

The "New Mexico" making 21 knots

## U. S. S. "New Mexico"

### A Description of the World's First Electrically Propelled Battleship

By Henderson B. Gregory

**P**ROBABLY no battleship, excepting H. M. S. "Dreadnought," the pioneer of all-big-gun battery and turbine drive, has ever excited more widespread interest and comment than the U. S. S. "New Mexico," the first battleship afloat to be equipped with electric drive.

Electrical propulsion for vessels is not strictly speaking a new idea. It has been agitated for some years past, both in this country and abroad, but it is only quite recently that it has become an accomplished fact. To Mr. W. L. R. Emmet belongs the credit on this side of the Atlantic, while in Europe the Svenska Turbinfabriks Aktiebolaget Ljungstrom of Sweden has been the prime mover.

After much writing and discussion on the subject of electric propulsion, success was achieved in 1911, when the Navy Department awarded a contract to the General Electric Co. in June of that year, for electric propelling machinery for the U. S. Collier "Jupiter," according to designs prepared by Mr. Emmet. The unqualified success of this installation resulted in the Navy Department's decision to install electric propulsion in the "New Mexico," and after further study and investigation of the problem this decision has been extended to cover all capital ships.

The "New Mexico" is one of the three battleships authorized in 1914, her sister ships being the "Mississippi" and "Idaho," which are equipped with direct-drive Curtis and Parsons turbines, respectively. The Navy Yard at Brooklyn was selected to build the vessel, and the contract for the electrical machinery was awarded at a cost of \$431,000.

In appearance the "New Mexico" very closely resembles her immediate predecessors, as seen by the picture of the vessel. There is one large smoke pipe, between the two cage masts, four turrets on the center line—two forward and two aft—mounting twelve 14-inch guns, and the usual five-inch torpedo defense battery is also provided. The vessel is of the following principal characteristics:

Length on L. W. L. . . . . .	600' 00"
Length over all . . . . .	624' 00"
Breadth, extreme, on L. W. L. . . . .	97' 4½"
Draught, mean, to L. W. L. . . . .	30' 00"
Designed speed, knots . . . . .	21

The propelling machinery consists of two alternating current turbo-generators operating four motors, one connected to each line of shafting, there being four propellers. The general arrangement of the engine and motor rooms is shown on page 341.

The motors, when developing about 29,000 s.h.p., will drive the vessel at her designed speed of 21 knots, the corresponding revolutions per minute of the propellers being 166.7.

The generators have two poles each, and the motor stator windings have a switch which can be thrown to give them 24 or 36 poles, thus providing two prime speed reductions, 12 or 18 to one. Speed variation with either pole connection is effected by changing the turbine speed.

At speeds up to about 15 knots one generator is used to drive the four motors, each on the 36-pole connection; from 15 to 17.5 knots, one generator is used on the four motors, each on the 24-pole connection; from 17.5 knots to full speed two generators are used, each driving two motors on the 24-pole connection.

The main turbines are of the 10-stage, horizontal, Curtis type, designed to develop full power with a steam pressure of 250 pounds gage at the steam chest. A section through the turbines is shown in Fig. 2. The casings are cast iron split horizontally and bolted together. The steam end heads and valve chests are of cast steel, and the exhaust casings are cast iron.

The rotor shafts are forged steel and carried by a bearing of the self-aligning type at each end. The bucket wheels are forged steel and securely keyed to the shaft, the first stage wheel having two rows of

buckets, all other stages having single rows. All buckets are of non-corrosive material.

There are 30 nozzles for the first stage, arranged in 10 groups of three nozzles each. The steam to each group of nozzles is supplied by a separate valve, controlled by the governor. The nozzles of the other stages are cast in the diaphragms, the latter securely held in the turbine casings and fitted with packing rings at the shaft to prevent steam leakage between stages.

A thrust block is provided at the front end of each turbine just forward of the main bearing. It is of the single collar type and arranged for ready adjustment.

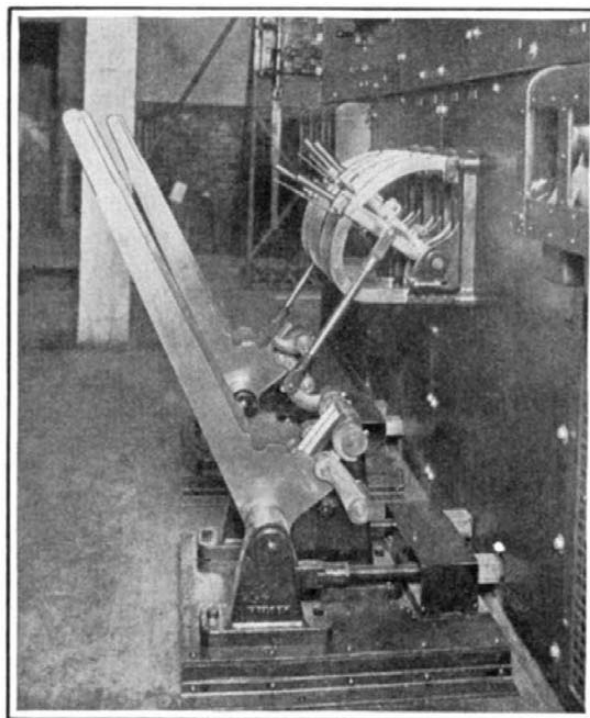
Each turbine and generator is connected together by a flexible coupling, to insure proper distribution of the load on the four bearings of the set, and to take care of any variation in alignment of turbine and generator.

Steam for each turbine passes through a strainer integral with the throttle valve, thence enters the steam chest and from the chest, as determined by load requirements, through one or more of the 10 controlling valves, to the first stage nozzles. The speed control of each unit is by means of a centrifugal governor mounted vertically on the front end of the turbine and driven at reduced speed by worm gearing from the rotor shaft.

The main generators are bi-polar, each of 11,400 k.w. capacity at 4,242 or 3,000 volts. They are of standard construction, with cast iron stator frame and core built up of enameled steel punchings securely fastened by dovetail connections to the stator frame.

The generator rotors are forged steel, having radial slots machined in them to receive the rotor windings, which consist of coils of heavy strap copper connected in series, specially insulated for this service with particular regard to protection against dampness. The rotor windings are secured against centrifugal stresses by metal wedges provided in the slots of the rotor core. Ventilating fans are fastened to the end of each rotor for forcing air through the generators. The rotors are carried in self-aligning bearings.

Two 300-kilowatt, three-wire, direct current, geared turbo-generating sets are installed for excitation of the main units and for driving engine room auxiliaries. The turbines for these sets are non-condensing, the exhaust steam from same being used in the fifth or eighth stages of the main turbines according to the load on the main units. In addition to the 300-kilowatt exciter sets, there are two motor generator boosters through which the voltage delivered to the main generator fields can be varied to suit heavy and light loads, and also to furnish the temporary large excess of excitation necessary when reversing. The use of the boosters renders such field variation possible without disturbing the voltage delivered to the motors which drive auxiliaries. The 300-kilowatt exciting sets are of same voltage as the ship's



"New Mexico's" control levers set for full speed ahead

lighting and power sets, permitting interchangeability in emergencies. Connections are so arranged that the main generator fields and main circulating pumps may be operated at either 120 or 240 volts as desired.

The main induction motors are two-phase with primary windings in the stator, so arranged that the motor can be operated with 24 or 36 poles in either forward or reverse rotation. Switches external to the motors are provided for effecting the changes in poles and rotation. The stator frames are of cast steel construction with core built up of segmental laminations, the segments being held securely through dovetail slots in the frame. Radial air ducts are provided along the length of the core, opposite to and in line with similar ducts in the rotor, to provide space for ventilation.

The rotors consist of cast steel spiders securely keyed to the shaft, to which are secured the cores built up of segmental laminations. There are radial air ducts in the core of the rotor similar to those in the stator described above. The windings are of the double squirrel cage type, consisting of two separate short circuited systems of bars arranged one below the other in the same slots. On starting, when the frequency of the rotor current is comparatively high, the outer winding is alone effective. As the frequency or slip of rotor decreases and the motor speed approaches that corresponding to the generator the lower winding, of low resistance, carries more and more of the circulating current, a small portion only being carried by the outer or high resistance bar when up to full speed. By means of this construction, using the high resistance winding on starting with special provision to care for expansion, the use of external rheostats and collector rings on the motors to provide suitable torque conditions becomes unnecessary. The weight of the rotor is carried by two self-aligning bearings supplied with oil from the main lubricating system. Ventilating fans are fitted at each end of the rotor.

The alternating current switching arrangement comprises, in general, two eight-pole double throw generator disconnection and voltage changing switches, four eight-pole single throw motor disconnecting switches, all hand operated at place; one bus tie switch, operated from within the switchboard cage; two three-pole double throw reversing oil switches and two six-pole double throw pole changing oil switches, operated from working platform by the four large levers shown on the opposite page; and the field switches, controlled from working platform by two small outside locomotive latch levers as shown.

Under normal conditions the switchboard is operated as two separate boards, each side of the ship being independently controlled. However, when operating all four motors or any combination of motors on one generator, the bus tie switch is thrown in and the combined switchboard operated as a unit, the idle generator's disconnecting switch being open.

The high voltage generator connection is used when running two motors on one generator and the low voltage when one generator is supplying four motors.

The motor and generator disconnecting switches are each operated by a single lever, and provision is made so that under no conditions of overload or short circuit can they be opened by magnetic stresses nor can they be jarred out by shock of heavy gun fire. All switches, both oil and knife type, are arranged so that they cannot be opened unless the field current has been removed from the main generators.

In view of the fact that the field must be opened before

making any change in the switching, it is extremely necessary that the field switch be rugged and absolutely reliable, also that precautions be taken to prevent the switch from jarring out and opening the field circuit accidentally. A great deal of care has been taken regarding both of these features in the design of the switch.

The equipment is provided with temperature indicating apparatus located on the main switchboard in front of the operator, for ascertaining temperatures of machine windings at all times. Steam and vacuum gages, revolution counters, etc., are also mounted on the board in front of the operator.

There are four three-bladed, manganese bronze propellers of the solid type, machined to true pitch, and polished all over. They are 13 feet 5 inches diameter, 15 feet 2 inches pitch, 50.43 square feet projected area, and turn outboard when driving the vessel ahead.

There are two main condensers of 15,300 square feet of cooling surface each, one for each main turbine. They

oil at a maximum pressure of 300 pounds per square inch to the burners, which are of the mechanical atomization type, seven per boiler.

TRIAL DATA	4-Hour Full Power Trial
Steam at boilers, lbs. gage.....	278.6
Steam at turbines, lbs. gage.....	272.1
Steam at turbines, 1st stage, lbs. gage.....	139.7
Vacuum, inches.....	29
Barometer, inches.....	30.83
Fire room air pressure, inches of water.....	4.1
Feed water temperature, F.....	182.8
Main generators, volts.....	4,257
Main generators, amperes.....	1,873.5
Main generators, fld. volts.....	171.7
Main generators, fld. amperes.....	318.25
Main generators, r. p. m.....	2,042
Main motors, amperes.....	994.5
Main motors, r. p. m.....	167.69
Slip of propellers, per cent.....	16
Speed in knots.....	21.08
Shaft horse-power.....	31,197
Pounds of water per hour per s. h. p. (main engines, excitation and main engine auxiliaries).....	12.017

Acknowledgement is made of the valuable assistance rendered by Mr. A. R. Cheyney of the Bureau of Steam Engineering, Navy Department, in connection with the preparation of certain features of this article, and The General Electric Co. for permission to publish illustrations of the electrical installation.

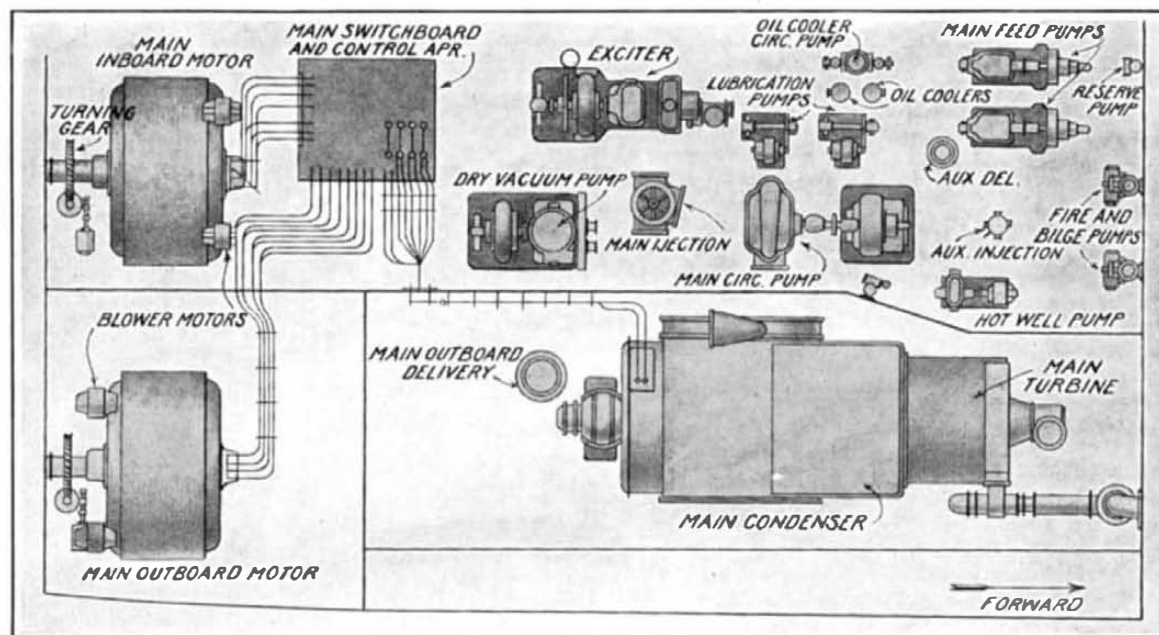
### Adulteration of Cotton in China

AT the recent annual meeting of the Anti-Adulteration Association of Shanghai, it was brought out that the Chinese had the habit of adding water to cotton in order to increase the weight. As regards the figures, President E. C. Pearce stated that during the 12 months under review the association had dealt with more cotton than in any similar period of its existence. Of the quantity for 1917-1918, 64 per cent contained more than 12 per cent of moisture, and 7 per cent contained over 15 per cent moisture, this being curiously enough the same percentage as for the previous season. If we allow the Chinese up to 12 per cent for the so-called natural moisture in China cotton, no less than 71 per cent that came under the notice of the association contained added water, i. e., over 12 per cent of moisture. The constant aim of the association is to combat this evil, and everything is being done to that end.

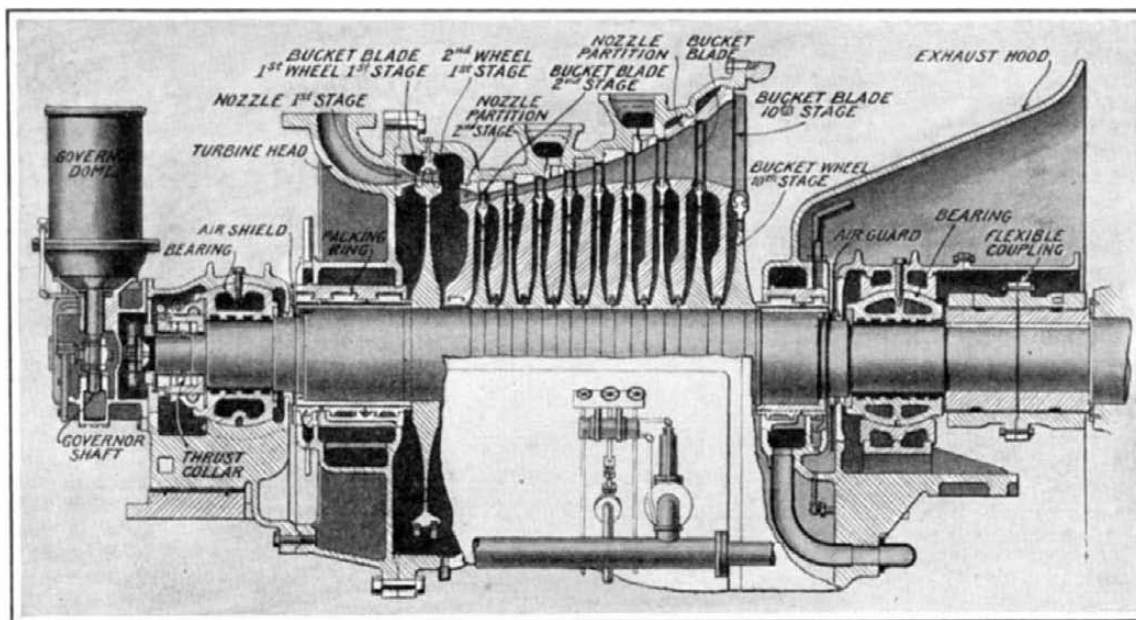
### Rubber Substitutes for Cables

AS rubber is no longer procurable in Germany for the manufacture of cables, and the rubber substitutes obtained in the earlier days of the war are no longer available, manufacturers have been forced to make use of bituminous materials or impregnated paper. The regulations of the German Institution of Electrical Engineers have been modified to admit such substitute materials, and in the prescribed tests the voltage has been reduced from 2,000 volts to 500 volts after immersion in water for one hour, instead of 24 hours. Accordingly, some of the products now on the German market lie on the verge of the limit of minimum safety, particularly for use in warm, damp situations. On the other hand, the M-cables, manufactured by one of the German firms, with impregnated paper insulation, are capable of withstanding the normal peace-time tests.

The article in the *Electrotechnische Zeitschrift* continues to describe a series of tests made on a number of types of cables, including the M-type. Most of the samples reached undesirably low insulation values after 15 minutes' immersion in water. After 24 hours' immersion all of them broke down between 270 and 550 volts, except the M-type, that stood up to 800 volts. The effect of bending and heating is also investigated.



General arrangement of engines and motor rooms



Cross-sectional view of one of the main turbines

are of the return flow type, with tubes rolled into the tube sheets at the inlet end of the tubes, and gland packed at the other end to allow for expansion.

Steam is generated in nine Babcock and Wilcox water-tube boilers, arranged abreast in batteries of three, in three separate watertight compartments. The boilers are designed for a working pressure of 280 pounds, are fitted with superheaters, and have a total heating surface of 55,458 square feet, exclusive of superheaters, which have an additional total of 4,476 square feet, sufficient for about 50 degrees F. superheat. Oil fuel and forced draft are used for the boilers.

An elaborate fuel oil system is installed, consisting of four light service booster pumps, two located in each extreme fire room. These pumps draw oil from the fuel tank manifolds and discharge same to the suction of the service pumps, which are of the heavy pressure turbo-rotary type. There are two service pumps in each fireroom, six in all. The service pumps deliver the



### Agricultural Labor to Cure Cripples

SCIENTIFIC efficiency is peculiarly triumphant when two important objects can be made so to dovetail into each other that a single operation accomplishes the attainment of both, a fact realized by our remote ancestors when they coined the phrase, "killing two birds with one stone." A very striking example of this comes to hand in a report laid before the French Academy of Sciences not long since as to the remarkable efficacy in restoring wounded men suffering from the secondary results of their injuries to the use of their limbs.

The *sequellae*, as they are termed, of serious wounds, are various, and all more or less disabling, even permanently, if special care be not taken to relieve them. They include not only the stiffness of the joints which is always an attendant of prolonged disuse, even where the joint itself remains uninjured, but swellings, adhesions, lack of muscular and nervous power, stiffness of new scar tissue, etcetera. The treatment of these must follow the actual healing of the wound itself and is accomplished by a variety of methods such as hydrotherapy, thermo-therapy, electrotherapy, marmal or mechanical massage; and also operations which employ cortical motor excitations of the muscles produced either by suitable gymnastics or by apparatus carefully devised to secure the mechanical repetition of the prescribed movements.

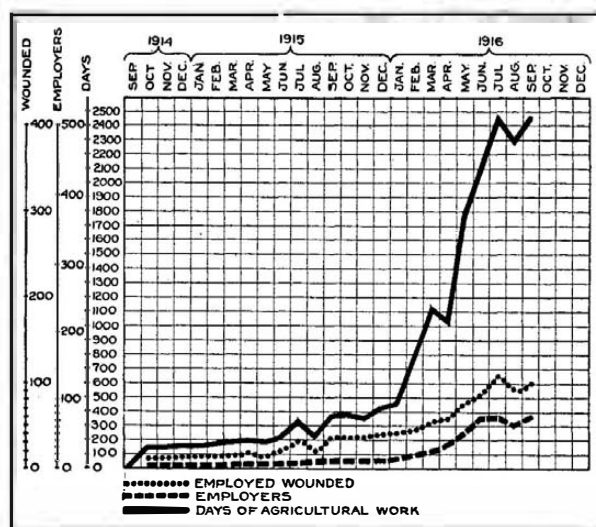
The applications of water, heat and electricity as curative agents are highly valuable in special cases, both as to the local reactions obtained, and the stimulus to the general health, hence in many instances they are practically indispensable. As far as concerns the mechanical exercises, however, whether as individual gymnastics or as mechanotherapy involving more or less complicated apparatus, it has the marked disadvantages of being very expensive, of being conducted indoors, of being necessarily limited to one or two hours per day where the number of patients is large, and most of all of being so uninteresting to the patient as to produce a lassitude and ennui, which are generally unfavorable to the patient's welfare.

These considerations led the physician who presented the report to substitute agricultural labor as a restorative treatment for the said *sequellae* of wounds. The experiment, which began in October 1914, on the tract of land called La Solitude, at Martillac, in the canton of La Bride, a hospital annex containing 125 beds, had continued for 30 months when the report was presented to the Academy on April 2d, 1917, and had met with the most remarkable success, particularly in the case of patients who had been previously accustomed to agricultural labor. The implements employed were merely the usual simple tools used for farm work, the hoe, the spade, the rake, the plow, the wheelbarrow and so forth; but it was found that these could be made to supply, singly or in combination, every possible attitude or form of exercise required for the restoration of function.

The obvious advantages spring not only from the surroundings of fresh air and more plentiful sunlight, but from the fact that the prescribed exercises continue for many hours daily instead of one or two, and this without over-fatigue, since there is no constant appeal to the attention, the movements depending largely on the reflex system, which is physiologically almost inaccessible to fatigue.

The greatest benefit of all, perhaps, is due to the continuous pleasurable interest arising from the achievement of tangible impersonal results, that normal delight in productive work felt by all healthy individuals. It is of course, requisite that each patient should have the nature and amount of his work carefully prescribed by a competent physician, who must see that the labor involves the required motion of the part affected, proportion the effort to the strength, and fix the hours of labor. He must also see that the patient does not substitute short cuts by using other muscles. Thus a man with a stiff-right arm, might get more work done by using his left arm, but the real purpose of his labor would thus be foiled. The director thus sums up the benefits accruing:

"The result of this truly physiological form of therapeutics, of this functional reëducation, have been most satisfactory set for the wounded men both physically and as regards their morale; for the country, from both the military and the economic point of view. As to morale, the entire mental outlook of a hospital patient is changed by work in the fields. Physically his general health and his cardiac and pulmonary functioning keep pace with the rapid decrease of the local disability. From the military outlook, 80 to 90 per cent of the men have been restored to service. Finally, an economic gain is achieved by the very considerable amount of supplementary farm labor thus secured."

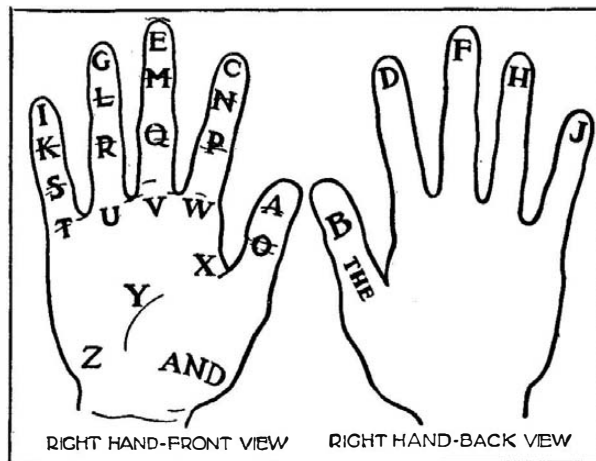


Curves showing extent to which France gave her wounded agricultural employment

Subjoined is a diagrammatic curve showing at a glance the number of days of agricultural labor obtained by the institution at Martillac. This came to 30,000 working days furnished to agriculturists in the two cantons of La Bride and Cérons.

### A Talking Glove for the Blind-Deaf

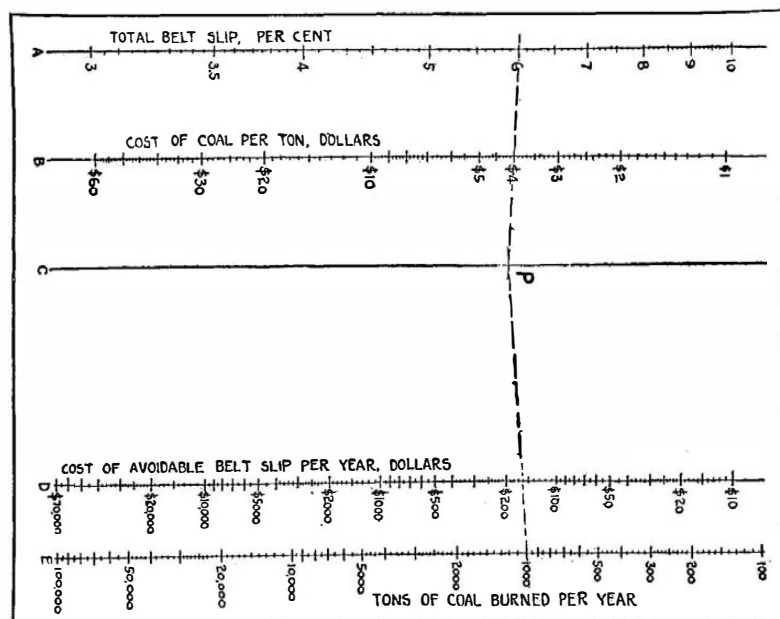
IF it is a problem to keep a blind person in close touch with the world about him, what shall we say of the difficulties of communicating with one who is at once



Talking glove for the blind-deaf, which makes it possible to carry on a touch conversation

blind and deaf? Yet such persons are always to be found, here and there, and they are communicated with, after a fashion. Helen Keller and others have been able to read lips with their fingers; and in a recent article in these pages, a deaf-blind girl was mentioned whose associates converse with her by "writing" out their words, in ordinary script and a letter at a time, on her palm.

For some years as a result of the war we may expect to have among us rather more than usual of these doubly afflicted unfortunates. Accordingly, it may not be out



Copyright, C. S. Co.

This chart beats a slide-rule for finding the cost of belt-slippage

of order to draw attention to the device employed by a Connecticut Yankee, Dr. William Terry of Ansonia, to meet his own rapidly approaching blindness and deafness. Dr. Terry's "talking glove" is not new in its bare idea; records show that as early as 1648 a deaf man talked with his wife by means of an alphabet localized on the joints of his finger, and it has been suggested that the scheme is vastly older than even this. But Dr. Terry's layout is perhaps as satisfactory a one as could be employed, and it makes provision for all the letters of the present English alphabet, which is not the case with all of its predecessors. And Dr. Terry at least brought to bear one new feature, which made it possible for him to talk with total strangers who were not acquainted with his system. This feature consists in a thin glove, marked with the letters in the locations which had been assigned them. When the doctor had made a new acquaintance, all he had to do was to draw on this glove, and he was at once equipped for conversation.

### Steel for Guns

THE metallurgy of gun steel has been greatly altered as a result of the war. This is particularly true in this country and is probably more or less so in England and France. As the war drew to a close, steel for large guns was being made in a radically different manner than had ever been thought possible, even early in the war.

In both England and in this country it was an accepted fact four years ago or less that only acid open-hearth steel could be safely incorporated in ordnance guns. The plants especially built in this country, early after our entrance into the war, adopted this process. The reason for this policy was that it is possible to make by this process unusually pure and reliable metal, and it was thought only by this method. The great disadvantage involved, however, is the length of time to produce a heat of such steel. In all such work the complete deoxidation, the formation of the proper slags, and the refinement of the metal consume from 13 to 15 hours in the case of a 40- or 50-ton heat with the utmost care necessary. As the development of the ordnance program of the United States progressed it was found that the large electric furnace refining hot metal on a basic bottom, could and did produce gun steel equal, if not superior to that made by the long-drawn-out acid open-hearth process.

While a 3-per-cent nickel steel was the standard alloy incorporated in many of the guns, it is stated that at one of the large British plants a plain carbon electric steel was giving entire satisfaction in the last months of the war. An interesting report, also, is to the effect that in one American plant gun steel that met ordnance specifications satisfactorily was being made in basic open-hearth furnaces—a steel that was tabooed for guns before the war and later.

It is probably a fact that had the war continued much longer, the electric furnace would have been the first selected as the agent with which to make ordnance steel. It was even being scheduled for one of the later plants and this is so, not so much perhaps because of the superiority in quality over acid open-hearth, but because the same amount of suitable metal can be made in about one-third the time. In prosecuting a war, time counts.

### The Cost of Slipping Belts

THE graphic computer, which enables us to lay a ruler across a group of scales on which our necessary data are laid out and to read then the answer from the ruler's intersection with another scale, is now a familiar friend. We have shown several examples in these columns, and may perhaps be forgiven if we show another.

An appreciable item of preventable factory waste is belt slip. But until he knows just how much his belt slip is costing him a manufacturer can hardly go very far toward its prevention; for there is no gain in spending a thousand dollars to save five hundred. The chart which we show will unravel this little problem without the necessity for calling in a power engineer.

If the total percentage of belt slip be marked on line A and the average price paid for coal on line B, there will be determined a point P on line C. If this point P be then joined with the proper point of line E, on which is plotted the annual coal consumption, it will cut line D at a point indicating the annual cost of the belt slip nuisance. Our figure shows the problem worked out for a plant suffering from six per cent slip, and burning 1,000 tons of coal per year at \$4 per ton. The cost of the belt slip is here seen to be no less than \$160 per annum, in spite of the rather small scale of operations indicated by the low fuel consumption.

### Making Freight Cars of Concrete

CONCRETE is rapidly becoming a universal material. Each day, so it seems, the world learns of a new application of concrete. Just now it is the concrete freight car which is attracting attention, not only as the latest application of concrete, but one that promises to be far-reaching.

The beginning of practical plans for the manufacture of reinforced concrete freight cars dates from 1909, when a patent for such a car was granted to Joseph B. Strauss, of Chicago. On account of the war, construction of a trial car was delayed; and it was but recently that the first car, of the gondola type, was completed by a Chicago company and tested under service conditions. Not only in the material used, but in its design and the details of construction, it represents an interesting departure from usual methods.

The basic feature of the design is a steel skeleton body forming the outer boundary of the car, and mounted upon a steel underframe. The concrete walls and floor are contained within this frame and, together with the frame and floor reinforcement, are connected to, and interlocked with, the underframe. The steel frame forms the finishing and protective edges, thus entirely shielding the concrete and also serving as a complete system of stress-bearing members.

In the construction of the test car, the "cement gun" was used. The forms were placed on the outside of the car, and the cement was shot against them from within. The outside of the car, that is the surface against the forms, was given a smooth finish, but the interior was left much as it came from the gun.

Tests of the completed car, both empty and loaded, demonstrated its practicability for rough service. In the test without load it withstood extremely rough handling in switching, and came through without injury. Subsequently, the car was loaded with 55 tons (10 per cent overload), of sand and turned over to a switching crew for service handling. It withstood this test also without injury.

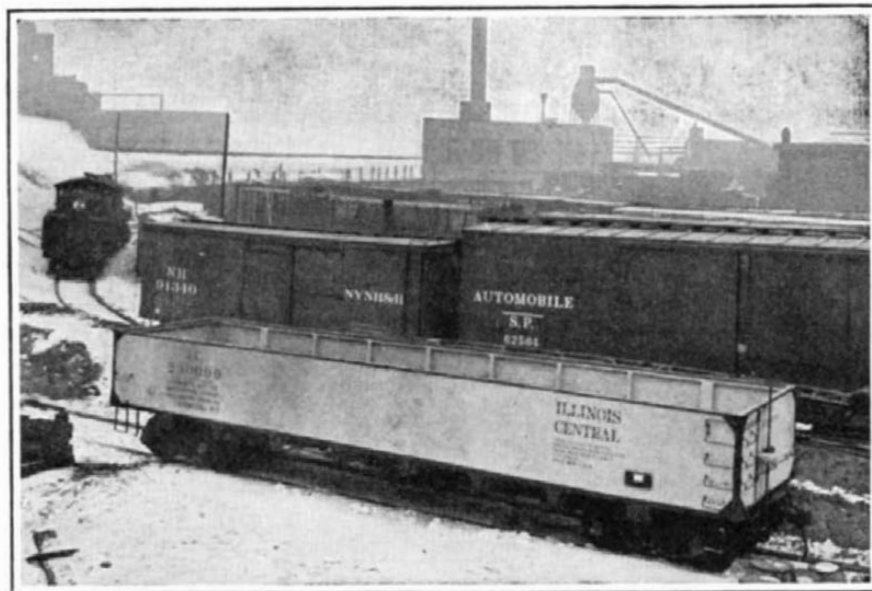
Other merits are claimed for the concrete car. It will not need painting and will practically eliminate maintenance charges. Its life will be much longer than that of the wooden car. It will have the important advantage, also, of being unaffected by its cargo, and will consequently be adapted better than the steel car for hauling slag and ashes.

Plans are already under way for the quantity manufacture of these cars. The fact that the first one was built with the sanction and coöperation of the United States Railroad Administration, and that the Illinois Central Railroad took an active interest in its construction and test, indicates that extensive production will not long be delayed. The Strauss car is to be tried out for thirty days by the Illinois Central Railroad, after which it is to be turned over to the United States Railroad Administration for such service as it may see fit.

### Zeppelin Sheds in Occupied Germany

ONE of the great drawbacks to the extensive employment of dirigibles in the past has been the matter of housing. Huge dirigibles, such as the Zeppelins, call for huge sheds the construction and maintenance of which is a large item of expense. Despite the drawback, however, the dirigible as a type has of late gained considerable favor in Great Britain and America, because of its numerous military and commercial possibilities.

Typical of the huge sheds required to house dirigibles is the Zeppelin shed shown in the accompanying illustrations, which is located at Treves in the American Zone of Occupation. The men and motor trucks about the base of the shed serve to give some idea of its size. The front of this shed consists of two immense doors of galvanized iron, braced at the rear by a sturdy steel framework as shown in the smaller view. The doors swing outward on their hinges, and are supported at the free end on rollers which travel on semi-circular rails.



Pioneer concrete gondola car which is now undergoing severe tests

### The Current Supplement

MORE and more the engineer and the manufacturer are coming to realize how much the microscope can tell them of the normal and abnormal structure of metals, of the causes of failure, even of the manner in which failure operates. But it is never easy to use the microscope; and sometimes the special difficulties of using

more thoroughly than we recall having seen it discussed since the advent of Bell's formidable elaboration of it into an alphabet of visible mouth gymnastics. *The Yellowing of Paper* touches upon an important industrial problem, while *Factories for Nature's Sugar and Starch* tries to show how nature carries on manufacturing operations of her own. Further short articles of interest will be found scattered through the pages of an unusually well-balanced number.

### Rustless Steel Invention

THE romance of rustless steel, one of the most recent metallurgical triumphs, is given increased prominence with the removal of control. The new metal, with a bright surface and able to resist the corroding effect of air, water and acids without staining, was discovered just prior to the outbreak of the war, and was immediately commandeered by the British Government for use in airplane construction and for purposes where strength and durability, combined with rust-resisting qualities were invaluable. The steel is a Sheffield invention, and was chanced upon largely by accident. A local metallurgist, Mr. Harry Brearley, author of numerous standard works, was experimenting in the armament shop to find a means of preventing erosion in gun tubes. After some of his experiments he noticed that certain pieces of chrome steel had not suffered from corrosive influences under conditions which would have rusted ordinary steel. He followed up this clue, and what is known as stainless steel was eventually worked out and added to Sheffield's metallurgical triumphs. It was applied to manufacturing cutlery.

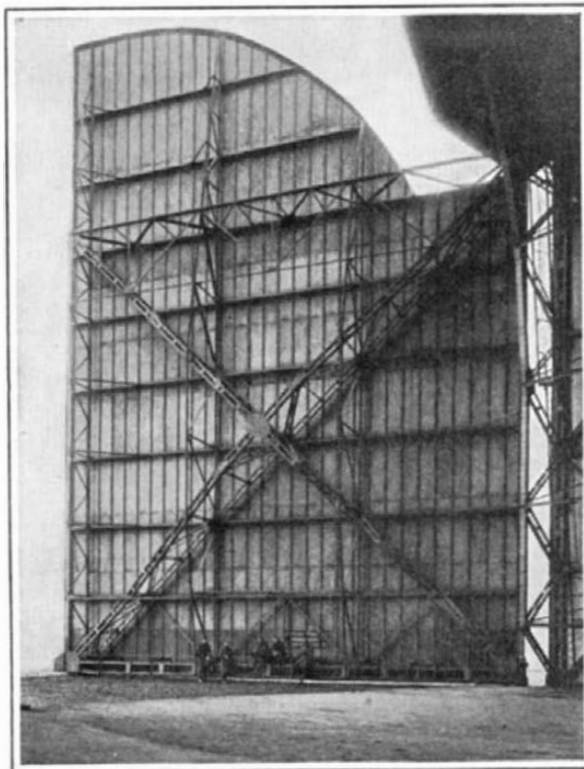
### Kiln Drying Oak for Vehicles

ONE of the distinct developments of experiments conducted at the Forest Products Laboratory at Madison, Wis., during the war was a rapid method of seasoning oak.

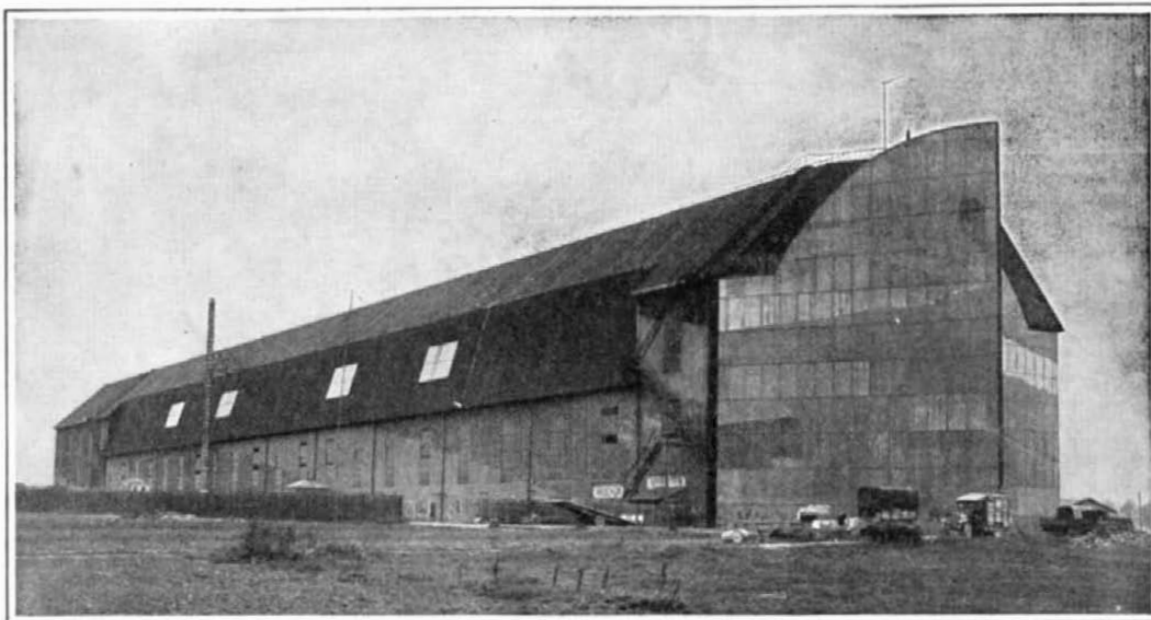
It requires from two to three years to air season heavier oak wagon stock. Better stock has been secured by drying this heavy green oak according to Forest Service recommendations and the time for 3-inch material green from the saw is reduced to 90 or 100 days.

Three large plants using this system have negligible losses as compared with losses at plants using other methods, which range from 10 per cent up to complete loss. Where there were heavy drying losses there was heavy pressure for relaxation in inspection, so that poor drying meant not only an excessive loss of stock and a holding up on deliveries but probably also poorer material in wagons.

One furniture plant with orders for spare parts that followed improper drying methods is reported to have lost \$25,000 worth of stock on one run, stock which was being depended upon to keep the force at work.



One of the front doors of the shed



Zeppelin shed located at Treves, Germany, in the occupied part of the former empire