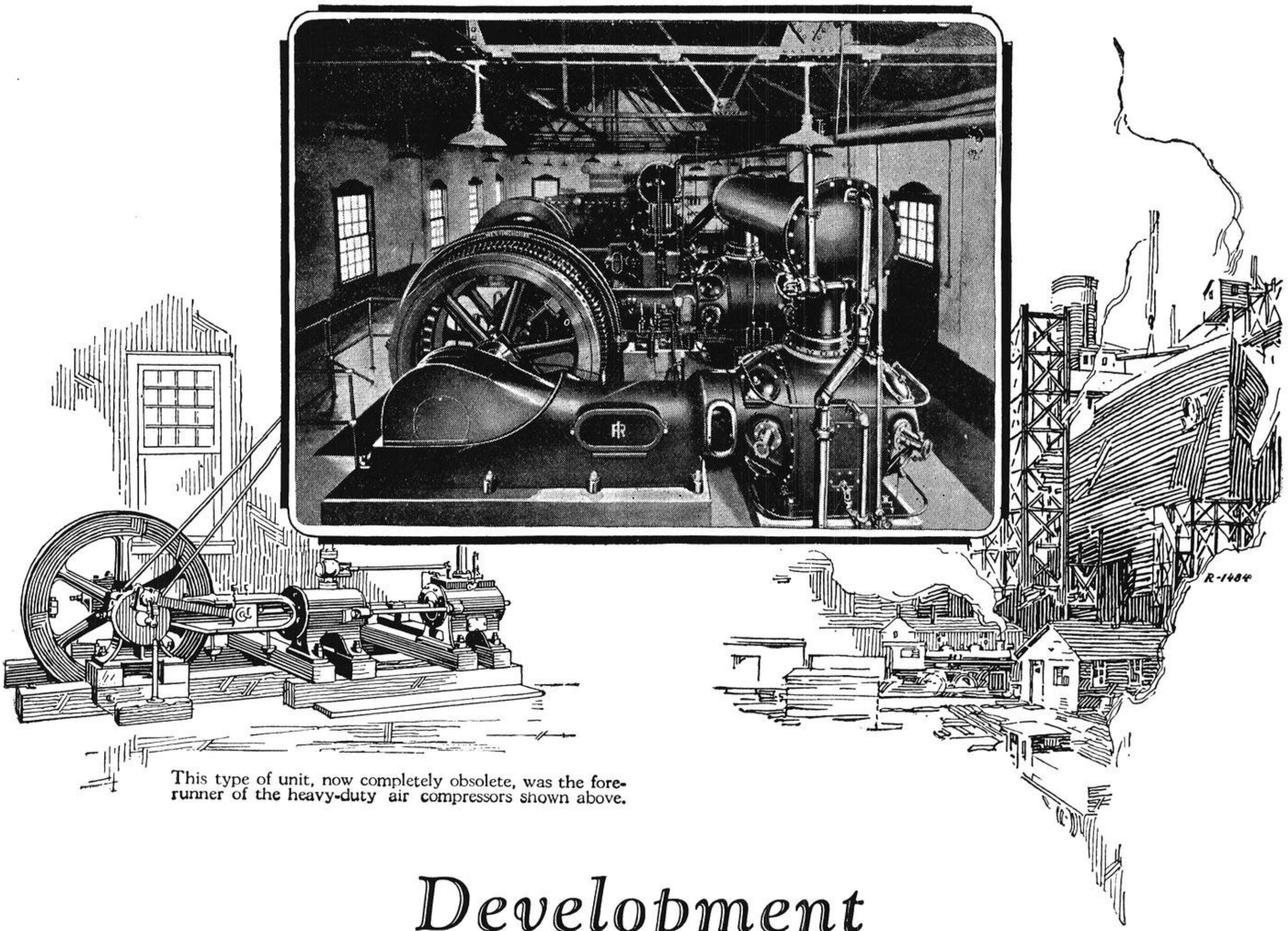
VOLUME XXXII NUMBER II



A MODERN BLAST FURNACE

PUBLISHED BY THE ENGINEERING STUDENTS
*of the* UNIVERSITY OF WISCONSIN

*November, 1927*




This type of unit, now completely obsolete, was the forerunner of the heavy-duty air compressors shown above.

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The Wisconsin Engineer

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Published monthly from October to May, inclusive, by
THE WISCONSIN ENGINEERING JOURNAL ASSOCIATION
306a Engineering Bldg., Madison, Wis.—Telephones University 177—277

Founded
1896

$1.50
A Year

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The Wisconsin Engineer
UNIVERSITY OF WISCONSIN

VOL. XXXII, NO. 2 MADISON, WISCONSIN NOVEMBER, 1927

# THE MOTOR GENERATOR LOCOMOTIVE

*By* RALPH R. BROOKS, e'26
*Westinghouse Electric & Mfg. Co.*

THE recent delivery of two Baldwin-Westinghouse motor generator locomotives to the Great Northern Railway for their Cascade electrification marked the second step in what promises to be a new era in steam road electrification.

Even before the electric railway had progressed far beyond the trolley car stage, its proponents were divided into two opposing camps. One camp, the "conservatives", considered the operating characteristics, the starting effort, economy and efficiency of the direct current series traction motor, and declared that low voltage d-c was the logical type of electrification. The opposing or "radical" group considered the lightness, cheapness and dependability of the high voltage single phase a-c overhead and distribution system, and proclaimed with equal vehemence that "single phase would solve any electrification problem." Even at that time, the basic truths in the two arguments were recognized by both opponents, the conservatives using a-c in transmission lines and distribution circuits to the substations, while the radicals were busying themselves in trying to duplicate, in a single phase commutator motor, the desirable performance characteristics of the d-c series traction motor.

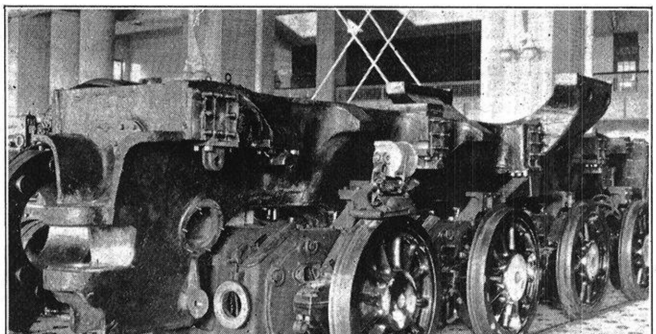


FIG. 1. *Trucks and Frame of D. T. & I. Locomotive*

Each succeeding electrification seemed a deciding factor one way or the other, but the advances in the electrical arts would then even the struggle. Trolley voltages were raised, motors were made more efficient, induction motors were successfully applied to locomotives.

But all this time, the railroads and the middle group of engineers, somewhat puzzled by the conflicting statements regarding the right sort of electrification, were wondering why a compromise or combined sort of locomotive could not be built. If a-c transmission is so desirable, why not bring high voltage single phase to the locomotive? If d-c traction motors are so excellent, why not use them and carry the conversion apparatus on the locomotive? These were the questions that were asked.

The obvious objection, that of excessive weight, was met, at least partially, by the answer that weight is sometimes desirable in a locomotive. But the idea thus broached was not developed because of the lack of a motor generator set sufficiently rugged and compact for locomotive use. When the natural development of the industry brought out such an equipment, the first motor generator locomotive made its appearance.

### *The Detroit, Toledo & Ironton Locomotive*

It will probably occasion but little surprise to learn that Henery Ford was the pioneer who dared try this idea. In electrifying, in 1924, the northern terminal of his newly acquired Detroit, Toledo and Ironton, an almost exclusive freight line, the first motor generator locomotive was designed by the Ford engineers, working in conjunction with Westinghouse engineers. The result, while electrically the same as the latest locomotive for the Great Northern, has many novel mechanical features that merit special consideration.

As may be seen in Fig. 2, the Detroit, Toledo and Ironton locomotive consists of two motive power (MP)

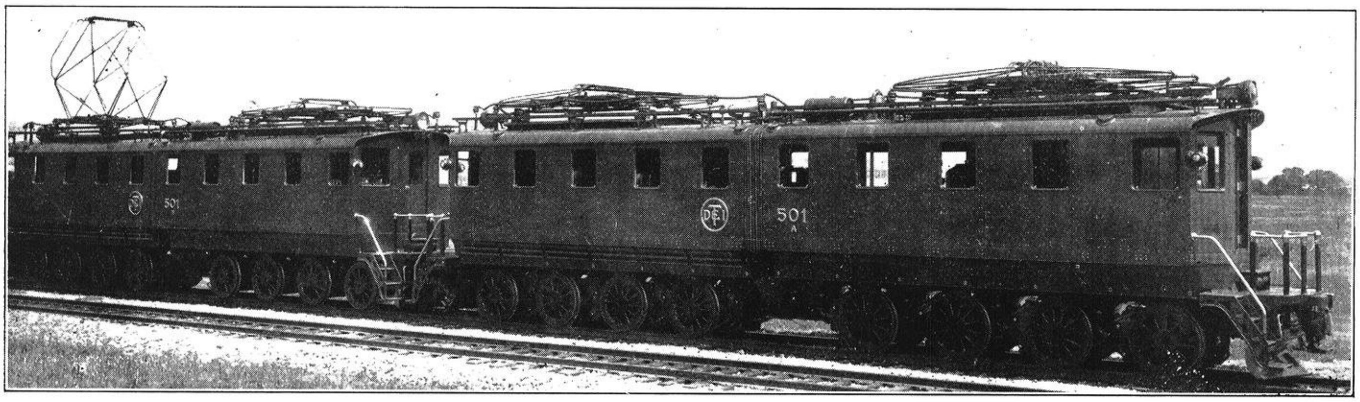


FIG. 2. *Detroit, Toledo, & Ironton Motor Generator Locomotives*

units. As is customary in electric practice, the units are exact duplicates, semi-permanently connected back to back, but capable of independent operation. Each motive power unit is again divided into two trucks, the leading or outside truck carrying the oil cooled 22000 volt transformer (tapped for 11000 volts), the compressor and the heavy control equipment and the trailing or inside truck carrying the motor generator set. This distinction of equipment requires a roomy cab, giving a locomotive rather longer than would ordinarily be considered necessary. The cab sections are mounted rigidly on the trucks, a canvas articulation, similar to that used on passenger trains, connecting the cabs on the two trucks making up a motive power unit. An unusual feature of the cab construction is the provision for removing the sides and roof surrounding the motor generator set (see Fig. 3) giving much greater accessibility than is possible with a more nearly standard construction.

*Mechanical Features*

But the real novelty on the Detroit, Toledo and Ironton locomotive lies in the mechanical arrangement of the trucks. As illustrated in Fig. 1, which shows one of the inside trucks, looking toward the connection between the motive power units, there is no frame in the ordinary sense of the word, but rather a cast steel backbone. This backbone is shaped like an inverted broad and shallow letter U, arms reaching up and out to support the cab frame and heavy equipment, and down to guide and rest on the "driving units".

These "driving units" consist of a motor frame, carrying the motor, pinions, gears, axle and driving wheels as illustrated in Fig. 1, which shows one of the trucks. Each pair of pinions is carried on a shaft inside the hollow armature shaft and keyed to it at the center. The torsion of this shaft between the keyed center and the pinions at the ends furnishes the desired flexibility in the motor drive. The pinions drive to gears keyed solidly to the driving axle which is carried in the solid bearings in the rear of the motor frame. This method of support is the reverse of the usual one in which both locomotives and motor weight are transmitted directly to the axle, for here the locomotive weight is transmitted to the axles through the motor frames. Four of these driving units are inserted in tandem between the vertical legs of each inverted U casting, the tractive effort being transferred through the motor frames to the individual arms of the backbone casting and thence to the coupling pin.

Such a setup offers the extreme in flexibility, in fact, it is so flexible that guide members from the backbone are necessary to keep the driving units properly lined up. It does, however, give the exceptionally short maximum rigid wheel base of 11 feet on a locomotive over 10 times that length.

The weight of the cab and equipment is transmitted to the four driving units of each truck by a series of springs, giving three pairs of support points between the backbone and driving units. This is well shown in Fig. 1.

The hollow spaces in the backbone casting have been very ingeniously utilized as ventilating ducts and storage reservoirs for compressed air. Fig. 1 shows an outlet of a ventilating duct.

Another interesting feature of this locomotive is the individual brake, one of which is shown on the leading wheel of the truck in Fig. 1. A similar brake is applied to the top of each driving wheel. The brake cylinder is fastened to the motor frame, so that the entire weight of the locomotive is carried on the brake shoes during the braking period, giving very effective retardation.

On the backbone, as on a cradle, are carried the heavy pieces of equipment, such as the transformer and motor generator set. Channel iron is bolted to the projections on the side to give a rectangular top on which the cab is built.

Another feature new with this locomotive was a combined controller and brake stand, with throttle type controller handles working in a vertical plane.

Following the usual Ford policy, the locomotive is exceptionally well finished, having heavy nickeled trimmings and a deep upholstered aluminum chair for the engineer.

The motor generator set is practically identical with that for the Great Northern and will be described with the other electrical equipment.

The performance of the Detroit, Toledo and Ironton locomotive in heavy slow speed freight service was very satisfactory. This would have induced other roads to try the same type, had it not been for the extreme unconventionality of the mechanical design. The average railroad executive has learned to be conservative, and doubtless considered that the motor generator principle was enough of an innovation without the added doubt due to new mechanical design.

*The Great Northern Locomotive*

The next locomotive of this type, the new equipment for the Great Northern, are more of the usual design.

The complete locomotive consists of two motive power units, duplicates of each other, semi-permanently coupled together.

Each motive power unit has a bar steel frame resting on the axle journals in the conventional manner. Forming the end castings of this frame is an integral central casting carrying all the heavy equipment. The cab is mounted rigidly on this frame. Each unit has a leading axle, four driving axles and a trailing axle, an arrangement which is classified a 1-D-1. Each driving axle carried a single axle hung traction motor, driving through pinions mounted solidly on the armature shaft to flexible gears on the driving wheels.

This locomotive uses the conventional form of controller and brake stand.

The Great Northern will use these locomotives in freight and passenger service over the Cascade Mountains in Washington.

These two locomotives are almost identical electrically so the electrical features may be most conveniently described at one time.

*Electrical Features*

The motor generator set on both locomotives consists of a 2100-HP, 25-cycle, 4-pole single phase motor driving a 1500-kw, 600-volt generator at 750 r. p. m. This generator had four fields, a series excited differential field, an interpole field, a compensating field and a separately excited main field. The motor of the Great Northern differs from that on the D. T. & I. in having a teaser winding, or a portion of the additional winding which would make a three phase machine of the motor. This furnishes a source of three phase power for driving the blower motors without overloading the machine with a larger exciter, and in addition utilizes the rugged induction motor for service to which it is admirably fitted. A 75-kw, 125-volt exciter is carried on the motor end of the shaft. A 25-kw regenerative exciter is carried on the other end.

The transformers are of the two circuit type, the auto-transformer having gone out of favor for railway use on account of the high voltage which may be put across the equipment in case of a ground. The Detroit, Toledo and Ironton uses an oil cooled transformer, while the Great Northern uses an air blast transformer. This latter is the more common, but on both the Ford locomotive and those for the Virginian, oil cooled transformers were used because of the high voltage, 23000, for which they were wound.

The control equipment is of the reliable HBFR electro-pneumatic type, the control current coming from the 125-volt storage battery used for starting the motor generator set. The control equipment is extremely light and compact for locomotive service, due to the fact that the only currents normally switched are field currents for the main generator about 30-40 amperes at 125 volts.

The traction motors, which are arranged for either series or separate excitation, are all connected in parallel on each unit, but are arranged so that any one may be cut out without affecting the rest.

The compressor is driven by a d-c motor from the main exciter when the motor generator set is running and from the storage battery when the motor generator set is down.

The blower motors on the Great Northern, two for the traction motors and one for the transformer on each unit, are driven by three phase induction motors. When the synchronous motor is running light, the auxiliary or teaser winding mentioned above furnishes three phase power to start and run the blower motors. When the synchronous motor is loaded, the teaser winding connection is broken and the blower motors are operated single phase.

*Operating Cycle*

Because of the electrical similarity of the two locomotives, the operating cycles are much the same. The Great Northern locomotive is described, but the points wherein the Detroit, Toledo and Ironton differ are indicated.

In order that an engine may be started and operated, it is necessary that the battery be charged. The air pressure may then be pumped up, and the two panta-

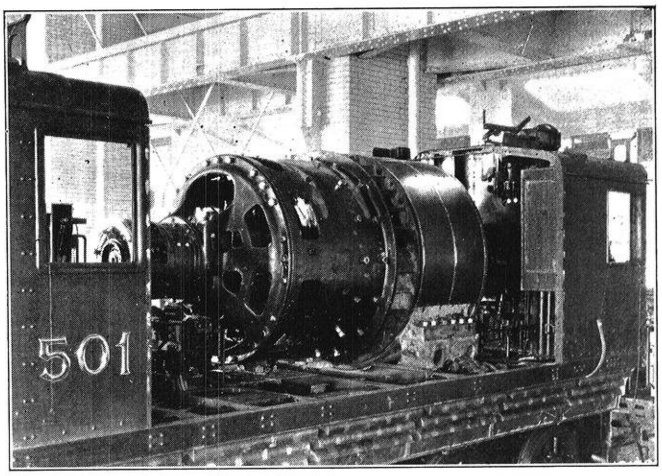



FIG. 3. *D. T. & I. Locomotive showing sides and roof removed*

graphs on each unit controlled. Two of these spring raised, air lowered pantagraphs are carried up on the locomotives at all times to insure a constant supply of power to the high tension bus line.

The motor generator set is started by running the main generator as a motor from the storage battery until approximately one third speed is reached, then

*(Continued on page 61)*

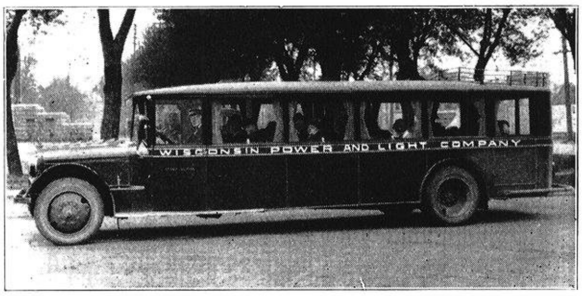
# BUS REGULATION IN WISCONSIN

*By* NEWELL E. FRENCH, e'23

WISCONSIN'S new bus law, enacted by the 1927 legislature, places auto transportation companies under regulation comparable in character and scope to that affecting other public service corporations in the state. Rates, schedules, facilities for service, safety of operation, competing service and accounting practices are all matters for review and regulation. The Wisconsin Railroad Commission is charged with the administration of the law.

Since 1915 the subject of motor bus regulation has been before the legislature, but the present measure was the first to surmount the legislative and executive hurdles.

The law provides that before an auto transportation company may operate, a certificate and permit must be obtained. Such certificate, the fee for which is twenty-five dollars, the commission is empowered to issue or refuse, as the public interest requires, and may refuse to issue a certificate whenever adequate transportation facilities already exist. The commission has authority under the law to coordinate bus routes and schedules of the various operating companies and also to prevent unnecessary duplication of service and unwholesome competition between bus lines and steam and electric railroads. The commission may not, however, refuse certificates to auto transportation companies who were in operation on March 1, 1927, and who comply with other provisions of the law; routes and schedules then employed are considered as established and must be recognized by the commission's certificate. These certificates of authorization will prescribe the route to be followed, rates or fares to be charged, the schedule to be maintained and other conditions of operation necessary to carry out the purpose of the law. Rather unusual, and of considerable interest, is the following excerpt from the law: *"No right, privilege or certificate held, owned or obtained by any auto transportation company under the provisions of this chapter shall be sold, assigned, leased, transferred or mortgaged either by voluntary or involuntary action."*




*A Modern Motor Coach*

Another important provision of the law relates to the control of auto transportation in cities and villages. The consent of the city or villages and its approval of the proposed route within the corporate limits must first be obtained before busses may be lawfully operated. Cities and villages may also require reasonable compensation for the repair and maintenance of pavements and bridges, and for the regulation of street traffic. The reasonableness of the compensation demanded and restrictions imposed is not subject to the review of the commission; the bus companies' only recourse is through the courts.

Any auto-transportation company engaged in carrying passengers must file an indemnity bond with the commission unless the company can satisfy the commission as to its financial ability to pay damages which may occur. Such bonds must indemnify the company to the extent of possible damages of $10,000 to any one person and from $20,000 to $75,000, depending on the size of the bus, for any single accident. Companies operating buses in freight or express service must file a similar bond in the amount of $2,000.

Annual reports are to be filed with the commission, containing such financial information, physical data and operating statistics as the commission may prescribe. The commission's accountants, in collaboration with accountants from a number of bus operating companies have recently prepared a classification of accounts which all auto transportation companies in the state will be required to follow. With the annual report must go the company's check for forty dollars for each motor bus in operation.

A tax based on ton miles of operation is provided for in the law. This tax, paid into the general fund and credited to the highway commission, is to be distributed by that body to the counties of the state in proportion to the ton miles of operation in each county. No portion of these funds, however, may be expended for maintenance or improvement of any highway within the limits of cities or villages. In passenger service, ton miles are computed on the assumption that over the entire run each seat of the bus is occupied by a 150 pound passenger; in freight transportation, it is assumed that every truck carries its maximum load over the entire route. The weight of the vehicle itself is of course included in the calculations. For passenger busses on pneumatic tires the tax is one-tenth cent per ton mile, and if the bus has two or more solid tires the tax is doubled; motor carriers of freight are taxed one-fifth cent per ton mile if pneumatically tired, and again the rate is doubled if solid tires are employed.

*(Continued on page 64)*

# COMMENTS ON THE MISSISSIPPI SITUATION

*By* ARTHUR H. FRAZIER, c'28

THE Mississippi flood relief will probably be one one of the first measures brought before Congress when it convenes this fall. It is not a new question; engineers and politicians in the lower Mississippi valley have for many years been asking Congress for sufficient funds to take care of the river properly. In an article written as far back as 1883 in the *Atlantic Monthly* (Vol. 51, page 656) N. S. Shaler, once State Geologist and Surveyor of the state of Kentucky, says in regard to floods, "For the lower portions of the Mississippi, that vast alluvial plain, richer than the lowlands of Holland or of the Nilotic delta, a remedy, or at least a satisfactory pallative, may be found in the system of diking and of side outlets, which have been so well proven in many other lands for thousands of years. As soon as the nation comes to a full sense of its duty by its inheritance, this part of the evil will certainly be dealt with."

*EDITOR'S NOTE*

*Here Mr. Frazier presents the results of a broad general study of the Mississippi situation, from various viewpoints, and in many phases. We believe this article has included many of the things most of us have overlooked in regard to the engineering aspects of the gigantic catastrophe which early this year overtook the states along the lower Mississippi.*

Professor Mead of our hydraulics department, who has been appointed by the U. S. Chamber of Commerce to the flood control committee, has offered the following interesting data relative to the Mississippi River: At one time the Gulf of Mexico extended up as far as Cairo, Ill., and the subsequent raising of the land, together with the sediment carried in by the Mississippi and its 240 tributaries, has filled in the Gulf to its present shore line. Indeed; the shore line is still moving forward. Floods on the lower Mississippi are caused by the synchronization of the floods of the tributaries. If the flood of one tributary followed that of another down the river, there would be no damage done, but when the flood from one tributary arrives at the mouth of another tributary at the time that the latter is in a flooded condition, there is liable to be trouble.

Mr. Mead is not a supporter of reservoir control for the lower Mississippi. He claims that a reservoir, to be effective, would have to be placed at the junction of the Ohio and Mississippi rivers, and that such a reservoir would have to be 15 ft. deep and as large as the state of New Jersey. The amount of earth excavated, if the land were perfectly level, would be sufficient to build 7000 miles of levees, 150 ft. high.

If the main tributaries should all have floods at such periods that they synchronize at the lowest tributary, the flow of water, as explained by Mr. Mead, would be approximately 4,000,000 cu. ft. per second.

"Call a special session of Congress for the relief of the flood sufferers" was the impatient demand following the Mississippi disaster, and it recalls the same spirit of impatience that was exhibited at the time of the Miami flood which devasted Dayton, Ohio, in 1913. The impatience of the people was one of the greatest problems the Miami engineers had to face when planning the flood control, according to Arthur E. Morgan, chief engineer of the project, and the success of the project hung in suspense several times, not on account of engineering difficulties, but rather, on account of the difficulty of controlling their impatience and keeping it from turning into disgust or indifference.

As the flood waters receded at Dayton, a slogan developed. Newspapers and periodicals caught it up and broadcast it thruout the valley: "Steam shovels must be at work within three months!" However, three months elapsed and the steam shovels were not at work; three years elapsed, and still no work was being done. Finally, in the fourth year, the shovels began their digging. The intervening time was a necessity, and it was legitimately used by the engineers to collect run-off data upon which the plans of the structure should be based. This involved a tremendous amount of research and a large amount of time. But imagine the effect of this waiting on the morale of people who, emerging from a great catastrophe, had resolved that then and there they were going to settle the flood menace. Fiery enthusiasm soon dies if there is not action, and unless faith in the ultimate success of the project can be built up in its place the needed financial support will be withdrawn and the project doomed.

How this contingency was met is explained in an address given before the American Society of Civil Engineers, April 5, 1922, by Arthur E. Morgan in which he said: "It was obvious that no job like this would carry through except as it had the support of the public . . . . Therefore, while we were preparing the plans, while we were working out the project, we were informing the public, we were talking at meetings, we were writing up features of the work, and in every possible way endeavoring to have the public understand and have an insight into the job . . . . If they believed that it could be done, there was more likelihood of its

*(Continued on page 62)*

# MEETING A BLAST FURNACE EMERGENCY

*By* PAUL D. FELL, c'28

A SERIES of very interesting incidents, unique in blast furnace operation and maintenance, occurred at Mayville, Wisconsin. A concrete footing that had been in service many years began to heave and throw the furnace out of plumb. During the process of jacking up the furnace, improper guy lines resulted in a twisting of the supporting columns, almost moving them off the jacks. The furnace, after being lowered once, was found to be off center, and had to be raised again and moved to the proper position. These occurrences in no way reflect upon the skill with which the work was done, and are described here to show how tremendous engineering difficulties can be successfully surmounted by the use of some of the simpler principles of engineering science.

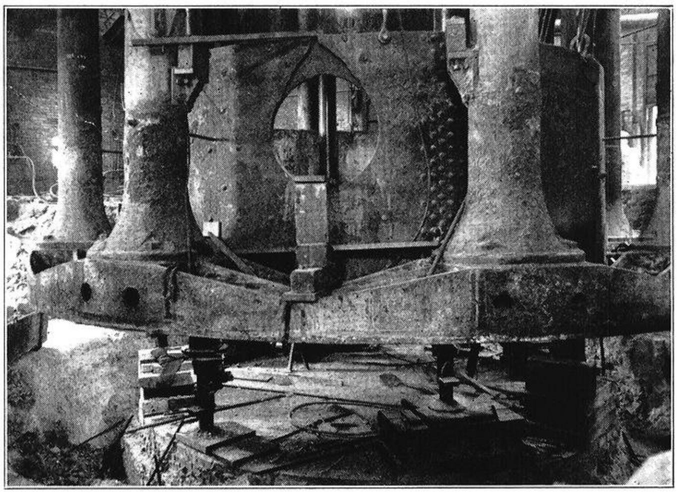


FIG. 1. *The Furnace Raised For Repairs.*

The brick lining and cooling system had been removed from the stack of the furnace and workmen had started removing the salamander (iron which settles below the iron notch and cannot be drawn off with each cast) when it was noticed that the furnace was rising. That the furnace was actually rising was first noticed when the roof trusses, which are attached to the shell, were torn loose from their settings. The water and air feed pipes, however, were sufficiently elastic to withstand the movement.

Any plans for remedying the condition had to be made and executed without loss of time, since the masons who were to do the relining were already on the job when the foundation heaved. The most feasible plan, and the one which was carried out, was to raise the furnace sufficiently to enable workmen to remove the old foundation material from directly under and around the base of the furnace and to place new material.

The first step in carrying out the proposed plan was to remove the entire bosch and raise the hearth ring (which can be seen suspended by cables in Fig. 1) out of the way of the workmen. The materials inside of the hearth ring, bricks and concrete, were excavated down to the railroad rail reinforcing. This excavated concrete was in such condition that only a pick and a shovel were needed to remove it. New material, consisting of a concrete base and furnace base brick, was placed. The new concrete was a 1 : 2½ : 4 mix with 6.1 gallons of water per sack of cement, the coarse aggregate being crushed slag.

After the concrete had been given time to develop about one-third of its 28-day strength, the lifting rigging was placed. The lifting was done with 75 and 100-ton jacks, the lift being transmitted to the furnace through a system of columns and I-beams. Eight 12-inch pipes, 22′ long, were used as the lifting columns. These pipes were threaded and capped at each end, the caps at the top end were bolted to the I-beams and at the bottom were bolted to the jacks, which, in turn, were bolted to their blockings. This arrangement gave the effect of square ends so far as the stiffness of the columns was concerned. To stiffen the columns further, they were bolted to the hearth ring with U-bolts. The I-beams that the columns acted against were placed under the bosch ring.

To stabilize the stack, guys were strung from four points in such a way that they would run radially from the stack and at right angles to each other. The riggers, however, placed a few extra guys and got them tangential to the furnace. When the jacks were worked, these guys tended to twist the furnace off the pipe column supports. Serious results were prevented, however, by counteracting the effect of the tangential guys with more guys.

After the guys were properly arranged, the furnace was jacked up 6 inches to give clearance between the furnace column bases and the concrete base. During the jacking operation, the furnace was kept plumb by raising each jack a given amount — about one-quarter inch — at a time. By this means, also, a uniform load was maintained on each pipe column.

While the furnace was in this position, the old material was excavated for a distance of about 3 feet around the hearth. This excavation was filled with a 1 : 2 : 4½ mix of slag-concrete. After the concrete had hardened, the furnace was lowered onto the new base. In checking up on the center of the base, it was found to be about 2 inches off center, a condition which had to be rectified so that the centers of the skip-hoist and of the furnace would coincide. Shifting the base required that the furnace be lifted again so that steel plates and rollers could be placed. The jacks were then lowered so the base rested on the plates and rollers. A number of jacks were placed in a nearly horizontal position between furnace base and bracing and in such a way that their lines of action were parallel to the desired direction of movement. When a checkup from the skipway showed the furnace to be centered, it was again raised and the rollers and plates were removed. Then the furnace was lowered to its final position and concrete poured around and partly over the column bases.

This is believed to be the first case in blast furnace history where a furnace was raised due to heaving of the base. The theory advanced to explain the cause is this: The limestone aggregate in the concrete directly under and around the hearth had been calcined, and water that had been poured on the salamander to cool it, seeped through to the calcined aggregate and slaked it so that expansion took place. It is definitely known that ground movements had nothing to do with the rising of the foundation.

The first furnace at Mayville was constructed shortly after the discovery in 1850 of a small iron ore deposit near the town. This furnace was a charcoal burner of small capacity, but smelted all the ore that could be hauled from the mine. The railroads had not yet advanced into that part of the country, so all the hauling was done by team. Limestone deposits are found close to Mayville, and charcoal, likewise, was produced in the surrounding country; therefore, these materials did not require a long haul.

At the present time, the furnaces at Mayville are the most modern in the state. Both are 500-ton furnaces, about 80 feet high, and provided with self-supporting skipways. The only dry-blast system in the country is used in conjunction with these furnaces. The dry-blast is obtained by freezing the moisture out of the air. In this way a considerable amount of heat is saved and the quality of the iron is more uniform from day to day.

The waste gas from the furnaces, in excess of that used in the stoves, is burned under boilers. The steam derived in this way is used to run the blowing engines, dry-blast engines, and the turbines in the electric power plant.

We often think of the blast furnace industry as being far removed from Wisconsin — way off East perhaps — but here is an example of a typical plant of the most improved type right at our door, offering us opportunity for study and observation at first hand.

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*"To select well among old things is almost equal to inventing new ones."—Trublet.*

**A NEW TYPE OF RECTIFIER**

Preliminary announcements have been made of a new type of rectifier which is extremely simple in principle and operation and which will be described in detail in a forthcoming paper before the American Institute of Electrical Engineers. The discoverer of the principle is Dr. L. O. Grondahl, who described it in a recent number of *Science*. The rectifier consists of a disk of copper, having a coating of oxide formed on its surface, and another metallic disk forming the opposite electrode. Under suitable conditions current flows more readily from the oxide to the copper than in the reverse direction.

The peculiarity of the new rectifier lies in the fact that the direction of the electron flow is opposite to that indicated by the theory underlying the electron tube. Explanations of contact rectification that appear most prominently in the literature, as, for example, electrolysis and thermoelectricity, are shown by Dr. Grondahl to be untenable for the new electronic solid junction rectifier. The seat of rectification is apparently restricted to the layer near the junction between the copper and the compound formed on it.

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**HUNTING FOR "BURIED TREASURE"**

One of the many mysteries of the Earth will soon be uncovered, if the hopes of Mr. D. M. Barringer Jr. come true. He predicts that under the floor of the famous Meteor Crater of Arizona lies a huge meteor, perhaps the largest that has ever struck this World, composed of meteoric iron and nickel and rich in the metals of the platinum group.

Many parties have explored and operated in the Crater, but all have given up in despair of ever finding the "buried treasure". All of this early work has been carried on in the center of this mile in diameter crater. Mr. Barringer has made a very careful study and survey of this distict, and through the many evidences that he discovered, he is able to show beyond reasonable doubt that a meteor lies buried at the far south end of the bowl.

A shaft is to be sunk to a depth of 11500 feet from which level lateral tunnels will be driven. Mr. Barringer's father who was a Mining Engineer carried on a bit of exploration work for a private company back in 1908. He succeeded at this time in imbedding his drill bit in solid material at the exact depth at which his son predicts the meteor to lie. Due to lack of funds the work had to be discontinued. As only a soft sandstone is known to underlie the district, it is highly probable that his bit struck the meteor. With this and many other facts and principles of geology in his favor, Mr. Barringer seems to have a very good chance of succeeding.

—*Scientific American.*

# Campus Notes

### PI TAU SIGMA ELECTS SEVEN MECHANICALS

Five juniors and two senior mechanical engineers were initiated into Pi Tau Sigma, National Honorary Mechanical Engineering Fraternity on November 1. The men are: R. V. Brown, '29; L. A. Dodge, '29; R. Hartenberg, '28; E. Koebke, '28; H. E. Rex, '29; E. W. Rusch, '29; and M. H. Rutherford, '29.

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Wm. A. Kuelthau, freshman electrical, has been elected to Phi Eta Sigma, freshman honorary society.

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### ENGINEERING INSTRUCTORS JOIN FACULTY BOWLING LEAGUE

Instead of forming a league of its own as in former years, the engineering faculty has joined in the all-university faculty bowling league and has nineteen men in the eight teams organized. The results of several years of competition among the engineers have shown that they are "there with the goods"; the high single game and three game records are held by them.

The men representing the Engineering school are Professors Hyland, Watson, Wilson, Larson, Millar, and Van Hagan; instructors Barker, Basford, Griffith, Anderson, Shiels, Richtmann, Doke, Trotter, Livermore, McNaul, Worsencroft, and Puerner.

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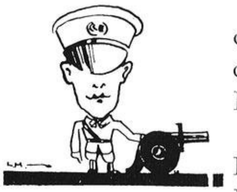
### E. C. M. A. HOLDS CONVENTION AT OHIO STATE

The seventh annual convention of the Engineering College Magazines Association was held at Columbus, Ohio, October 20 to 22, the Ohio State Engineer being the host to the twenty-one engineering magazines represented. Prof. L. F. Van Hagan, national chairman of the association, and R. W. Leach, business manager of the *Wisconsin Engineer,* were the Wisconsin representatives.

Certificates of merit for publishing the best student editorial and the best alumni notes department last year were awarded to the *Wisconsin Engineer*.

### THIRTEEN ENGINEERS APPOINTED CADET OFFICERS

The announcement of the appointement of R. O. T. C. cadet officers for the year includes the names of thirteen engineers out of thirty. They are as follows:



Field artillery, A. C. Herro, ch'28, and J. F. Galbraith, e'28, captains; C. J. Nees, m'28, and R. H. Brigham, e'28, lieutenants. Signal corps, W. H. Fuldner, Ransom Tyler, H. W. Zermuehler, L. V. Saari, B. A. Wunsch, and Haaken Romnes, senior electricals, captains; A. P. Engrebretson, C. B. Robertson, and M. N. Goldstein, junior electricals, lieutenants.

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Prof: "I believe you missed my class yesterday."

Stude: "Why no I didn't, really; not in the least."

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### TAU BETA PI SLIDE RULE AWARDED TO ROEMING.

The slide rule awarded annually by Tau Beta Pi to the sophomore engineer with the highest weighted average for his first year was given to G. C. Roeming, civil, with an average of 94.11.

The next ten men in the class and their averages are as follows: R. E. Sanner, civil, 93.38; R. J. Kraut, mechanical, 93.37; E. A. Johnson, electrical, 92.82; Chas. Schwartz, chemical, 92.55; Wm. A. Kuehlthau, electrical, 92.29 (second semester only); R. W. Kubasta, mechanical, 92.05; E. W. Howes, electrical, 91.58; S. K. Guth, electrical, 90.52; S. L. Johnson, electrical, 90.26; and R. S. Plotz, civil, 90.08.

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### TALK ON NAVAL FLYING COURSE GIVEN BEFORE A. S. M. E.

At the first meeting of the A. S. M. E., on October 13, a detailed talk was given by R. R. Smith on his experiences while taking the flying course at the Great Lakes Naval Training Station. He told the mechanicals how rigorous the medical examination was, how the "whirling" tests was made, and how flying was actually taught.

Plans were made for a membership drive among the Sophomore and Junior classes. Initiation was planned to be held in November, committees being appointed to see to the surprises for the initiates and to see that the staple form of refreshment was not wanting.

(Continued on page 60)

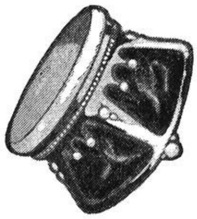
# Waste Dethroned!

Waste no longer reigns in Industry! Timken Bearings have decreed it! Machinery users are freed of the excessive tax of friction, wear, inaccuracy and under-production.

Power savings as high as 60% and lubrication savings of even greater proportion stand to the credit of Timken Tapered Roller Bearings.

On high speed work Timken Tapered Roller Bearings are being specified for operation at 15,000 r. p. m. On heavy duty jobs Timkens are carrying single loads upwards of 2,500,000 pounds.

On the spindles of the finest machine tools Timkens are making extreme precision a permanent quality. In electric motors Timkens are revealing hitherto unheard of saving and endurance.



In *every* type of equipment the exclusive combination of Timken tapered construction, Timken POSITIVELY ALIGNED ROLLS and Timken-made electric steel has brought a new era of economy, precision and endurance.

So great are Timken betterments that it is advantageous in many cases to replace obsolescent types of equipment *at once*. Leading manufacturers in every line now offer Timken-equipped machinery.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

**TIMKEN *Tapered Roller* BEARINGS**

# Editorials

**GIANTS OF 1940!** Wanted — business leaders for the next generation. They're in the making. Here and now they are being measured — jaw for force — eye for vision — shoulders for breadth to carry the irritations of detail — giants of a new kind for a new era.

Giants change!

There was the type that came with the puffing Iron Horse. Pioneers! Drivers who triumphed by sheer force alone.

They drove railroads across the continent. They bridged rivers, built cities, linked them up with telephone and telegraph.

New conditions of growth, development, and competition have evolved a new race of giants. A race that is less the pioneer and more the organizer. Years ago these leaders were burning the midnight oil. They were studying and analyzing — equipping themselves to direct the successful businesses of today.

Who will be the industrial giants of 1940? They will be the men who are burning the midnight oil right now. Men who are studying organization, labor, finance, selling, buying, transportation — the fascinating subject of practical business economics.

As the president of a nation-wide public utilities company said, "Somewhere there is a man getting ready for my job."

Business today is operated on the double quick. Decisions involving thousands of dollars are made by a nod of the head.

Quick decisions are sometimes called "hunches". But the successful man's hunches are based on a background of experience, observation, and study.

How do you stack up, Wisconsin Engineers? Are you gaining the ability to make right decisions at the right time? Are you reaching out and grasping the opportunities that are daily set before you? *Are you fitting yourselves to be the giants of 1940?*

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**R. O. T. C.** Of late the Reserve Officers' Training Corps unit at Wisconsin seems to have run afoul of hard luck. The largest part of the artillery detachment has been demobilized since the beginning of the semester, and now the entire R. O. T. C. system is under fire. Whether the fire is a real honest-to-goodness fire, with smoke and everything, or just a strong blast of hot air is yet to be seen.

Our feelings in the matter are somewhat varied. It has always seemed to us that the Military Department offers an excellent course (at least so far as we have gone with it) in the fundamentals and practice of national defense. To get the same amount of training elsewhere requires years of training and subordination, and then the reward of a commission is not assured. The R. O. T. C. system places the college-trained man in a position of leadership — his rightful position — one which he could not readily have attained without it.

But the pacifist cry has been raised! War must be made impossible, therefore the army must be disbanded — they would put out the fire by carrying the smoke away in buckets.

We are sorry to see events take such a turn. It has always been our secret hope that the future would see an air detachment here, manned by men from the College of Engineering much as the Signal Corps is now manned by engineers. We had also hoped that in connection with the air detachment, the college would offer a course in aviation covering both the theoretical and the practical phases of this thrilling new science. Madison is ideally located for the training of pilots and the manufacture of planes, and the situation has all the earmarks of an opportunity.

But the pacifists, like the poor, are with us always — they whine by day and howl by night. The R. O. T. C. must go!

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**STAFF POSITIONS** While the staff of the *Wisconsin Engineer* is reasonably well rounded out, there are still some fine positions left open for men who wish to gain the very valuable experience which this type of work offers. We wish to take this opportunity to especially urge the freshmen and sophomores to make themselves known to the staff members and indicate what branch of our work interests them most.

There seems to be a mistaken idea going the rounds that to work on the staff of the *Engineer* requires some uncanny superhuman ability or a God-given aptitude at putting one's thoughts and mental processes down on paper. Nothing could be farther from correct. One must, of course, be able to write coherently and simply, but beyond that point no especial ability is required.

Our year is getting nicely under way. The first, and most difficult to publish, issues are off the press. From now on, the going will be smooth and anyone who has a desire to become a staff member will find that this time is especially propitious for a beginning. Engineering journalism is a broad field, rapidly increasing in importance, and employers are eager to secure the services of men who have shown ability in that direction. Here is the place to make a beginning and now is the time — come around and get acquainted with the staff.

# Alumni Notes

At the last Badger-Wolverine tilt the following alumni registered as present:

**Arnold, A. B.**, m'26, Racine, Wis.
**Blaisdell, C. O.**, e'24, Chicago, Ill.
**Ely, Alex W.**, c'12, Janesville, Ill.
**Fredrickson, A. F.**, m'18, Waukeshaw, Wis.
**Field, G. H.**, c'25, Milwaukee, Wis.
**Flom, M. O.**, m'21, Chicago, Ill.
**Hahn, L. H.**, min'21, Milwaukee, Wis.
**Hoebel, H. F.**, e'25, Adrian, Mich.
**Jones, T. D.**, min'22, Omaha, Nebr.
**Jensen, Harold Wm.**, c'25, Chicago, Ill.
**Karger, Frank.**, c'20, Milwaukee, Wis.
**Kubosch, F.**, ch'23, Milwaukee, Wis.
**Mitchell, Norman M.**, m'23, Milwaukee, Wis.
**Meyers, J. W.**, c'27, Kenosha, Wis.
**Nelson, W. F.**, e'27, Green Bay, Wis.
**Olson, E. E.**, m'24, Milwaukee, Wis.
**Osius, E. F.**, e'24, Jackson, Mich.
**Risteen, H. W.**, m'24, Wisconsin Highway Commission, Eau Claire, Wis.
**Schrader, R. R.**, c'26, Chicago, Ill.
**Strassburger, Erich.**, c'26, Kohler, Wis.
**Robinson, H. P.**, ch'27, Milwaukee, Wis.
**Rubenstyne, Jack.**, m'21, Engineer Turner Construction Co., Chicago, Ill.
**Thiemann, V. A.**, e'25, Green Bay, Wis.
**Thomsen, D. E.**, c'27, Fon du Lac, Wis.
**Vaclavik, F. J.**, e'24, Engineer Commonwealth Power, Jackson, Mich.
**Vallee, J. W., e'27**, Milwaukee, Wis.
**Webster, H. C.**, c'08, Milwaukee, Wis.

## ELECTRICALS

**Andrae, Stephen C.**, e'25, is teaching in the College of Engineering at the University of Minnesota. He was formerly in the Chicago office of the Westinghouse Co.

**Coe, S. M.**, e'24, was in Madison for the week-end of the Michigan game. Mr. Coe is appraisal engineer for the United Light and Power Company of Davenport, Iowa. His home address is 1305 W. 3rd St., Sterling, Ill.

**Cotter, Sylvester D.**, e'27, was in Madison Oct. 30 to visit his parents. He is working for the Michigan Bell Telephone Company of Detroit, and has completed their six week's school for student engineers. He says he likes his work, likes Detroit, and likes married life, so we certainly envy him. His address is 11786 Whitham Ave., Detroit, Michigan.

**Everett, Richard E.**, e'27, is taking the training course for student engineers given by the General Railway Co. of Rochester, New York. His present address is 39 Grover street, Rochester.

**French, Newell E.**, e'23, whose marriage to Miss Margery Swoboda of Racine last May, was one of the big social events of the season, is living at 1249 Drake St., Madison, Wis. Mr. French who was Faculty Adviser for the 'Engineer' for three years is now in the Statistical Department of the Wisconsin Railroad Commission at Madison.

**Gale, Grant O.**, e'26, is now located with the Kewaunee Manufacturing Company of Kewaunee, Wisconsin. He was formerly employed by the Illinois Bell Telephone Company of Chicago, Illinois.

**Lardner, Henry A.**, e'93. A friend from New York City sends us a clipping from the roto section of the Sunday paper showing four solid-looking citizens in tuxes, with the information that they officiated at the opening of a new school in Montclair, N. J. In the midst of the group is Mr. Lardner, designated as Mayor of Montclair. As a side issue to mayoring, he is vice-president of the J. G. White Engineering Corporation. He is one of the many graduates in positions of responsibility who are regular subscribers to the 'Wisconsin Engineer'.

**Matthias, Lynn H.**, e'26, is taking graduate work at the university. He is living at the Orchard apartments on North Orchard St., Madison.

**Walvoord, R. H.**, e'27, is with the T. M. E. R. & L. Co. of Milwaukee, Wis.

**Wooldrige, Kent E.**, e'25, was married Sept. 28, to Miss Lucille Otis of Neenah. Mr. and Mrs. Wooldridge will live in Chicago, where he is employed as an electrical engineer. Mr. Woolridge won the Wisconsin Utilities Scholarship in Electric Railways in his senior year at the University.

**Woy, Prof. F. P.**, e'03, who has been giving the courses in Engineering Administration is on a year leave of absence from the University. Prof. and Mrs. Woy are spending the winter in California for the sake of Mrs. Woy's health. Their address is La Bonita, 1162 Prospect St., La Jolla, California.

**Wise, J. E.**, e'16, who is Illuminating Engineer with the Wisconsin Industrial Commission has moved from 1615 Summit Ave., to 2238 Eton Ridge, Madison, Wis.

## CHEMICALS

**Oliver W. Storey**, ch'10, a chemist in the Burgess laboratory at Madison, together with G. T. Corlinson of Niagara Falls, has been granted a patent for a new process of producing oxidized carbon.

## MECHANICALS

**Drewry, M. K.**, m'22, who was at one time editor of the 'Engineer' informs us that his new address is 755 Beulah Ave., Milwaukee, Wis. Mr. Drewry is an engineer of the power plant division of the T. M. E. R. & L. Co.

**Edwards, A. W.**, m'25, has changed his address to 307 Building Industries Building, Cincinnatti, O. He is sales engineer with the Trane Co.

**Flom, Mervin O.**, m'21, M. S. in Metallurgy '22, was in Madison for the Michigan game. Flom is with Sargent and Lundy, 72 W. Adams St., Chicago, Ill. He is the proud father of a son, John Mervin, age four months.

**Gillette, Edmond S.**, m'13, better known as "Eddie", Wisconsin's greatest quarterback, is now putting a plant into operation for the manufacture of metal furniture at Santa Monica, Calif.

**Polaski, Steve**, m'26, while in town to see the Michigan game, called on Prof. Hyland. He is still working for the Forsythe Leather Co. of Wauwatosa, Wis.

**Shoemaker, W.**, m'25, wrote to say that he is working for the Yale and Towne Co. in his home town, Philadelphia, Penn. He is much pleased with the work and sends his best regards.

**Stewart, Frederick C.**, m'23, writes, "I notice that the 'Wisconsin Engineer' is about to come out again, and should like very much to have my name on your mailing list. As you see from the letter-head I am now at the Georgia School of Technology as Assistant Professor. There are a number of Badgers around here and we manage to display a little Wisconsin spirit at times."


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### MINERS

**Field, W. S.**, min'24, revisited the University recently. Mr. Field is employed by the Indian Territory Illuminating Oil Co. with headquarters at Witchita, Kansas.

**Jones, T. D.**, min'22, Superintendant of the American Smelting and Refining Co. of Omaha, Nebr., reports the birth of a son, Thomas Morgan Jones, on June 26, 1927.

**Nelson, Floyd**, min'24, and **M. Dwight Harbaugh**, min'24, are with W. C. McBride, Inc., St. Louis, Mo.

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### CIVILS

**Abbott, Ellis P.**, c'08, has left his position as chief construction engineer for the Pan American Petroleum Transport Company, of New Orleans, and is sailing for South America, where he will go as sales engineer for the Crane Export Corporation.

**Abendroth, George H.**, c'25, is now with the Dravo Construction of Camden, N. J. During the two years following his graduation he was instructor in Railway Engineering at the university. His present address is City Y. M. C. A., Camden, N. J.

**Ahrens, B. F.**, c'23, formerly of La Crosse, Wisconsin, has removed to Black River Falls, Wisconsin, and can be reached there care of Mrs. Caves.

**Anderson, Russell A.**, c'15, is in partnership with his brother in the material supply business at Sawtelle, Calif., with offices also in Los Angeles.

**Barnes, E. M.**, c'22, and **A. J. Horst, c'27, are** located on the construction of the new Fayette County building in Uniontown, Pa. They are employed by Engstrom and Wynn of Wheeling, Pa.

**Batchelder, F. J.**, c'15; CE'17, has announced a change in the name of his firm from the Illinois Appraisal Company to F. J. Batchelder and Co., Inc. His offices are located in Chicago and New York.

**Bendt, J. P.**, c'12, is engineer with the Koppers Construction Co., working on coke oven construction. His address is 298 Manistique Avenue, Detroit, Michigan.

**Buckmaster, J. L.**, c'27, has secured a position as Junior Topographic Engineer with the United States Geological Survey located at La Crosse, Wisconsin.

**Busby, Lynn J.**, c'25, has moved from 1430 Mound St. to 519 S. Orchard St., Madison, Wis. Mr. Busby is in the employ of the Wisconsin Highway Commission.

**Case, J. Frank**, c'90, to whom the college is indebted for the Archibald Case Loan Fund for needy engineering students, was appointed last year by the League of Nations as a member of a committee to investigate and advise about transportation facilities in Poland. The problem is exceptionally interesting because, in the past, Poland was developed with a view to the interests of the countries among which it had been partitioned. The duty of the committee was to plan a system of railways, waterways, and harbors that would assist in the development of a re-united Poland. It was also asked to report on the drainage of the Pripets marshes which cover a tremendous area in eastern Poland. Printed copies of the two reports have just been issued by the League. The Polish government has already begun to carry out the recommendations made therein.

**Chase, Leon E.**, c'22, has left the Bridge Department of Illinois Highway Commission and gone to Pontiac, Mich. His address is 204 Whittemore Street.

**Eldred, George E.**, c'16, has been appointed to succeed F. F. Mengel as division engineer for the Wisconsin Highway Commission at Wisconsin Rapids.

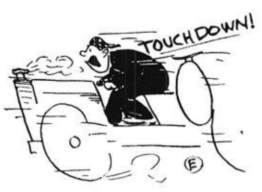
**Gartner, I. C.**, c'24, was in Madison the first part of August looking up old friends. He was on his way to his mother's home in Missouri and expected to visit Denver friends before returning to his position with the Commonwealth Power Co., at Jackson, Michigan.

**Gettleman, W. F.**, c'14, visited the college on Oct. 10. He is in consulting practice in Los Angeles under the firm name of General Engineering Service Co., 321 Byrne Bldg.

**Green, Sherman**, c'23, writes that after spending a year with the Pitometer Company, Kansas City, he went to Texas with the Humble Oil and Refining Company. Upon the failure of his father's health, he went to Idaho and now "I am mismanaging 1500 acres of irrigated aggravation". He has a son, Sherman Jr., whom he is sure will attend the Engineering School at the University of Wisconsin.

**Hedges, Warren B.**, c'26, is now associated with the Hedges-Weeks Construction and is doing rail work on masonry construction in Florida and Alabama. He gives his address as: Hedges-Weeks Construction Company, Aliceville, Alabama.

**Buck, Howard P.**, c'17, is coaching the football team at the University of Miami, Florida. "Cub" was well known to football fans during his years here at school, having captained the Badgers in 1915. Last year, his first as the Miami coach, the team won every one of its games despite the fact that it was the first team to represent the University of Miami on the gridiron.




**Howson, Louis R.**, c'08, CE'12, has been elected a trustee of the American Water Works Association, his term of office ending in 1930. Mr. Howson presented a very well done paper on the Water Softening Plant of Miami, Florida, at the 47th Annual Convention of the Association in June, and the article has been reprinted in the July issue of "Water Works". He is a member of the firm Alvord, Burdick and Howson of Chicago.

**Mackie, J. E.**, c'23, secretary of the Pacific Coast Building Officials Conference, appeared before the Building and Loan Secretaries Association of Southern California at the August meeting of that body and presented the purpose and scope of the uniform building code movement. Following his talk the Building and Loan Secretaries passed a resolution endorsing the work of the Conference and urging the adoption of the code by the various cities when practical and equitable.

*(Continued on page 61)*

# Engineering Review

## DIABOLIS PENETRABILIS

The Diabolis Penetrabilis is a new crustacean recently seen in the neighborhood of Wisconsin Rapids, Wisconsin. Translated into English the name means "The Devil that Goes" or "Go-Devil". One can easily see the reason for this name when the Diabolis is studied. Through a ten inch pipe line about four miles long the Consolidated Water Power and Paper Co. pumps sulphite pulp from the slush tanks of its mills at Wisconsin Rapids to the slush tanks of its mills at Biron. As reported by the *Consolidated News,* the magazine of the company, this in itself is quite an accomplishment. There was a tendency for a slimy jelly-like fungus to grow on the inside of the pipe. When this fungus occasionally broke off, it discolored the pulp. Chemical treatment did not solve the problem; so Mr. T. R. Hayton of Appleton, Wisconsin, was called on to find a method. His work resulted in the invention of the Diabolis Penetrabilis. It is about twenty-four inches long and is equipped with hardened steel blades or scrapers which look much like propeller blades, except that they are rounded at the ends to fit the pipe. There are guides both fore and aft to keep the blades on the pipe walls and the motion of the liquid propels and rotates them. Thus the fungus is swept off the walls and the Diabolis moves forward through the pipe at a speed of two hundred feet per minute. It has never failed to negotiate turns on the twenty foot vertical run of pipe at the Biron end. We can well believe that scientists and bioligists are flocking to Wisconsin to study the Diabolis Penetrabilis in its native habitat.

—*Power Plant Engineering.*

## WEB STRESSES IN CONCRETE BEAMS

Tests of 139 reinforced-concrete beams to investigate shear failures and webb stresses are reported by Prof. T. E. Richart in Illinois Engineering Experimental Station Bulletin 166, just issued. The tests extended over a 12 year period, and dealt with spans of 6 to 10 ft., depths of 10 to 21 in., and flange widths up to 21 in., loaded usually at the third-points. In the beams which had no web reinforcement, failure was by diagonal tension at shearing unit stresses from 130 to 580 pounds per sq. in. Failure occurred suddenly, without display of toughness. Beams with web reinforcement always showed gradual yielding. They exhibited the largest amounts of diagonal tension in the region between load-point and support, while near load and support the diagonal tension was relatively small. The diagonal tensions reached large values in those beams which were under heavy shearing stress compared to the bending stress — that is, short and deep beams, and those having large percentage of longitudinal steel. However, these beams also showed the highest shear capacity. Adequate anchorage of both longitudinal and web steel was found to be important. Generally the observed stresses in the web steel were well below the stresses calculated on the assumption that the web steel carries all the shear, and approximated those corresponding to the division of the shear between concrete and steel sections. But with increasing percentage of web reinforcement, the proportion of the total shear carried by the web steel increased. Vertical web members were about equally effective with those inclined at 45 degrees. —*Engineering News-Record*

## GREAT RESERVOIR FOR LONDON'S WATER SUPPLY

The water supply of the City of London has recently been increased by the addition of a new reservoir, known as Queen Mary's Reservoir. It is of interest because it is the largest reservoir in the world having artificial embankments. This impounding basin covers an area of about 723 acres, and has a capacity of nearly 7,000,000,000 gallons.

As the site selected was on flat ground, the entire bottom of the reservoir had to be excavated to a depth of six feet below the surface; the material thus obtained being used to rear the enclosing embankments, which rise to a height of 38 feet. The inner slope of the embankments is lined with concrete slabs six inches thick, and the outside, covered with rich soil and loam, is to be planted with ornamental shrubs. The exterior outline of the reservoir is that of an irregular 7-sided polygon with rounded corners, and advantage is being taken of this to add to the scenic charm of the structure.

— *Compressed Air Magazine*

## USE OF NOBLE GASES

In recent years helium, neon, and argon have been obtained economically enough to make them of commercial importance. It has been found that a beautiful red glow is produced by passing an electric discharge through a glass tube containing a small amount of neon. Hence neon is now used in a novel type of electric sign in which the letters and designs are made from glass tubing. Helium, as we all know, is used advantageously in balloons because of its lightness and non-inflammability. Argon is used for filling electric light bulbs of high power as it is found to increase their efficiency as compared with vacuum lamps.

—*Scientific American.*

## CAMPUS NOTES

*(Continued from page 52)*

### AUTOMATIC CLOCK INSTALLED IN STEAM AND GAS LABORATORY

A clockwork mechanism has been installed in Prof. G. C. Wilson's office which automatically rings the bells for readings on the engine tests made in the Steam and Gas Laboratory. It eliminates the old "pipe and gong" with which junior and senior engineers have been working up to this time.

The mechanism was designed and built by Mr. Romare, builder of the gridclock, and also of the class bell mechanism. It consists of a Seth Thomas clock which makes electrical contact every half second. The current, when contact is made, operates a relay much like the escapement in the clock, which in turn operates two gears, one making a revolution every ten seconds and the other every five minutes. By means of projections on these gears, the signal bell is rung once every five minutes and two-ring warning is given ten seconds before each ringing.

The men working with the clock are very well satisfied with it and are rather proud that it is a product of the Engineering building, both in design and in construction.

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H. C. Weiss, min'28, the 1927 St. Pat, did not return to school this fall but is head of a good sized crew doing Indiana road work. No, not making little ones out of big ones.

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### A. I. E. E. HOLDS GET TOGETHER

The first meeting of the student branch of the A. I. E. E. was held Wednesday, October 19, in the Engineering Auditorium. It was a general get-together for the senior, junior, sophomore, and freshmen electricals.

Prof. C. M. Jansky and Prof. E. Bennett told what the A. I. E. E. stood for and explained the relation between the national body and the local student branch. H. J. Kubiak played a violin solo, accompanied by Miss Dixon at the piano.

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R. B. Teare, e'27, has been granted a research fellowship in the Electrical engineering department.

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### THEY SOUND REASONABLE

Another crop of civil juniors is being introduced to the English language with interesting results, as indicated by the following definitions culled from their attempts at defining words:

Refractory—pupils eating place at a boarding school.
Extant—distance between midle of chord and arc.
Mitigate—to move to other parts.
Gubernatorial—pertaining to the power of eating.
Alluvium—a bright metal.

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Prof. R. S. McCaffery, department of mining engineering, is conducting a research of the contents of the slag from the St. Louis iron furnaces.

## ALUMNI NOTES

*(Continued from page 57)*


**Nelson, Russell A.**, c'26, was married to Miss Elizabeth Edwards of Madison, on October 15, in the first Congregational church of this city. Mr. Nelson is now in the contracting and building business with his father in Madison. He is living at their new home on Oxford Road, Shorewood Hills.

**Pilz, Russell J.**, c'26, is now in Chicago. He is living with William Bradenburg, c'27, at 454 Melrose St., Hotel Del Monte, Chicago, Ill.

**Price, Elmer E.**, c'23, visited Madison during the registration period. He is advertising manager for Eugene Dietzgen Co. and is a booster for more and better English for engineers. The latest catalogue of the company was written by him and he prepares many special bulletins. Incidentally, he is the father of a 2-year old son, Thomas Spencer. His business address is 166 W. Monroe St., Chicago. His home address is 536½ Michigan Avenue, Evanston, Ill.

**Saks, John S.**, c'25, gives his new address as 2920 Wrgiht St., Milwaukee, Wis. He is resident engineer with the Metropolitan Sewerage Commission.

**Severson, Norman A.**, c'27, is employed as a draftsman for Consoer, Older & Quinlan, consulting engineers of Chicago. His present address is 1630 Juneway Terrace, Chicago, Illinois.

**Smith, Judson P.**, c'26, fellow in hydraulic and sanitary engineering last year, spent the summer with the United States Public Health Service, inspecting water systems on lake steamers at Sault St. Marie, Michigan. On October 1, Jud will begin work for the Marathon Rubber Products Company of Wausau, Wisconsin.

**Smith, Leon A.**, c'12, superintendent of waterworks at Madison, Wisconsin, is the author of an article describing the new six million gallon reservoir at Madison, which appears in the May 26 number of the Engineering News-Record.

**Tate, Stanley A.**, c'26, who is with the Wisconsin Highway Commission, is working at present as inspector on the laying of pavement on U. S. Highway 51, between Mosinee and Rothschild. His temporary address is Mosinee, Wis.

**Thiel, Walter C.**, c'22, is acting efficiency engineer for the city of Los Angeles during the absence of his superior who is taking a two month's trip to Europe.

**Tschudy, L. C.**, c'23, has been with the Feather River Power Co., Storrie, Calif., for nearly a year and a half. During that time he has had direct supervision of the survey and construction of a two mile waterway through solid granite. Since the completion of that project, he has had charge of the survey for an eight mile Conduit grade line. After completing the survey, he was given the privilege of completing the work. The pipe at the inlet is 23 inches and at the outlet it is 36 inches. In connection with the actual construction of the pipe, three small dams, ranging from 15 to 80 feet, are being built to divert the flow of small streams into the pipe. An interesting point in the construction of the pipe is that it is being acetylene welded, a comparatively new thing in the construction of pipe lines of this type.

**Wolf, Albert M.**, c'09, CE'13, was in Madison for the Michigan game. He is at present the president of the firm of Wolf, Sexton, Harper & Trueax, Inc., Engineers and Architects, with offices on the 30th floor, Tribune Tower, Chicago, Ill.

**THE MISSISSIPPI FLOOD SITUATION**

*(Continued from page 49)*

being done than if they believed it impossible, and the job of building an expectation of success was an element just as vital in the progress of this work as the design of the concrete conduits."

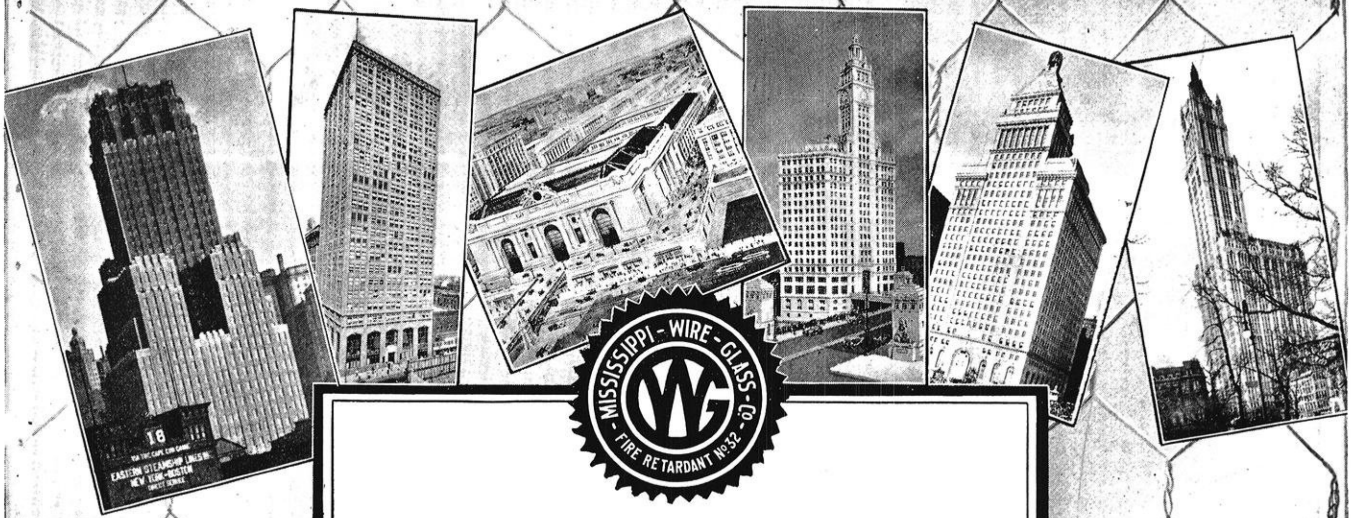
Every great engineering project has in it something that effects future engineering works. Fifteen years ago, according to Mr. Morgan, the attitude of American engineers on reservoir control of floods was quite uniformly hostile. We find in his address, mentioned above, "On the Lower Mississippi there had been a long, hard fight over the question of reservoirs or levees. The use of levees was right; the Army engineers knew it was right — they had fought for their use and in that fight reservoirs *in toto* were pretty well discredited."

So well had the army engineers convinced the public and other members of the profession that levees were the best means of flood control, that when reservoirs were finally adopted for control in the Miami District, criticism was showered upon the engineers from all sides, even from within the profession. To see the job through, it was necessary to gain the substantial engineering opinion of the country, so they brought in the leading engineers who opposed their ideas, spread before them the surveys and data which led to the decision that reservoirs were the most practical, and the opposing engineers could find no fault.

The Miami Engineers had faced an adverse engineering opinion built up by the Mississippi engineers in whose territory, Morgan states, reservoirs were entirely impracticable, and carried to fields where the question had not been caefully examined.

The Miami project is completed and the engineering profession as well as public opinion is "sold" on the reservoir plan. This spring the Mississippi indulged in another flood, and now the tables have been turned. The Mississippi engineers are faced with an adverse engineering and editorial opinion built up by the Miami engineers, in whose territory levees were impracticable, and another campaign of education will probably be necessary.

Blame for the failure of many public projects has been quite generally thrown upon the shoulders of the engineer. He is the 'goat' it seems, whether he really is to blame or not. The Chicago Tribune of Sept. 25, 1927, for example, quotes Charles Lathrop Pack, president of the American Tree Association as stating that the Mississippi flood was "one of the most gigantic defeats engineering science has ever suffered." His interest is evidently in government appropriations for planting trees, and the reflection his statement casts on the engineering profession is immaterial to him so long as he gains his point. However, we have some supporters: The Literary Digest (Apr. 30, 1927) quotes the Memphis Commercial Appeal, a paper printed on the banks of the Mississippi, as follows: "The government engineers have builded well with the money available, but it has been an uphill fight to get an annual



appropriation of $10,000,000. . . . If $20,000,000 a year is required for several years, the government cannot justify its position by withholding this amount." Surely the engineers cannot be blamed for their failure to prevent a catastrophe which they haven't been given more than half a chance to work at."

Remarks such as made by Mr. Pack should not be passively overlooked. Engineers as a rule "haven't time to argue," but in order to hold the prestige which the profession has obtained, it is necessary to nip such statements "in the bud".

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### BUS REGULATION IN WISCONSIN

*(Continued from page 48)*

The tax collector is to be a frequent passenger, for in addition to the certificate fees, annual report fees and ton mile tax, there are the usual bus and truck license fees, payments to municipalities for the use of streets and bridges, gasoline tax, real estate and personal property taxes, and state and federal income taxes.

The new law prohibits the use of trailers in passenger service and the use of double decked busses in interurban operation. Interurban busses are also limited to a length of thirty feet and a width of eight feet. Operating speeds may not exceed values resulting in an average speed over a prescribed route of twenty-five miles per hour.

It will be interesting to observe the effect of this legislation. If the experience of public utilities with commission regulation is to be reflected in the experience of the auto transportation companies, it may be that the industry will find its position considerably strengthened. Defined under the new law as "common carriers" and their financing controled by the commission in accordance with the state's stock and bond law, auto transportation companies in Wisconsin may find a wider market for their securities and enjoy more advantageous financing. And it is not unlikely that the industry will benefit through coordination of service and elimination of unwholesome competition.

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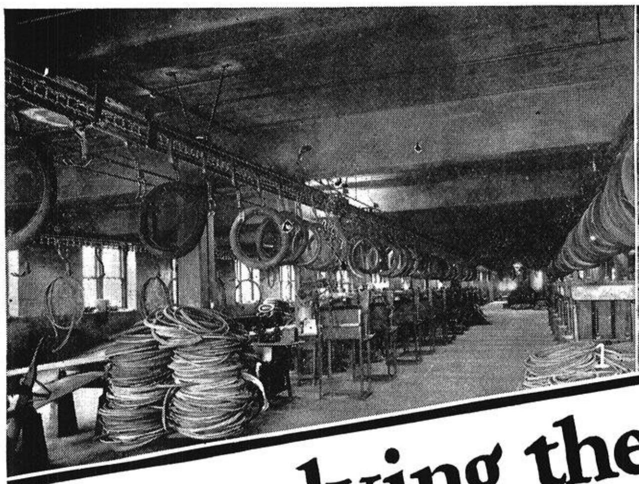
### THE MOTOR GENERATOR LOCOMOTIVE

*(Continued from page 47)*

single phase power is applied to the motor, operating it as an induction motor until synchronous speed is reached, when the field is applied and the motor pulls into step.

With the synchronous motor operating from the line, the locomotive is ready to operate. The first position of the controller energizes the main generator field from the main exciter through a resistance, and applies the resultant low voltage across the traction motors, now connected as series motors. As each of the thirty controller steps (45 on the D. T. & I.) is reached, more resistance is cut out of the generator field circuit, increasing the field of the main generator and consequently increasing the voltage across the



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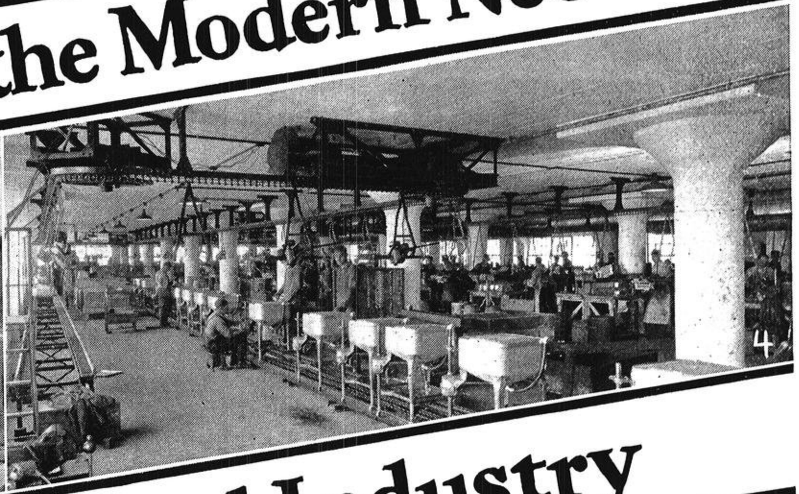

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traction motors, until the locomotive is running at normal speed, approximately half of maximum speed. It should be noted that each one of the thirty (or 45) steps are running steps, that there is no resistance in the motor circuits at any time, that the motor generator set can at all times deliver full power to the motors, that the only power loss is that due to the resistance in the main generator field circuit, a loss of truly insignificant proportions.

With the motor generator set now working at rated voltage, the motor circuit is rearranged to separately excite the traction motors. The controller passes through another thirty positions, each one a running position, varying the field of the traction motors. The excitation for this connection, used for high speeds at heavy loads, is furnished by the regenerative exciter.

*Regeneration*

With the exception of the split phase locomotives, using the inherently regenerative three phase induction motors, the motor generator locomotive furnishes the least complicated form of regeneration. In fact, the motoring connection last described is also the regenerating connection. The separately excited traction motors operate as generators, when the field strength, at any speed, is such that the voltage developed by the motion of the traction motors themselves is greater than the normal voltage of the main generator, reversing the current, and causing the main generator to drive the synchronous motor as a synchronous generator.

*Safety Devices*

When so many of the functions and so much of the equipment of the substation are placed on the locomotive, many of the safety devices have to come, too. It has already been mentioned that two pantagraphs are always up, to guard against any interruption of power to the synchronous motors, but should such a contingency arise, a relay has been provided which clears the traction motor circuits and replaces the starting connection of the motor generator set. Arrangement has also been made to automatically increase the synchronous motor excitation when the pull out point is approached. Another safety device reduces the load, giving an indication of the change to the engineman, whenever the grade increases or the trolley voltage decreases sufficiently to dangerously overload the locomotive. The division of the load between the two units is accomplished by having bus line connections between the two main exciters to insure the same field excitation for both main generators. The traction motors divide the load equally, whether connected for series or separate excitation. A ground detector checks the conditions of the circuits, and if a ground develops, indicates which side of the circuit is grounded.

The locomotive is well metered, so that the engineman can, at all times, see the operating conditions in both units.

Many of the these safety devices were developed for the Great Northern, being the outgrowth of the experience gained on the Detroit, Toledo and Ironton.

*A Contrast in Locomotives*

The motor generator locomotive has some very fine features, but railroad men, along with other shrewd buyers of electrical equipment, have a disconcerting habit of inquiring into comparative costs, comparative weights, comparative efficiencies.

But, unfortunately, the electric locomotive, unlike its steam brother, is still a highly specialized creature, its individual nature being subject to the whims and fancies of both designer and buyer. In fact, the locomotives supplied on each of the major electrifications are so much of a tailor made job that it is difficult to find locomotives of comparable design operating under comparable conditions.

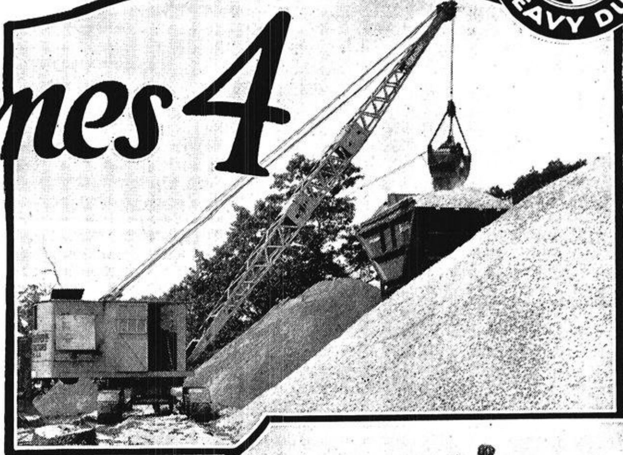
But there have been chosen, out of the locomotives of recent design, some which may be set up beside the motor generator locomotive to form some basis of comparison.

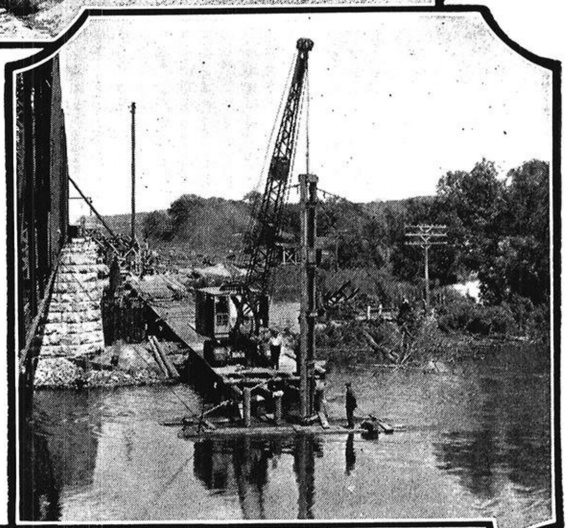
The 1924 Norfolk and Western (or its Virginian prototype) is a locomotive designed for slow speed heavy freight service, operating from a high voltage, single phase trolley. It may well be compared with the D. T. & I., designed for the same type of service, but without having to meet the severe grade conditions encountered on the Norfolk and Western. It will be noted that the D. T. & I. has a somewhat lighter weight, a slightly greater horsepower rating, and due to the lessened chance of slipping, will have a much greater maximum starting effort, proportionately more than shown, as this value is little more than conventional. The difference in flexibility is noticeable, the D. T. & I. having 45 running speeds in each of two connections, the N. & W. having but two speeds, both running.

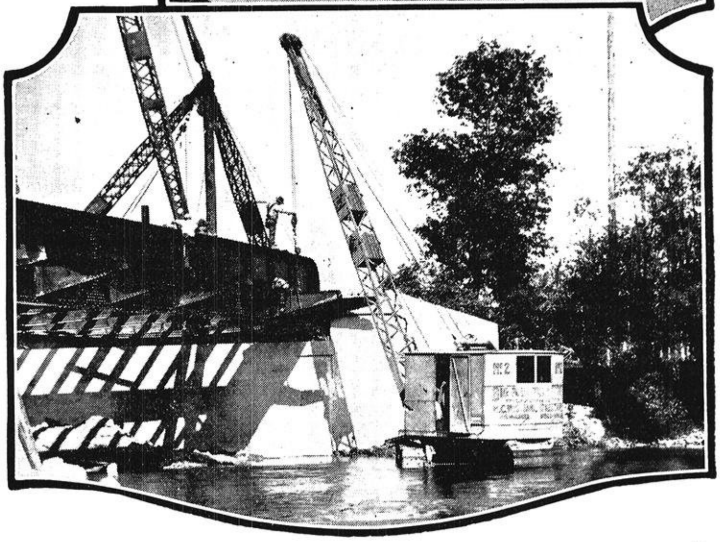
A somewhat fairer comparison can be made in the case of the Great Northern. This locomotive is designed for freight and passenger service through and over the Cascade mountains. Not many miles to the north, America's most spectacular electrification is handling the same service through the same mountains with d-c locomotives, built in 1920. And back in the East, the Pennsylvania settled, in 1924, on a single phase locomotive as a system standard. These two are both single unit locomotives, as contrasted with the other three discussed, which are all two unit locomotives. And these two are of the types to which the motor generator locomotive must prove itself superior if it is to gain ground.

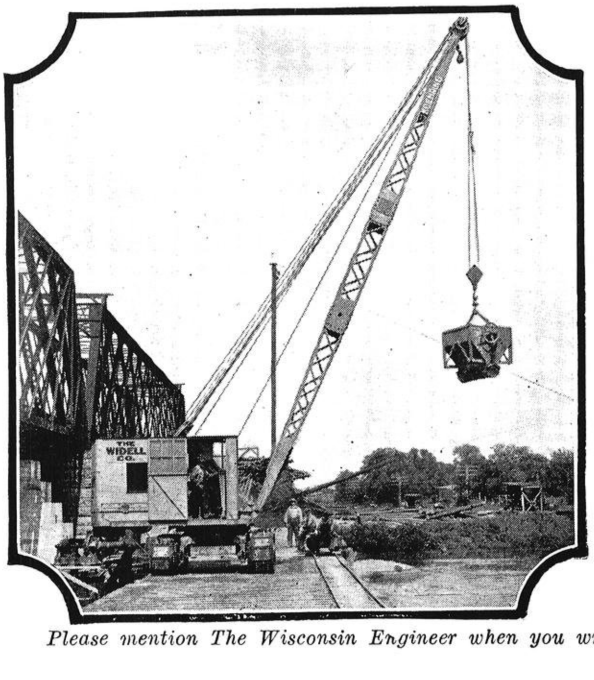
The Chicago, Milwaukee and St. Paul locomotive, somewhat lighter than the Great Northern, has a starting effort disproportionately lower, due again to the lack of slipping in the motor generator type. The higher horsepower rating of the C. M. & St. P. is due in great part to the much higher maximum and average speeds. The motor generator type scores again in the flexibility of operation having thirty running speeds in each of two connections, as against only three for the C. M. & St. P.

The Pennsylvania type L-5 is a much lighter locomotive, but has about the same characteristics, in proportion to weight, as has the C. M. & St. P, except









speed. And this means that the L-5 is also overmotored for its weight, speed and starting effort as compared to the Great Northern locomotives. This is due, as stated above, to the heavy advantage which the motor generator type has during the starting period.

It would not be safe to draw too many and too sweeping conclusions from such a comparison, but one fact does seem to stand out. In spite of "putting the substation in the locomotive", the motor generator type is no heavier, for its power and speed, than comparable a-c or d-c locomotives.

*The Future of the Motor Generator Locomotive*

Motor generator locomotives are daily demonstrating their practicability. The question now arises as to their future development.

It seems quite evident that, barring an extremely rapid development of the motor generator, or the modification of some other rectifying device, the motor generator principle will not soon be applicable to multiple unit equipment. But many electrification projects are extensions of, or have as an important portion, a terminal electrification, so that the system of electrification is largely dependent on the suitability of this system for multiple unit operation. There is quite a general feeling among both the railroad men and the travelling public that the trolley voltages common in single phase railway work, viz, 11000 or 23000, are far too high to be carried on or in the car that carried the passengers. But the extremely successful operation of the 11000 volt single phase electrification of the Philadelphia terminal of the Pennsylvania is fast removing the force of this argument.

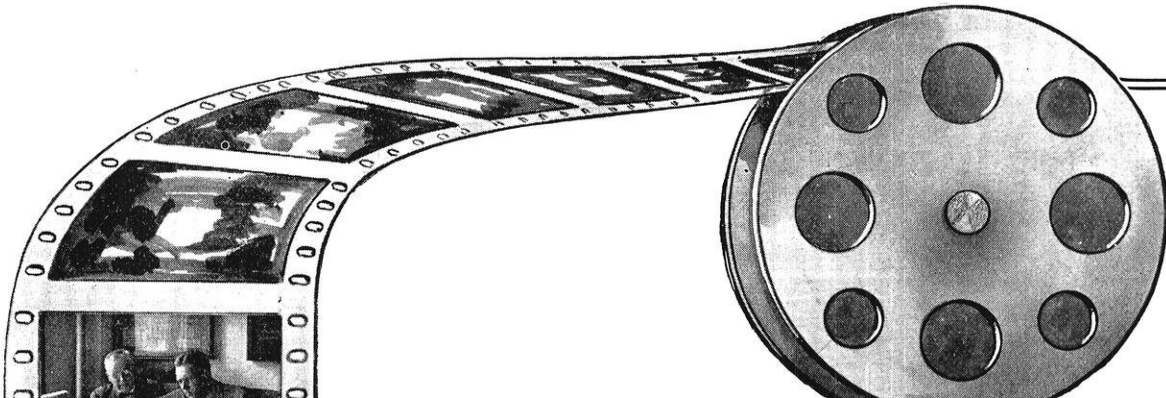
And this same terminal electrification has also removed much of the pith from the contention that a high voltage a-c trolley destroys the usefulness of near-by communication lines. It is not that the interference does not exist, but rather that means have been found to combat or nullify its effects.

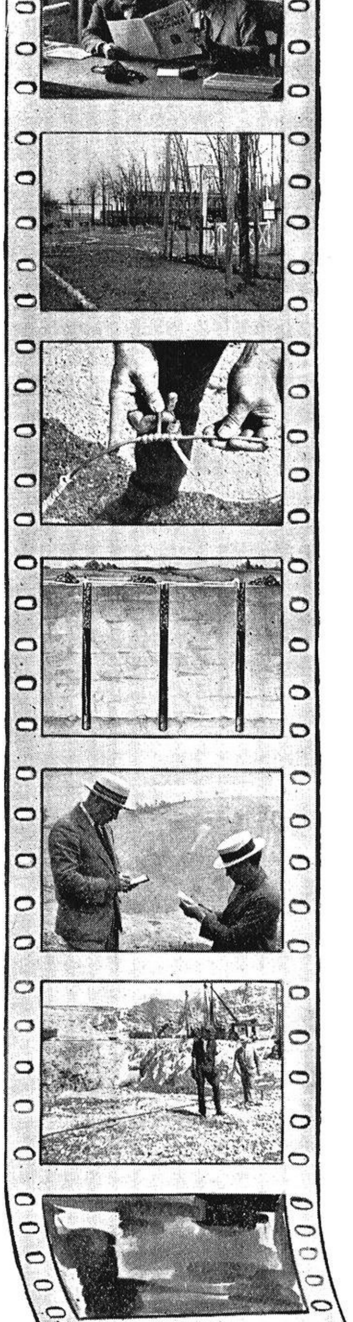
There are, therefore, at present few obstacles to prevent the application of single phase trolley to a complete project. And this will permit the use of the motor generator locomotive as well as the single phase locomotive.

It thus seems that the motor generator will have to demonstrate its superiority to the single phase locomotive rather than to any other type. Although the cost of the motor generator locomotive is somewhat greater, the weight for equal capacity is but little more. The motor generator locomotive possesses greater flexibility in running, greater economy of operation, a smoother and larger starting effort, a better power factor, and a far simpler means of regeneration.

Looking at the entire problem as impartially as we may, there seems to be a wide field for this type of locomotive. And although the two here described are the only successful ones yet built, other railroads are seriously considering their adoption, while many more are watching with deep interest the performance of the ones in operation.

The motor generator locomotive is here to stay.





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The title of another film "How Jimmy Won the Ball Game" apparently has no connection with explosives. The scenario is a story of human interest, tense with excitement, and some pathos, and it carries an important safety lesson in handling and using blasting caps.

All of these films are available for free distribution, the first two in Standard (35 m. m.) and narrow (16 m. m.) widths and the third film in Standard width only. Please make booking arrangements for showing these films as far in advance as possible to avoid disappointment.

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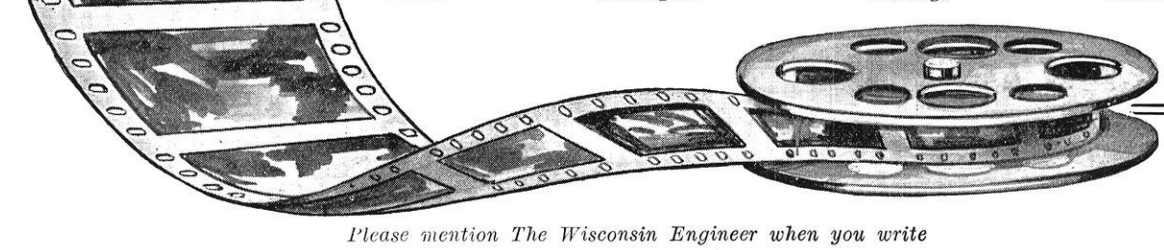

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