The Automotive Manufacturer

The Hub of Automotive Engineering

BODY BUILDING - AUTOMOTIVE PARTS - ALLIED INDUSTRIES

Vol. XLII, No. 7. NEW YORK, OCTOBER, 1920 $2.00 Per Year Issued Monthly

Published monthly by The Trade News Publishing Co., Edison Building, corner Elm and Duane Streets, New York City.
Entered as second-class matter June 23, 1879, at the post office at New York, N. Y., under the Act of March 3, 1879.

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The Hub ← A CONSOLIDATION OF → AUTOMOTIVE ENGINEERING

Vol. LXII NEW YORK, OCTOBER, 1920 No. 7

More Powerful 1921 Buicks Present Detailed Refinements

Very Few Changes as Compared with 1920 Models—Refinements Free Driver of Need for Adjustment and Attention—More Graceful Bodies

TO the casual observer the 1921 Buick cars will show very little difference from the 1920 types, but among the changes made are some in the body lines at top, radiator, cowl and hood, as well as filler piece between step and body. These lines seem to make the car much longer Compared with the cars of this year they look to have at least 4 inches more wheelbase, yet the wheelbase is unchanged. More than this long and low appearance, the changes which have been made blend the chassis and body into a more harmonious unit, and give it a much more graceful appearance. Those who know the capabilities of Buick cars in the way of power and ruggedness, that is sheer mechanical goodness and brute power, will be much pleased with this new body design which adds to that, superior appearance.

Prices have not been reduced, and as compared with the announced prices of a year ago, show an average increase of about $400. There are seven body styles as follows: three passenger roadster, five passenger touring, four passenger coupe and five passenger sedan, all on the shorter wheelbase chassis which is 118 in.; four passenger coupe with folding and disappearing extra seat (an entirely new form), seven passenger touring, and seven passenger sedan, all of the long wheelbase chassis of 124 in. Apparently the long wheelbase seven passenger touring is expected to be the most popular, or else the price has been kept down so as to make it most popular for this shows the smallest increase, only $280 over last year. The three passenger roadster and five passenger touring on the 118 in. wheelbase chassis come next with but $300 increase over their 1920 prototypes. The shipping weights, it should be mentioned, are unchanged, so that whatever

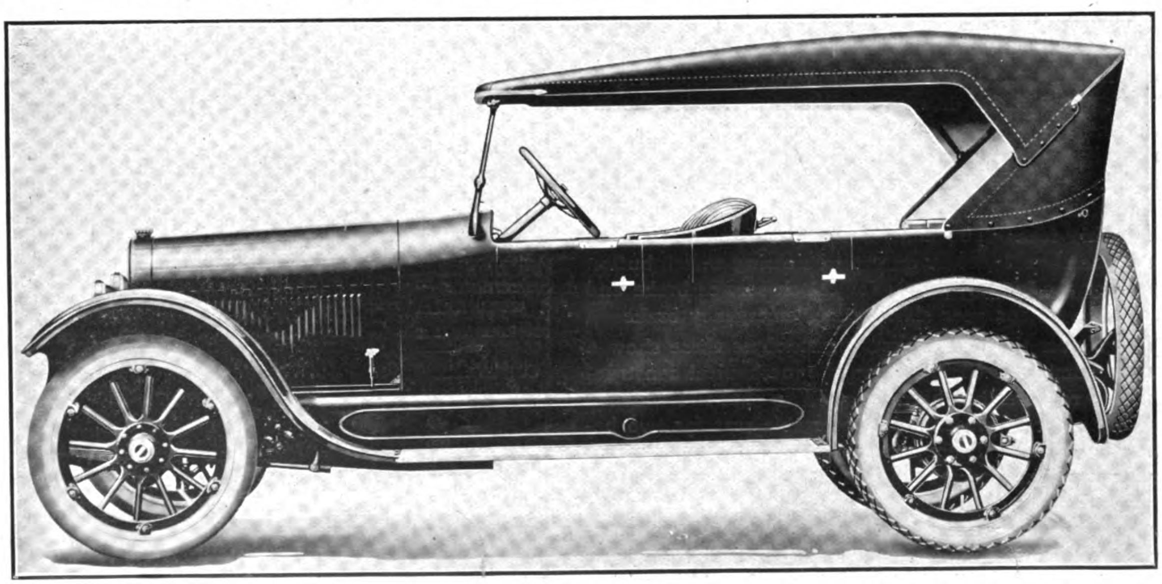


Fig. 1. Side view and general appearance of the Buick 21-45 five passenger touring car, typical of the 1921 line

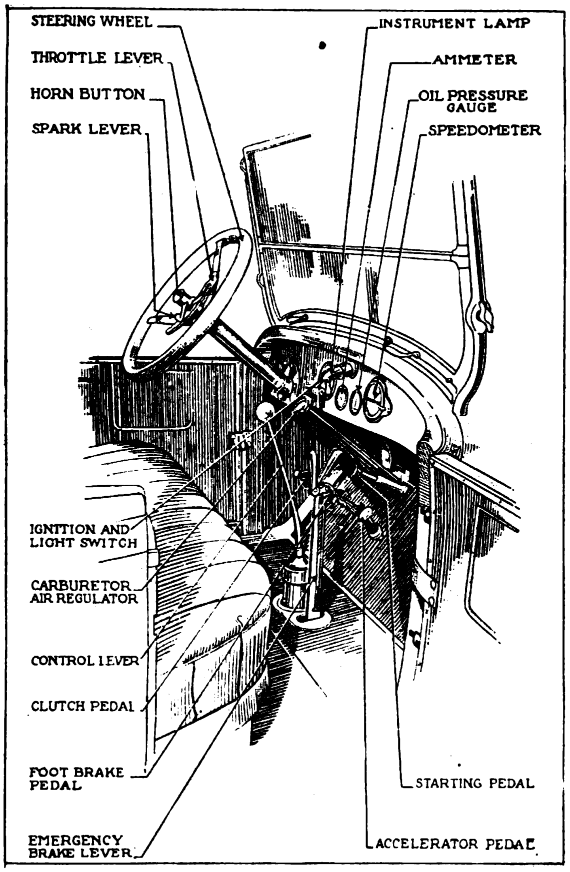


Fig. 2. Driver's compartment showing convenient arrangement of pedals, levers and instruments

power has been added by detail refinements in the motor adds to the performance of the car.

The five passenger touring car shown in Fig 1 will give a splendid idea of the appearance of the whole line, in addition to which the drawings shown in Fig 4 present the balance of the line for comparison. Next in order of importance to the man who drives is the provision for his comfort and convenience, and this is indicated in Fig. 2. As this view of the driver's compartment shows, the instruments are grouped conveniently in front of the driver on the instrument board, with the levers and pedals disposed in the more or less standard fashion on either side of the steering post, and at the driver's right, or convenient to his feet. The control includes friction retained spark and throttle levers on top of steering wheel, button type foot accelerator, pedals for clutch service brake and starter, levers for gear shifting and emergency brake.

To go over the bodies first, inasmuch as these show a greater number of changes than the mechanical construction, the roadster has been changed so that the widened rear of the body presents a comfortable seat for two besides the driver. There are two spacious compartments for luggage, one back of the seat and the other larger one beneath the rear deck. In the five passenger touring model the driving compartment and tonneau have been rearranged to provide more room, and the seats have been changed so as to afford the most comfortable position for driver and passengers. The upholstery at the sides of the seats is cut off rather squarely so that it gives almost arm rest appearaance and comfort.

The seven passenger touring has wider door openings, and more room than formerly for the extra passengers. All the open cars are equipped with a new top, which permits an unobstructed outlook to all occupants. The curtains swing with the doors. All closed cars are equipped with stormproof windshields with a new support for the upper and outer glass which alters the appearance somewhat, with anti-glare sunshade, and water tight doors. The changes in cowl and bonnet lines have been along the line of combining the two so that they present no line of demarkation, and appear as one with with a single slightly sloping straight line from radiator to windshield. This long line gives the impression of a longer engine space, and helps to make the car look longer and lower.

Taking up the mechanical part of the car, it will be best to describe this as a whole, without attempting to go through and present minor changes only. The chassis, as Fig. 5 shows, has a six cylinder water cooled engine at the front, back of the radiator, and driving through a multiple disc clutch to a three-speed transmission. Enclosed propeller shaft drives spiral bevel gears on the full floating rear axle. Semi-elliptic springs are used in front and cantilevers at the rear Both brakes are in the rear wheels, external contracting band and internal expanding band.

Taking up the motor first, this has 3⅜ bore and 4½ in. stroke, a ratio of 1 to 1.33 Cylinders are cast in a block, a single casting of semi-steel. Pistons are of cast iron and carry three compression rings near the top and

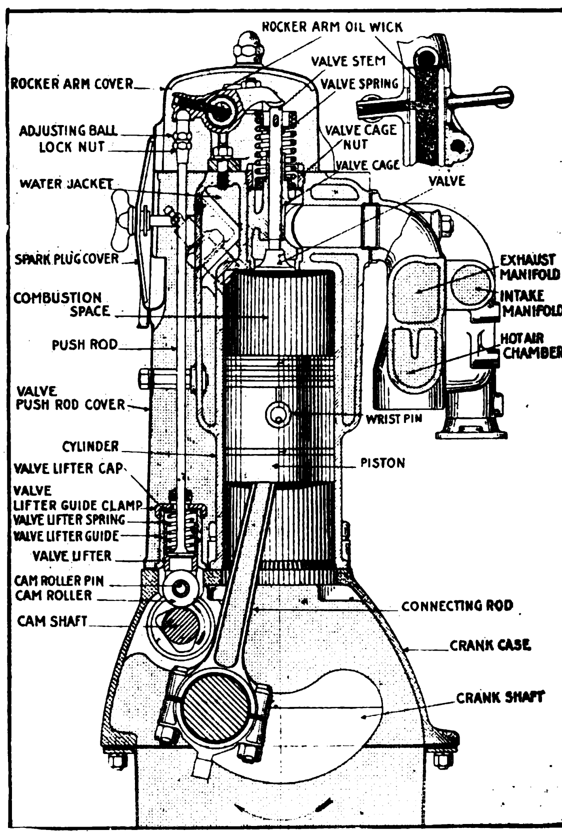


Fig. 3. Cross section through engine showing overhead valves, double spring valve motion and other features

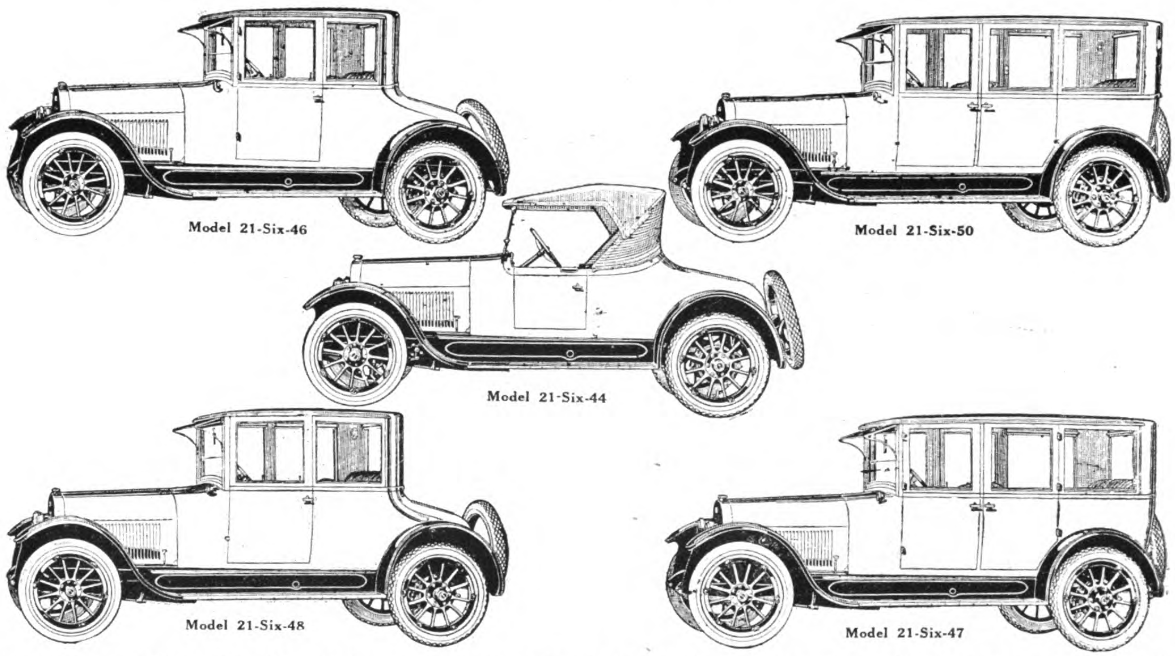


Fig. 4. Group of the 1921 Buick body forms, properly labeled, and showing the longer lower lines which characterize the 1921 product

one oil ring near the bottom. Connecting rods of the conventional H type are drop forged in the company's own forge shops of high grade steel. Extra heavy crankshaft has four bearings, those at front and rear being unusually long. Valves are mounted in removable cages set down in the cylinder heads, and are operated by noiseless adjustable self-oiling push rods. A section through the motor shown at Fig 3 will illustrate all these points and many more, notably the double spring operation of valve motion, one on the valve stem, the other on the lower end of the push rod. The latter holds the cam follower down onto the cam at all times and eliminates noise at high speeds.

The complete power unit, including clutch and transmission, is suspended at three points from the main frame, the two rear points being arms cast on the flywheel housing, which is an integral part of the crankcase. Although rating at but 27.3 h.p., the motor is said to develop in excess of 50 on the block.

Cooling is by water, circulated by centrifugal pump driven by spiral gears The radiator is of a new cellular type, with a new form of drain cock. The pump is located on the side of the cylinder between cylinders 2 and 3. Lubrication is by self-contained constant level circulating splash system. The gear pump is driven by spiral gears from the camshaft and is completely enclosed in the lower part of the crankcase. Pressure is indicated to the driver by gage on the instrument board, while an improved style of oil level gage on the crankcase helps in filling to get just the right amount.

Carburetion is by standard type of carburetor, located on the left side of the motor, and supplied with fuel from the rear tank by vacuum system. The intake manifold and exhaust header are so designed as to present an internal hot fin in the manifold which assists in vaporizing the heavier fuel of today. The carburetor may be regulated in part from the dash, where an air regulator is provided. Electric current for all purposes is supplied by a complete Delco single unit, built as an integral part of the motor and operating in conjunction with large storage battery. The ignition is of the high tension jump system current from the generator being supplied through an accessible distributor and timer. External wires are very short and pass through the spark plug cover, which covers the whole upper part of the right side of the engine, so as to be located almost entirely within the compartment. As in previous years, the spark plugs are set into the side of the cylinder near the upper part so that they actually enter the combustion chamber at the upper corner.

The clutch is of the multiple disc, dry type with four driving and five driven plates. All these are faced with asbestos fabric, so that the clutch is smooth in action and

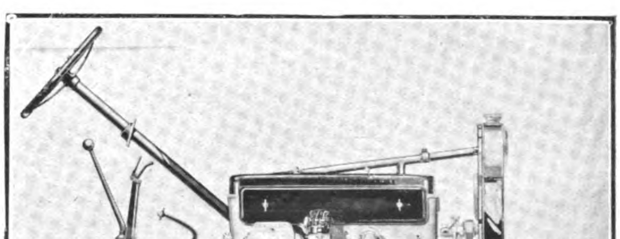
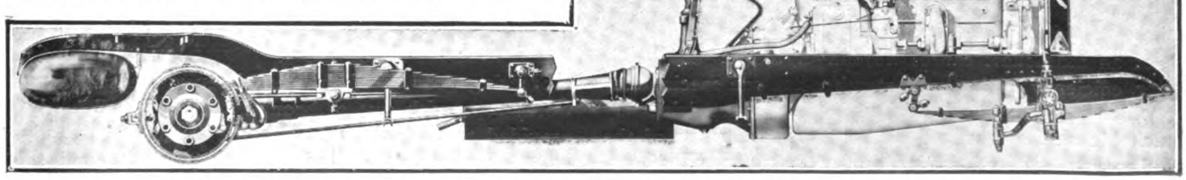



Fig. 5. Chassis sketch indicating disposition of various units, sturdy frame and adequate springing

positive. The release collar is mounted on a ball bearing, has an accessible adjustment, and is lubricated by two large grease cups located outside the case.

The transmission, rearmost part of the unit power plant, gives three speeds forward, and works on the selective plan. All gears are forgings, specially heat treated, and are mounted on short stiff shafts. The main shaft is on a pair of combination friction and thrust bearings, while the lay shaft, which is below, is mounted in plain bearings. The shifting mechanism is mounted on the gear case cover, and can be removed with it.

The rear end of the transmission carries, as a rearward extension, a spherical housing, within which the universal joint is located This full sphere forms on its inner surface a bearing and pivot for the driving shaft housing, a tube of large diameter which acts as the torsion member. As the center of the spherical joint and that of the universal joint in the shaft are identical, the housing and ball bearings An adjustment is provided to take up wear in the bevel gears, and a similar adjustment for the thrust bearing.

There are two sets of brakes, arranged concentrically on the rear wheel brake drums. The outer, contracting bands, are the service brakes and are operated by pedal. The inner, expanding type, are the emergency brakes and are worked by the hand lever. The brake drums are of large diameter pressed steel, and bolted to the wheel spokes. An inner member closes the inside of these drums so that no dirt, water, stones or other road material can get into the brakes Both forms are fully adjustable for wear, and this adjustment is so designed as to be easily reached and quickly operated.

Wheels are of the wood artillery type with 12 spokes all around. They have very large hub flanges and are equipped with demountable rims The tire sizes vary somewhat, all but the sedan on the shorter wheelbase

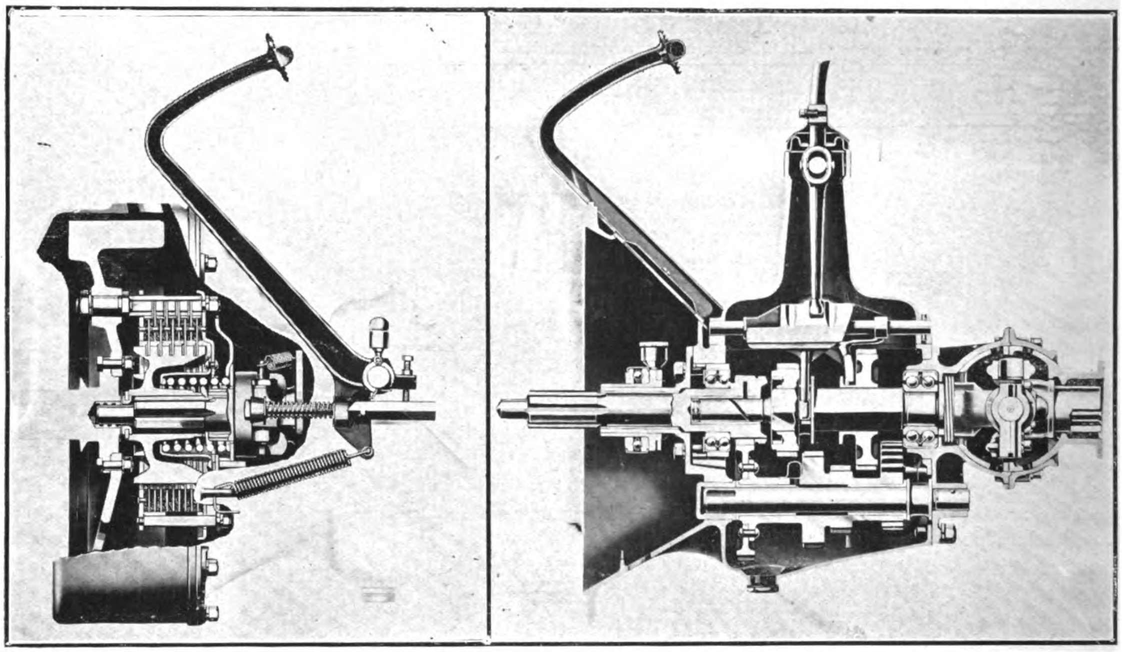


Fig. 6. Clutch (at left) showing fabric faced discs and enclosed spring. At right, transmission showing wide-faced gears and sturdy shafts

shaft act about the same point, in fact function as a single unit. This may be seen in both the chassis view, Fig. 5 and the transmission view, Fig. 6 at the right. From this point the drive is to the rear axle, which is of the full floating type. The actual drive is by spiral bevel gears. In this type of gear noiseless performance and efficient action are realized.

The full floating axle supports the weight of the car on the axle housing or tube, not upon the axle shaft. By carrying the weight upon the housing in this way, the shafts do nothing but carry the drive, which arrangement makes for safety and efficiency, safety in that the breaking of an axle shaft causes no danger to the passengers or car, efficiency in that each member has one special duty for which it is designed and built. Wheels are driven by detachable shafts mounted on large ball bearings of the annular type. Differential is mounted on taper roller bearings, and rear end of driving shaft on annular and thrust job having 33 x 4 in. all around, while the five passenger sedan and all forms on the longer wheelbase job have 34 x 4½ in. all around. In all cases the fronts are straight side plain treads, while the rears have the all-weather tread.

The front axle has a drop forged I beam section, double heat-treated, with integral yokes (Elliott type), the center portion being perfectly straight as is the tie rod also. This gives a very pleasing front appearance which cannot be had with large bends or curves in the front axle and rod. Steering knuckles are drop forged, as are the tie rod yokes, both these and the axle proper being produced complete in the Buick shops.

Steering gear is of the semi-irreversible split nut and worm type with nut of bronze. A large ball bearing is provided to take the thrust, and this may be readily adjusted. The case is packed with lubricant and this is maintained by a large, convenient grease cup, easily reached by raising the hood. The wheel is of large diameter, set at a very convenient angle for the driver's comfort, and carries spark and throttle finger levers, as well as central horn button.

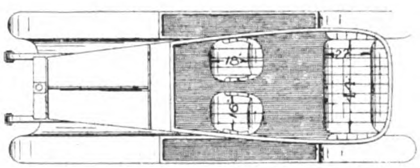
Frame is of reinforced pressed steel, channel section, with exceptionally stiff and deep side members. This will be noted in Fig. 5, in which the section is shown broken away at its deepest point just at the driver's position. There are four heavy cross members, one at the extreme front which acts as a radiator cradle, one at the extreme rear which acts as a fuel tank support, and two intermediates, placed beneath the driver's seat and midway between that point and the rear axle The engine has its forward point of support on the front cross member and needs no rear supporting member, as the two supporting arms at the rear rest directly upon the frame side members. In addition to its vertical taper, the upper flange of the frame tapers to give greater width just in front of the rear axle where the passenger weight is carried.

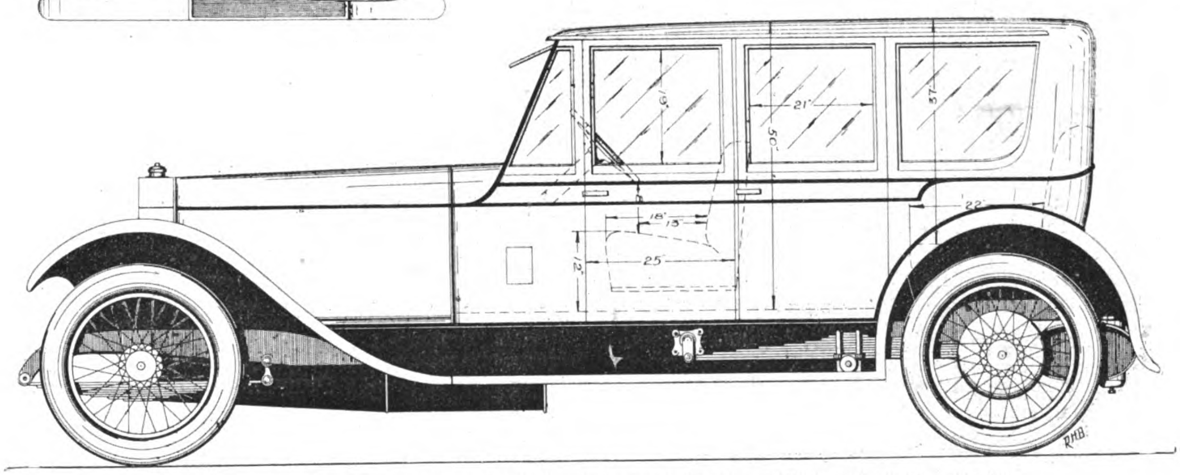
persons, the two front seats being of the divided arm-chair pattern while the rear seat is undivided full width. Both front and rear parts of the body afford unusual leg room, a point often neglected in smaller and shorter bodies, and one which brings much discomfort to tall people.

When all the windows are down, this body presents all the advantages of the open type body, with the added protection which the permanent top gives. The strikingly long fenders blend well with the other long lines of the body and are in pleasant relief to those commonly used, of doubtful utility and devoid of artistic effect.

Wire wheels of a special built up type add to the distinctive appearance, or if preferred, disc wheels which are rapidly coming into vogue, could replace them and would add further to the distinctive appearance.

Characteristics of the chassis: Wheelbase, 143½ in.; body space, 101¾ in.; tread, 56 in.; front seats are 16 in. wide by 18 in. deep; rear seat is 44 in. wide by 22 in. deep; both doors are 25 in. wide.





Five passenger enclosed drive limousine body, designed to be com modious and smart appearing

Federated Engineering Societies Gaining Ground

The Federated American Engineering Societies, which was started several months ago by the four large national societies representing the civil, mechanical, electrical and mining engineers, is obtaining substantial support, and is gaining ground very rapidly. It was started to bring about solidarity in the engineering and allied technical professions, and is to be an organization of societies, not individuals, This society of societies when completed by the adherence and support of all organizations would then become a super-organization representing the whole technical and engineering profession of the country.

The four major societies have appointed delegates to the first meeting of the American Engineering Council in Washington, D. C., Nov. 18-19, 1920. Other bodies that have voted to become charter members include: Kansas Engineering Society, Alabama Technical Council, Engineering Association of Nashville, American Institute of Chemical Engineers, Engineering Society of Buffalo, and the Society of Industrial Engineers. Before the meeting it is expected that more than a dozen additional societies and professional bodies will have decided to come in as charter members.

Ideal Car Serial—No. 12

Five Passenger Enclosed Drive Limousine

Specially designed for The Automotive Manufacturer by
RICHARD H. BURKE

This design of an enclosed drive limousine body has been prepared to be mounted on a Rolls-Royce chassis. Like many other standard styles of body work, the enclosed drive has undergone many alterations in its lines and methods of construction The design shown herewith is along the latest American lines, which presumably would differ somewhat from English, French or other designs of the same body for this well known chassis.

This body, which should interest the owner-driver requiring a comfortable and commodious car, is fitted with double doors on each side and larger quarter side lights in the back. The size of these lights, coupled with the big ones in the doors, and the unusual amount of glass in the front, makes an unusually well lighted body, and one from which it is possible to see clearly in every direction. The body gives ample seating accommodations for five

Paint As An Engineering Material

By E. J. SHEPPARD*

IF we refer to the dictionaries in an attempt to define "paint" we find that all agree on one meaning—namely, "coloring matter for the face." The average description is "a substance used for painting." We next find that the word "paint," when used as a verb, is described as meaning "to cover with color"; color in its turn being described as a pigment or paint, which leaves us at the exact point at which we started. The American Society for Testing Materials has however adopted the following definition: "A mixture of pigment with vehicle intended to be spread in thin coats for decoration or protection or both." You will note that the definition gives greater prominence to the act of application and its purpose than to the material applied.

The use of decorative and protective coatings is of great and unknown antiquity. In biblical times Noah "pitched the ark within and without with pitch." Savages used pigments mixed with grease or fat for decorative purposes even up to recent times. At present there is nothing in domestic or outdoor life so common, so constantly before our eyes, as painted surfaces, yet outside the ranks of those directly interested, little attention is paid to the nature and composition of paint and of its proper and economical use. It seems that paint is often considered a luxury rather than a necessity; while paint improves the appearance of property, it is more valuable as a protection.

If paint is to exercise its function as a decorative or protective agent or both, it is obvious that it must have one quality, without which it will not protect very long nor decorate very satisfactorily. That quality is durability.

It is a general belief that paints are less durable than formerly, and in some instances this is probably true. It must be remembered however that where some paints last for a long time, many others have perished; it is essentially a case of survival of the fittest.

The durability of paint is influenced by four important factors:

1. The pigments used, their chemical composition and physical properties.
2. The vehicle.
3. The nature of the surface.
4. The application.

Let us now consider each of these factors individually. In selecting pigments there are three fundamental qualities to be looked for:

1. Opacity in an oil vehicle.
2. Fineness.
3. Paint making quality.

The opacity as defined by the American Society for Testing Materials is "the obstruction to the direct transmission of visible light afforded by a substance, comparison being made with sections of equal thickness." Many substances have little hiding power when mixed with a liquid, whereas in the dry state, where the particles are surrounded by air, they possess this property. In an oil vehicle the refractory index of the oil and pigment may be so close that the pigment has little hiding power.

The fineness as defined by the same society is the term used to denote the extent of subdivision and expressive of the number of particles of pigment in a unit volume exclusive of voids.

Finely ground pigments help to give a perfect paint, greater ease of application, and a finish to the job as well as greater spreading power. The best pigments are exceedingly fine powders and their physical characteristics are at least as important as their chemical composition, and in recent years the physical properties have been receiving the most attention. The pigment is the decorative part of the paint, that is the distinctive color desired is provided by the pigment.

On examining, for example, the white pigments, we find that only five fulfill the requirements of opacity in an oil vehicle—white lead, zinc oxide, basic lead sulphate, leaded zinc, and lithopone. The addition in small quantities of pigments deficient in hiding power may have no injurious effect, they may even be beneficial, but in larger amounts they should have the effect of cheapening the product. Now, cheapness is not an objection, except when it blinds or defrauds the purchaser. The chief so-called auxiliary pigments most commonly used, as asbestine, whiting, barytes, silex, china clay, etc., are more or less transparent when ground in oil; therefore for a white or tinted paint that really hides, some one of the five opaque pigments mentioned must be used. The auxiliary pigments alone are utterly without value and become in a degree respectable from their association with materials which are intrinsically valuable.

If the addition of these auxiliary pigments in small quantities to a paint made from an opaque pigment does not decrease the hiding power, then some explanation should be made as to the method by which this result was obtained. If it has been found, for example, that the addition of a small percentage of barytes to a white lead paint does not lower the hiding power of the latter, it must be due to the fact that less oil was used or that less surface was covered per gallon of paint than with the straight white lead paint.

Some people distinguish between "addition" and "substitution" of auxilary pigments to paints made with opaque pigments.

It is true that the addition of an auxiliary pigment does not decrease the hiding power of white lead, but the subsituation does decrease the hiding power. If you make a paint of say, 4 gals. of oil and 100 lbs. of white lead, and another paint of 4 gals. of oil with barytes in place of some of the white lead, the hiding power of the latter will be less than that of the straight white lead paint. If however you take 2 gals. of paint, each containing the same amount of linseed oil and white lead and you add to one of these gallons a portion of dry barytes, the hiding power of the mixture will be greater than the straight white lead paint; what has been done then is the addition of pigment without increasing the oil. But the addition of dry

*Chief chemist, St. Louis Lead and Oil Co. Read before the Assoc. Eng. Socs. of St. Louis on June 9, 1920.

barytes necessitates the addition of more oil to make the paint suitable for application. You have therefore a substitution, not an addition.

Zinc oxide is perhaps as opaque as white lead, but it requires from one and one-half to two times as much oil to make a paint, hence the film has less pigment in it and it is generally allowed that it takes from three to four coats of it to equal two of white lead. An ordinary white lead paint contains at least a half more pigment by volume than an ordinary zinc oxide paint. It is therefore plain that a film of white lead will be much more opaque than one of zinc oxide, because there is so much more pigment in it.

White lead is one of the oldest manufactured pigments. It is mentioned by Xenophon, who wrote 400 B. C., and it was well known to many Roman writers about the beginning of the Christian era. Since that time it has become a well known article of commerce. We must therefore conclude that there must be some good reason for this supremacy of many centuries. A general utility white pigment equal or superior to white lead may some day be discovered and judging from the patent office reports of this and other countries, many attempts have been made to replace it, but without success. The reason for this seems to be that many of the substitutes do not possess the qualitites for which white lead is conspicuous; namely, opacity and durability.

As a pigment white lead possesses all the good qualities desired by a painter. It is distinguished from all other white pigments by the ease with which it mixes with oil and by forming a paint which flows readily from the brush and from which the brush marks disappear, leaving an even surface. White lead is the only white pigment which alone has been successfully used in conjunction with linseed oil.

Some years ago a theory was formulated in which a paint film was likened to concrete, and this theory has been responsible for the suggestion that the rigidity of a paint film might be increased if a pigment of various sized particles be prepared, so as to obtain what is known as a reinforced effect. In the last ten years many panel and fence tests have been made in an attempt to substantiate this theory, but no direct proof has been obtained. There is no doubt that there is some advantage in mixing products of various sizes but there is also no doubt that the reinforced effect is overdone by some of its exponents.

The ideal paint vehicle should have the following properties:

1. Freedom of working in the liquid condition.
2. Ability to change fairly rapidly on exposure to air to a durable film possessing the following characteristics:

A. Flexibility to enable it to follow the expansion and contraction of the painted surface without rupture.

B. Hardness to enable it to withstand mechanical injury.

C. Impermeability to moisture and gases, especially when used with pigments.

Linseed oil is practically the best commercial paint vehicle known today. It has ideal working qualities, but the very property which enables it to be used as a paint vehicle, that is, "to dry," is really the first stage of disintegration.

As I have stated before a paint is composed of pigment and a vehicle, and it is obvious that either alone will not protect. While the pigment alone does not change appreciably, the oil does change and the paint coating is finally destroyed. Sometimes one may hear that "the oil is the life of the paint," but even a superficial inspection of the paint tests made in recent years will effectually correct this idea. Dried oil is more or less porous and the pigment stops up these pores, thus making the coating more impermeable. It increases the hardness of the dried film, thus increasing its resistance to the wearing-away process caused by the elements, sand, etc.

The addition of volatile thinners to paint is largely for the purpose of thinning the paint to a better working consistency, that is, to reduce the labor of spreading the film in a sufficiently thin layer, and to assist the penetration of the oil and pigment into the wool. For these purposes they are valuable, but carried too far they cheapen the paint. Since they volatilize when the paint is spread, they thin the paint without increasing the proportion of oil in the dried film, thus making the film harder than if the vehicle were all oil.

The vehicle is the binding medium holding the particles of pigment together. On exposure the oil begins its various reactions of oxygen absorption and, as mentioned before, this is the first stage of disintegration. When hard, the reactions do not cease, and the oil decomposes slowly. The pigment thus loses its binder and the particles are gradually washed away. This results in what is generally called "the chalking" of paint and it is a progressive action which is more noticeable with certain pigments. The film remaining attached to the surface is continually getting thinner but is in an excellent condition for repainting.

The late Dr. Dudley of the Pennsylvania Railroad believed that the greater the proportion of pigment in the paint, the greater the durability owing to the fact that the pigment apparently protects the oil from decay.

The Surface

It is of the utmost importance that the surface to be painted should be in a fit condition to receive the paint.

Xenophon, some 400 years before the Christian era said "that a war horse, even if all his other points were fine, would yet be good for nothing if he had bad feet, for he could not use a single one of his fine points." It is exactly so with painting—if the foundation is poor, the subsequent work and material are thrown away.

To attempt to apply paint in damp, frosty or foggy weather on a greasy or dirty surface is a waste of time, material and thought. The presence of water, as in damp or unseasoned woods, is a frequent cause of trouble; the water evaporates in warm weather, either breaking the oil film, or throwing it off in the form of blisters.

The Application

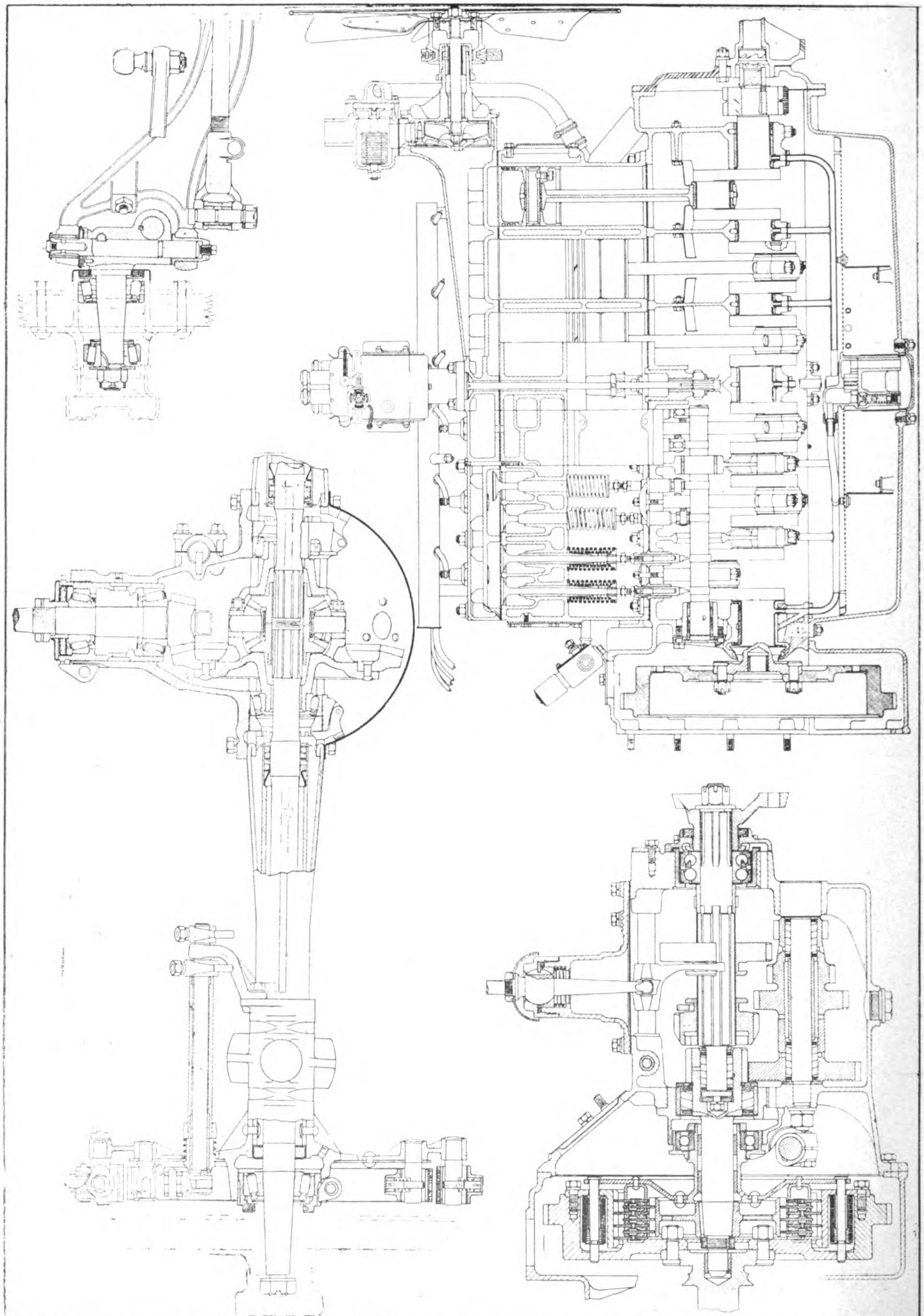
In the case of a defective job of painting, it is easier to blame paint materials than it is to blame workmanship. Marterials are tangible, workmanship is intangible. Every manufacturer of paint feels that if his paint were properly applied it would give perfect satisfaction.

Cost

Sooner or later the question of cost enters into all discussions of a practical nature. The cost of preserving structures by means of painting should cover:

1. The cost of materials per unit of area.
2. The cost of labor per unit of area.
3. Duration of effective service.
4. Cost of preparing surfaces for repainting.

(Continued in November number)



Most important units in the new Packard Single Six Motor Car. Fig. 1. (lower right) Longitudinal section through engine; Fig. 2. (lower left) Clutch and transmission drawing showing details of construction; Fig. 3. (upper right) Front axle end and steering knuckle; Fig. 4. (upper left) Part elevation, part section of rear axle showing pressed steel housing.

Packard Announces Single Six Smaller Model Car

Long-Expected Small Car From Big Detroit Plant Uncovered—Details Show Clean, Neat L-Head Six Rating at 27 H.P., 116-in. Wheelbase and No Remarkable Departures From Current Practice

ONE of the first of the new higher grade motor cars designed to present light weight, high gasoline and tire mileage with adequate power and substantial construction, is the newly announced Packard small car. The word small here is used in a relative sense, for the car has a wheelbase of 116 in. and is by no means a little machine. On the contrary, it has been designed for the utmost roominess compatible with the carrying of five passengers with maximum economy.

It should be stated at the outset that the Packard Company does not expect this new smaller model to replace the Twin Six; it is intended only to supplement it, to be a general purpose car of shorter wheelbase and lighter weight, and consequently having greater maneuverability in traffic. While it does resemble the Twin Six greatly in design as well as general appearance, in that a great many of the proven mechanical features are common to both and the same standards of workmanship are said to be set for both, there really is no possibility of confusing the two.

As has been stated the new Single Six is a five passenger job, and is offered in touring, runabout, coupe and sedan bodies. The touring car is priced at $3,640 at Detroit, the roadster at the same figure, the coupe at $4,835, the sedan at $4,950, and the chassis only at $3,000. What follows is largely mechanical description as illustrations of the body forms and descriptions of the same are not available as yet. When available, they will be presented to our readers.

In a general way, the car may be summed up as having block-cast six-cylinder motor rating at 27.34 h.p. and yielding 52 on test, dry disc clutch, three-speed transmission, wheelbase of 116 in., chassis weight of 2,250 lbs., and touring car weight, ready for the road, with gasoline, water and extra tire, of 3,080 lbs.

During the war the Packard Company did a great deal of war work especially in the construction of airplane engines of which it was one of the largest producers in the country, if not actually the largest. Considering this, and its possible influence upon all subsequent design and construction, it is interesting to consider the new power plant. This, shown in Figs. 1 and 5, is said to represent about two years of development work at the Packard factory. In fact this design is the culmination of experiments and trials which started immediately after the war and continued up to a recent date, when the final design was decided upon. It is an L-head unit with its six 3⅜ by 4½ in. cylinders cast in a block. Its S. A. E. rating is 27.34 h.p., and the brake horsepower, as developed on the Sprague dynamometer, averages about 39 at 1,600 r.p.m. and 52 at 2,400 r.p.m. which is below the peak point. The peak point on the horsepower curve is about 2,750 r.p.m. The breake mean effective pressure is around 83 lb. per sq. in. at 800 r.p.m., and above 80 lb. from 500 to 1,600 r.p.m. The compression ratio is 21 per cent. The engine structure is built up of four principal components, these being the cylinder block and cylinder head, which are both of cast iron, and the crankcase and oil pan, which are both of cast aluminum. This division of the structure into four castings permits of the simplest possible casting and hence permits of core work giving the maximum water jacketing space, and at the same time, minimum weight.

The pistons are also cast iron, and weigh 1 lb. 7 oz. each. They are 3⅜ in. in length and fitted with three rings all above the piston pin. These rings are 3/16 in. wide by 7/64 in. thick. The piston is therefore a square type with the same diameter as length. The piston pin is slightly below the center of the piston and the piston pin boss provides sufficient stiffness without additional ribbing in the piston. The piston pin is of seamless steel tubing, anchored in the boss by means of a screw through the bottom of the boss.

Valves are interchangeable, of the usual 45 deg. type, being 1½ in. dia. in the clear, with a lift of 11/32 in. The order of firing is 1-5-3-6-2-4. Valves are so timed that inlets open 9 deg. past upper dead center and close 42 deg. past lower dead center. Exhausts open at 47 deg. before lower dead center and close 4 deg. past upper dead center. As will be noted this gives an interval between exhaust closing and inlet opening of but 5 deg. Valves are closed by double concentric springs, and are accessible for adjustment by the removal of a cover plate held in position by thumb nuts.

Connecting rod is a drop-forged I-beam section machined all over. It is 9¾ in. center to center, bushed at the upper end for the piston pin bearing and split at the lower end for crankshaft bearing. The former bearing is ¾ in. in dia. and 1½ in. in length, and the latter 1¾ in. in dia. and 1½ in. long. The shaft has seven bearings for rigidity, all of 1¾ in. dia. Lengths from front to rear are: Front 2 9/16 in. center, 1 57/64 in.; rear 2½ in.; four intermediates, each 1 9/64 in. These figures give an aggregate bearing length of 10 33/64 in. and a projected bearing area of 18.503 sq. in. It is of the oval cheek type, and all bearings and pins are ground to size. Both connecting rods and crankshaft are of 40 point carbon steel.

Timing drive is by silent chain, this being 1 7/16 in. wide, in a triangular layout to operate camshaft and generator shaft sprockets. The camshaft is 1 in. in dia. with cams integral mounted in four bearings, which are 27/16, 1, 1 and 1¾ in. in length from front to rear. Valves are operated by a lifter finger pivoted at one end and operating the tappets at the other by a hardened and ground button forming the end of the finger and contracting with the bottom of the hollow tappet. The lifter finger carries a roller follower slightly nearer the tappet end upon which the cam acts. This lifter finger is pivoted on a rocker shaft accessibly mounted in the removable side of the crankcase. These rocker shaft assemblies may be removed in groups of six by removing the stud nuts holding them to the crankcase. Springs prevent side sway and noise by forcing the arms against proper surfaces. The finger type of valve operation has the advantages of greater ability to follow the cams at the higher speeds and removal of thrusts. It will be recalled that the engine shows its power at relatively high speeds, giving 39 at 1,600 and 52 at 2,400 r.p.m., so this feature is of double importance.

Lubrication of the motor is by full pressure system, the oil pump in the center of the aluminum oil pan being driven by the same vertical shaft that drives the ignition distributor at its upper end. This is in the center of the length of the engine, between cylinders 3 and 4. The pump can be removed from beneath, without dropping the oil pan, by removing the nuts from the studs holding the cap in place, this as Figs. 1 and 5 show being on the outside of the oil pan. The pump is of the gear type and

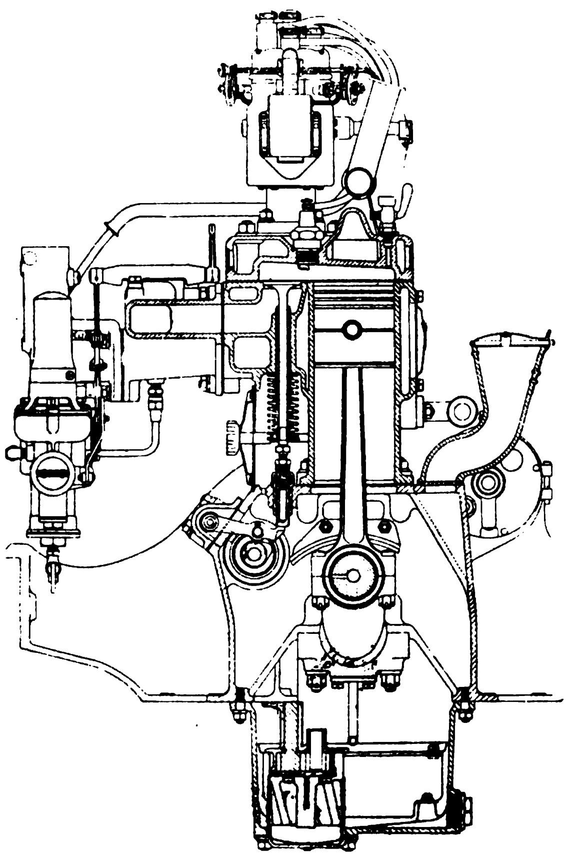


Fig. 5. Cross section of Packard Single Six Engine

at 1,000 r.p.m. delivers 25 lb. per sq. in. pressure. After passing through bearings and lubricating other parts, the oil returns to the crankcase where it is drained through a screen in the oil pan, and is again screened before it enters the pump. Baffle plates in the oil pan, placed transversely, prevent surging of the oil.

Carburetion is similar to that on the Twin Six, the vaporizer being the same. This is fed from a 19-gal. tank at the rear of the frame, with Stewart vacuum system of feeding. The fuelizer, so called, is used on the smaller model also. This consists of a heating chamber through which some of the combustible charge is by-passed and in which it is ignited by a special spark plug. By the use of up-to-date methods in manifolding it has been possible to closely approach airplane figures in fuel economy tests. With full load at wide open throttle, the best point on the economy curve is 0.57 lb. of fuel per b.h.p.hr. which approximates results obtained in aviation practice. A little kink in manifold design, which was learned in building sixes, consists in the use of a split lead; that is, there is a partition in that branch of the intake manifold which extends down toward the carburetor, which breaks the stream into two parts for the fore and aft groups of three cylinders. It has been found by Packard engineers that loading exists in the plain T form of construction in the intake manifold of a six, due to the surging which takes place. By means of this split distribution the surge is eliminated and no loading troubles are experienced.

Ignition is by Delco system, and starting and lighting by Atwater-Kent, with Bendix pinion shift. The ignition distributor is driven from the top of the same vertical shaft as drives the oil pump, and is located on the top of the engine slightly to one side, between cylinders 3 and 4, as mentioned previously and shown in Figs. 1 and 5. The Atwater-Kent starting motor is separate from the generator, the motor being held by standard type S. A. E. flange to the flywheel housing on the crankcase. Generator is on the right side of the engine, driven by timing chain. It is secured to crankcase by boss on the timing gear housing at front end.

Cooling is by water, circulated by centrifugal pump. The system has a capacity of 4 gals. and the temperature is controlled by a thermostat which is set at 120 to 150 deg. F. An unique feature of this design is that the thermostat construction is an integral part of the water outlet header, being built into a slight projection on top of the front end, as Fig. 1 plainly shows. The arrangement is such that the water is bypassed back to the jackets and does not circulate through the radiator until it reaches the temperature at which the thermostat is set to open. One desirable effect of this is to warm the engine up quickly, as on starting when the water is cold it does not circulate to the radiator but simply surges around within the jackets and header until it becomes hot enough to open the thermostat, that is above 120 deg. It is of the direct acting type.

Another unusual feature of the design is that the water pump and fan are practically one unit, being driven by a V-type of belt from the same shaft. To bring about this result, which eliminates many parts the pump has had to be lifted from the usual position alongside the crankcase, which is below the lower level of the water jackets so the water flows to it by gravity, to a position above the tops of the cylinders so the water must be lifted by suction. While this position increases its accessibility on the one hand and while its exact location make little or no difference to the motorist so long as it circulates the water satisfactorily on the other, it does represent a departure from conventional design.

In this high position, this unit combines the functions of the pump shaft and fan shaft, gives a balanced construction, and calls for but one packing gland, which is in an accessible position behind the fan. The radiator is a hexagon type with extra large tank at the top. This precludes the possibility of the water level dropping so low that the pump will not feed, and by providing larger water capacity makes for more certain and more efficient cooling. One advantage of this high location is that the generator is made more accessible, the removal of the pump from the usual position giving more room for this and other accessory units. The arrangement provides also for a swinging adjustment of the generator to take care of the silent chain drive slackness if any.

Before leaving the discussion of this interesting powerplant, it may be mentioned that it belongs neither to the high speed nor the low speed class. It is also of great interest to compare this with the Packard 1-38 of 1912, which had about twice the displacement of the present model, and yet it developed only the same horsepower. Of course this engine operates at 2,400 as compared with 1,800 for the 1912 model, but as a result of better design a higher mean effective pressure is secured. Another way of looking at it is that for the same horsepower the weight of the engine has been cut in two.

The clutch, shown in section in Fig. 2, is a dry plate type with seven plates, four driving and three driven. The plate diameter is 8 in. and the whole unit is housed within the flywheel in the conventional manner. As will be noted in the drawing, each disc is faced on one side with asbestos facing. Springs are of the small-diameter coil type, and are entirely enclosed within the flywheel covering plate. While the transmission which is a unit with clutch and engine, is mounted on Hyatt roller bearings, a ball thrust bearing is provided at the rear end of the clutch with threaded collar means of adjustment.

The gear set provides three speeds forward, the gearbox ratio being 3.368 to 1 on first (low), 1.774 to 1 on second, direct on third (high), and 4.26 to 1 on reverse. Clutch and gearset have been designed together to give a very smooth shift and to facilitate this, the rotating mass in the clutch has been cut to the minimum, so that when the clutch is disengaged the only units in motion are the very light sheet steel discs. The shifting gears have an unusually short travel, as the drawing Fig. 2 shows, and are chamfered for easy engagement. Gears also have unusually wide faces. Main shaft is short and of large diameter, with gears mounted on splines which extend the entire working length. The whole transmission is very compact, the distance between main bearings being quite short. This makes an exceptionally sturdy unit, and one which should be very quiet in operation. Besides the roller bearings mentioned, the rear end of the main shaft is mounted on a combination load and thrust bearing of the double row ball type. Shifter mechanism is mounted on the cover plate and removes with it. Drive is through hollow propeller shaft with two universal joints of the fabric disc type. The shaft has an outside diameter of 1¾ in. and an inside diameter of 1 39/64 in., making the shaft walls only slightly over 1/16 in. in thickness, 0.0703 in. to be exact. This is probably the type of extremely thin-walled but very strong and flexible drive shaft described in Automotive Manufacturer for April, on pages 21, 22 and 23. It will be recalled that these advantages were mentioned at that time. Lack of lubrication needed, extreme quiet, lighter weight with greater strength, easier riding and longer life, shock absorber action which saves drive shafts and units at either end, saving in repair bills and replacements, greater all round economy.

Drive is taken through the springs, and torque through a torque arm, pivoted to the differential housing at the rear end, and to the frame cross member directly beneath the driver's seat at the front end. The rear axle, shown in partial section in Fig. 4, is of the smei-floating type, with taper roller bearings at all points. The axle gear ratio is 4.31 to 1. The brake drums are on the rear wheels and have an expanding brake working on the inner, and a contracting band working on the outer surface. Diameter is 14⅜ in. and width of face 2¾ in. Semi-elliptic springs are used both front and rear, the fronts being 38 x 2, and the rears 54 x 2¼ in. Wheels carry 33 x 4½ in. tires all around. The frame is a 7 in. channel of the straightline, tapered type, that is of a straight taper from the spring horns at the front to the rear spring attachments. A torsion tube cross member is used at front and rear ends, other cross members being of channel section. This taper construction gives a very narrow front, which in combination with the short wheelbase, produces an unusually short turning radius, it being possible to turn the car in a circle of 16 ft. 8 in. radius. Steering is by an opposed threaded worm and split nut mechanism with plain bearings.

Materials have been chosen throughout to facilitate the idea of light weight, high quality and modest price. Thus the crankcase is of aluminum alloy, transmission gears of chrome-nickel steel, propeller shaft and front axle 40 point carbon steel, axle shaft of chrome-vanadium steel, and axle gears of chrome-nickel steel, axle housing steel stamping, and frame of 20 point carbon steel.

As a result of its light weight, good balance, unusual fuel vaporizing ability and other built-in qualities, the company claims that it is very economical of fuel and tires, 20 miles per gallon having been obtained in testing it out, while some tires on experimental models were in fair condition after 25,000 miles of service. From this it is argued that the average driver should obtain at least 15,000 miles in average mixed city and country driving. Further driving advantages to which attention is called are ease of steering and very short turning radius, light clutch action and smooth gear shifting With all these desirable qualities, the new car should achieve deserved popularity in a short time.

Overheating Reduces Strength of Glue

That long continued heating reduces the strength of animal glue solutions is demonstrated by the following test made at the Forest Products Laboratory.

Solutions of a high grade joint glue and a veneer grade glue were heated for 48 hours at 104, 140 and 176 deg. F. and tested every few hours during this period for strength and viscosity.

In the first seven hours of heating at 176 degrees the veneer glue lost approximately one-half its joint strength, and the high grade glue joints weakened almost as much. The greatest loss in the strength of the glue joints occurred at this temperature. In the solutions kept at 104 degrees there was a sudden drop in the strength of the joints made with the high grade glue after 31 hours of heating, due possibly to a combination of bacterial and chemical action. The veneer glue joints showed a more gradual decrease at this temperature. The most favorable of the three temperatures tried was 140 degrees, but even at this temperature an appreciable weakening in both glues was noted at the end of 7 hours, and longer heating caused greater loss.

The viscosity of the high grade glue declined more rapidly than that of the veneer glue, but at the end of the heating test the viscosity of the high grade glue still averaged higher than that of the veneer glue.

Alcohol as a Possible Remedy for Fuel Shortage

Exact Statement of Present Fuel Conditions—Possibilities in the Way of Mixed Fuels, and Large Part Which Alcohol May Play in Mixtures

WITH reference to the present situation, it will be sufficient to state that all rosy statements to the contrary, there is a marked and growing shortage of crude oil, and consequently of the components needed for automotive vehicles. The official report covering the month of August, the latest complete report available, shows that despite the largest monthly production on record, totaling 39,144,000 bbls., which is at the rate of 470,000,000 bbls. a year, the shortage for that month alone, that is the difference between production and consumption, was 8,670,000 bbls. In July, which had the second largest production for the year, the output was nearly as large, 38,548,000 bbls., but at that the month indicated a shortage of 5,864,000 bbls. In June the story was the same and the shortage almost as great so that the total shortage for the last three months was 19,924,000 bbls. or in round figures twenty million barrels. At this rate the depleted storage stocks would soon be used up, were it not for the fact that imports from Mexico have also assumed record proportions. Whereas a few years ago, a Mexican output of sixty to seventy million was considered a sthat country's maximum, in July the total excess of imports over exports was 6,066,570, and in August 10,257,748 bbls. The latter is at the rate of 123,000,000 bbls. a year.

Against this situation, which shows that the lighter American oils are only meeting the situation through the tremendous imports of the heavier Mexican crudes, and the two combined are showing an actual shortage, with no other fields available to help out the situation, it must be admitted that the actual automotive fuel demand has been met by the production of a growing quantity of synthetic gasoline through the more or less widespread adoption of cracking production. In many cases, these have doubled the output of motor fuel from a given quantity of crude oil.

There are in use in this country today in excess of 8,000,000 automotive vehicles, and these are being added to at the rate of 200,000 a month, 8,000 per working day. Despite increased economy and the much greater number of smaller more economical cars, the average amount of fuel needed per year is kept up to the 400 gallon mark by the relatively greater proportion of trucks and tractors. On this basis, the number in use today requires 3,200,000,000 gals. per year, while the new vehicles add to this at the rate of 80,000,000,000 gals. per month, 3,200,000 gals. per working day. Pennsylvania and Ohio crudes will yield in excess of 33 per cent by cracking methods, but these oils form but 3 per cent of the total. The big bulk consists of Texas, California, Oklahoma and Mexican crudes, which are heavier. California and Mexican oils are of an asphalt base, and even under cracking processes yield less than 11 per cent on the average. Texas and Oklahoma oils yield about midway between the two, or from 16 to 18 per cent. Using these figures as a basis, present maximum production totals and maximum possible yield of motor fuel using all the crude oil, would yield but 3,000,000,000 to 4,000,000,000 gals. This is a maximum condition however. Based on the present consumption, and rates of increase, the amount needed will be 3,600,000,000 gals. a year by Jan. 1, 4,000,000,000 on June 1, and 4,400,000,000 Nov. 1 of next year. These figures show how narrow a margin we are working on, all this too, being upon the basis of using all the crude oil in cracking processes which is far from the actual case.

In this dilemma what other fuel sources are there? It was suggested by Joseph E. Pogue, Sinclair Refining Co. expert, formerly with the Bureau of Mines, Fuel Division, that aside from present crude petroleum including shale oil, there are two possible sources of motor fuel, namely, benzol from by-product distillation of coal, and the alcohols and ethers from organic substances. With reference to the benzol production, coke ovens produce less than 50,000,000 gal. a year, and artificial gas plants about 5,000,000, so that even with great and rapid increases in this field, only about 100,000,000 gal. a year can be counted on for some time to come. It is estimated that only one-twelfth of the coal consumed in the country is worked in by-product plants. Consequently, even if all the coal were consumed in such a way as to save all by-products, the output would be but twelve times the present figures, or in round figures less than 700,000,000 gal. a year.

From this point of view then alcohol offers the biggest future. Aside from providing a profitable work from the large number of breweries and distilleries of the country, the production of alcohol through fermentation processes might easily become a by-product of considerable profit, to the many food products plants and canneries.

The fermentation industry, notably the branch having to do with the manufacture of industrial alcohol, has been strongly stimulated by war demands, and industrial machinery is now available for the production of considerable alcohol for fuel purposes. The arrival of prohibition has also freed a large equipment from other duties, which might in part be devoted to a similar end. There are serious handicaps of a sentimental nature however which tend to bind the manufacture of industrial alcohol with governmental restriction harmful to proper progress; although the war-installed equipment and the cheapness of the requisite raw material may be sufficient to balance these drawbacks.

Alcohol alone can be used to advantage only in engines especially adapted to this fuel, but various mixtures of alcohol, benzol, gasoline or other petroleum distillates and other materials have given promising results. It is of great significance from an economic standpoint that alcohol, benzol and the lighter petroleum distillates such as gasoline and kerosene can readily be rendered miscible. It is probable that alcohol, like benzol, will not come into widespread use as a single fuel, but has a broad significance, for the present at least, only as a blending agent in connection with liquid fuels obtainable in larger quantities.

The quantity of alcohol which will be produced in this country in the immediate future is much more difficult to forecast than in the case of benzol. The United States in 1916, 1917 and 1918 turned out about 50,000,000 gal. of denatured alcohol each year, having jumped from an output of 14,000,000 gal. in 1915 under the stimulus of a demand born of munitions requirements. Much of the industrial alcohol under manufacture today is made from sugar molasses and waste sulphite liquor; while garbage, fruit wastes and ethylene from coal distillation plants have been suggested as supplementary resources. While the alcohol capacity of the country cannot be closely estimated without a special investigation beyond the scope of this article, the conclusion seems inevitable that for some time to come the available supply of alcohol will bear a close quantitative analogy to benzol, the two combined bulking small when compared with engine-fuel requirements which will approach 5,000,000,000 gal. late in 1921.

On the whole therefore it may be concluded that benzol and alcohol hold somewhat analogous positions in respect to the supply of engine fuel. Neither can be produced in sufficient quantities in the near future to replace gasoline; both have interesting possibilities in the direction of improving the character of the fuel supply in respect to present engine types. This whole field is undeveloped and stands in need of more research attention than has been accorded it.

Composite fuels, while holding out the possibility of improving the adjustment now obtaining between the fuel and the engine, present also the danger of obscuring for a time the necessity of adaptations on the part of the engine in the direction of higher thermal efficiency and lessened dependence upon specialized fuels. Composite fuels, if found to fulfill their initial promise of advantage in utilization, can be developed by the oil industry or, in a more limited manner, by outside agencies; but they can be more readily developed on a larger scale by the oil industry, because of its control of working channels of distribution.

While nothing revolutionary may be expected in the way of composite fuels that will displace gasoline in the next year or two, there may come into evidence a steady trend toward a fuel supply of petroleum origin carrying quantities of other materials, chiefly benzol and alcohol, which will facilitate utilization in the present types of engines. It would be unfortunate however if this outcome resulted in a relaxation of the efforts for higher thermal efficiency and for lessened dependence upon specialized fuels, which still remain essential elements in a fundamental solution of the engine-fuel problem.

The above represents largely the opinion of Mr. Pogue, who is essentially an oil man, in that he views the situation from a mineral oil standpoint, hence it is not strange that he leans strongly to that side, and makes plain the point that for years our main dependence will have to be upon mineral oils, and that the shortage of such basic commodities will keep the price high. But is this actually the case? Let us see if it is not a fact that our molasses, corn, acetylene and other potential sources of large quantities of fuel alcohol will bulk up so large as almost to make mineral oil secondary, and in the second place, to insure adequate fuels for continued automotive expansion. With the tremendous investments in automotive vehicle manufacturing plants, to say nothing of the equally large investments in parts, accessory and material plants, the latter is almost as important as the former.

Hitherto most of our so-called industrial alcohol has been obtained from sugar mill waste, i.e., the well known blackstrap molasses. The amount of this basic raw product is decreasing, mainly because the refiners have brought into play processes which make it possible for them to secure from the molasses various marketable syrups to satisfy the popular sweet tooth. True, low grade molasses can still be had from the sugar mills of the Far East and other remote sources, but this entails the service of special tank steamers and the added costs of transportation. How then are we to produce the great measure of alcohol which we shall want ere long?

In Germany nearly 70 per cent of the annual output of more than 100,000,000 gals. of alcohol is got from potatoes. In France, on the other hand, the chief source of industrial alcohol has been the molasses from the beet sugar refineries. Both of these basic raw materials are to be had in the United States in abundance, especially potatoes of the kind known to the farmer as seconds and culls, for which there is only a limited market. Potatoes that are unfit for food, because diseased or touched by frost, can be utilized in the manufacture of alcohol. A ton of the tubers, if they contain 16 per cent of starch, will yield 25 gals. of alcohol. Many millions of tons of potatoes are sacrificed yearly which could thus be profitably consumed in the distillation of motive spirits.

But probably the most promising native source of industrial alcohol is our vast corn belt; maize for years has stood pre-eminently as the cheapest raw stuff for the distillers. It is easy to raise and stands transportation and storage admirably. It is undeniably true that wood waste is susceptible of furnishing a great volume of industrial alcohol, but there are difficulties of an outstanding nature which now seriously hamper putting any of the processes in service upon a commercial scale of moment. Similarly, recent developments in the field of chemistry have shown that it is entirely practicable to get a goodly measure of alcohol from the waste liquor of the mills engaged in the making of sulphite paper stock. The Germans are said to obtain quite 3,000,000 gals. of spirits from this origin annually; and the Swedes are employing a kindred method of their sulphite mills—10,500,000 gals. of 100 per cent pure alcohol are thus realized in the course of a twelvemonth.

But alcohol in quantity enough for industrial and motive purposes is not to be had from by-product materials. We shall have to count upon an ample primary substance which can be cultivated for that purpose season after season. Here is where corn meets every requirement. It can be planted and harvested within ninety days throughout an enormous area; and a ton of the grain should yield about 89¼ gals. of pure alcohol. A large distillery should be able to handle 10,000 bushels of corn a day, and do this 300 days a year. That is to say a plant of this size would have an annual output of 7,500,000 gals.

In 1919 we grew 2,900,000,000 bushels of corn, representing a possible source of 7,250,000,000 gals. of alcohol. As a matter of fact, during the past year, our gasoline consumption amounted substantially to 3,100,000,000 gals. Manifestly then if one-fourth of our corn had gone to the distillers of industrial alcohol we should have been in a position to get enough motive spirits to cut down the use of gasoline by fully 58.4 per cent. And if alcohol were used as the basis of a synthetic fuel such as those already mentioned, the mixture with ether, toluol and benzol would effect a gasoline economy of quite 70 per cent in one case and 100 per cent that with ether alone.

The 1920 corn crop estimate of 3,100,000,000 bushels would yield 7,750,000,000 gals. on the same basis, so that one-fifth of it used for alcohol would supply almost half our present fuel needs.

The point to be kept in mind is that our farmers have it within their power tremendously to amplify the acreage planted in corn; and it has been suggested by the agricultural authorities that it would be possible to secure a still greater yield of alcohol if cornstalks were utilized. But this theoretical source of more motor spirits need not be considered because there are practical difficulties that stand in the way of putting laboratory revelations along this line to commercial use. Success in the manufacture of industrial alcohol rests fundamentally upon a sufficient and a continuous supply of the primary raw material, and because of its keeping qualities, corn can be harvested and then held in storage where it can be drawn upon months thereafter. In this respect it is unlike a number of other potential vegetable sources of alcohol which can be turned to account for this purpose only during a comparatively short season.

Without going into the details of the making of alcohol from farm products, it will suffice to say that the first object is to convert the starchy content of potatoes, corn, etc., into sugar through the agency of fermentation; and as a further result of the action of the yeast the sugar is split up into alcohol and carbonic acid gas. Subsequent continued distillation separates the alcohol from the water with which it is combined, adding step by step to the strength or purity of the spirits.

According to present practice, little if any of the carbonic acid gas is saved from the fermenting mash, and right here exists a means of greatly lessening the cost of alcohol. A bushel of grain during treatment will give off seven pounds of CO_2. This gas has a ready market in the charging of bottled waters, beverages, etc., and for use at soda fountains. In fact the present demand is far in excess of the supply. The CO_2 liberated during fermentation is in its purest state and is superior to that made from marble dust, which has to be very carefully filtered, etc., to render it salable. Carbonic acid gas figures in refrigerating systems, and its fields of application are wide and varied. With a proper installation there is apparently no reason why this money-making by-product of the distilleries should not be conserved.

Lest there be a mistaken notion that a foodstuff as such is lost in the manufacture of alcohol from corn, it should be kept in mind that there is a fibrous residue or "slop" which contains 12 per cent of fatty matter and 33 per cent of protein. This, when dried in drums, looks not unlike middlings, and constitutes an excellent feed for hogs, cattle and chickens. The thin slop may however be fed to livestock by mixing it with roughage or by adding a proportion of the "middlings." This brings us to the story of a new fuel which is rapidly growing in favor and finding many serviceable applications.

(To be continued)

Many and Varied Price Reductions Disturb Industry

WHEN Henry Ford on Sept. 21 announced his now famous reduction prices, in the language of the street, "he started something" and that something is still distrubing the industry, and bids fair to continue doing so up to the completion of the 1921 announcements the latter part of the year, or if these are delayed until show time, until well into January of next year. As a general proposition, the industry is now divided sharply along two lines, those who side with Ford and admit that the people want and must have a reduction in prices and must have it now, whether justified by present material and labor costs or not, and those who side with Durant and General Motors group and claim that they have always worked on a fair margin and that at present costs and profits no reductions are justified, in short that right now reductions in prices are economically unsound.

Everyone admits that material prices are high, yet it is only fair to say that if all manufacturers take their stand on the basis of present conditions and refuse to make any concessions, there never would be any change in the situation. It would seem as though the contention of those now reducing prices that as a result of such reductions they will be able to force lower prices on materials, and thus complete the cycle, is sound and based on good common sense.

Moreover the facts bear out their contention To date 29 car makers have reduced prices, while 5 have increased them; 13 truck makers have made cuts, and 1 has added the war tax, in effect, an increase; 3 tractor makers have made reductions, so the total of makers reducing is 45 against 6 making increases. Figures which are available for 22 of the car makers indicate that the average increase in the 4 years from Oct. 1, 1916, to Oct. 1, 1920, is $1,119. Based on the 1916 selling price which averaged $1,605, this amounts to slightly more than 69 per cent. And the Oct. 1920 price includes the recent reductions, that is with the reductions taken out, present prices show an increase of over 69 per cent in the last 4 years or about 17¼ each year. Even if the higher priced machines be eliminated the showing is less in dollars but greater in percentage, 20 cars which averaged $1,280 in 1916, now with the reduction taken out have an average increase of $908, which is 71 per cent for the 4 years or 17¾ per cent per year. A similar computation made in Detroit covers 17 prominent makes, and shows that from Aug. 12, 1918, to Aug. 12, 1920, these makes increased on the average $399 or 28½ per cent. That is, before the present price cutting began these 17 makes had been increased nearly 15 per cent each year.

Of course materials have gone up and still are very high, but a few of them have begun to come down, in fact some were down before the price reductions commenced. Labor too, is still very high, but with lessened demand for goods and some unemployment, that situation is expected to right itself slowly, from a beginning already made. That material prices alone are not the deciding factors may be realized from the simple statement that rubber is lower than it has been for years and cotton too is down to remarkably low levels, so low in fact that planters claim they take a loss when they sell; copper is lower than at any time in the last 5 years, zinc and lead are down to very low figures, aluminum is practically at a pre-war figure and that too, for a better and stronger metal than was available 6 years ago, yet many machines of which these materials form a large part are practically not reduced at all as compared with 6 months ago. All the materials entering into tires and tubes are down from 50 to 80 per cent as compared with a year ago (as for instance rubber at 28 cents compared with $1.05), yet tire prices have been reduced about 17-18 per cent on the average.

In many instances, the price reductions have brought about much immediate business, which was latent and simply required a good sized cut in prices and the attending publicity, to bring it out The forthcoming months will have a large influence in determining how the new year and its business are to shape up; if the price situation is handled carefully, there is still an enormous unsatisfied demand, and with prices at the right level, that is the level which seems right to the buying public, 1921 can easily become the best year the industry has ever known. With overlong adherence to high prices on the part of those manufacturers who claim price reduction now is economically unsound, the unsettled situation may be continued, the public may hold off from buying, and the coming year's business may be very much reduced. A united industry at low price levels and a large volume of business is much to be preferred to a disorganized industry with widely varying prices and spotty uncertain small volume business. Now that the movement has been started and has received the sanction of as many as 45 reputable manufacturers, it would seem that public opinion will shortly force the others into line, considering which it would seem the part of wisdom to make the necessary adjustments now, or at least between now and show time, so as to present a united front to the public then with the beginning of the 1921 buying season.

The following cars have been reduced in price to date: American, Bell, Bour-Davis, Chalmers, Chandler, Cleveland, Columbia, Crow-Elkhart, Essex, Ford, Franklin, Gardner, Grant, Hudson, Jordan, King, Liberty, Locomobile, Maibohn, Maxwell, Mercer, Moon, Overland, Paige, Stanley, Studebaker, Velie, Westcott and Willys-Knight. These trucks have been reduced: Day-Elder, Detroit, Diamond T, Federal, Ford, Gramm-Bernstein, Indiana, L M C, Maxwell, Patriot, Selden, Standard and Stewart. These tractors have been cut: Federal, Fordson and Sandusky.

The following car makers have increased prices: Anderson, Lexington, Pierce-Arrow, Roamer and Saxon. Among the trucks, Autocar has had the war tax added, in effect increasing the price by its amount.

Moisture Content of Wood Independent of Density

Even after long exposure to the same atmospheric conditions, different pieces of wood do not have exactly the same moisture content. Variations of 2 per cent were recently found in red oak blocks stored under carefully fixed humidity conditions at the Forest Products Laboratory.

These moisture differences, unlike variations in strength, are apparently independent of the density of the pieces. In the laboratory experiments, the variation proved to be as great in blocks of the same density as it was throughout the lot of specimens. Moreover, the range in moisture content was the same in wood of low density as in wood of medium density or high density.

Data on a few representative specimens are given in the accompanying table:

Density of specimen	Average moisture content in percentage of weight oven dry — Relative humidity at 80 deg. F. 38%	61%	88%
Low			
.519	7.6	11.2	19.4
.527	6.0	10.0	17.4
.536	6.5	11.0	18.2
Medium			
.630	7.7	11.3	18.9
.639	5.8	10.7	18.3
.643	6.8	11.3	19.5
High			
.720	6.4	11.2	19.3
.724	7.4	11.4	19.6
.753	6.1	10.8	18.8
Total Av.	6.7	11.0	18.8

Large Increase in Automobiles in Canada

Automobile registrations in Canada in 1919, according to U. S. Consul Felix Johnson, Kingston, Ont., aggregated 341,396 or practically five times the number in 1914. Prince Edward Island made the largest proportionate growth in registrations (3,019 per cent), whereas Ontario showed the greatest actual increase (113,080 more registrations), as between these two years. The returns by Provinces for the past six years were:

Provinces	Number of motor vehicles registered 1914	1915	1916	1917	1918	1919
Prince Edward Island	31	34	50	,303	639	967
Nova Scotia	1,324	1,841	3,012	5,350	8,100	10,290
New Brunswick	1,328	1,900	2,965	5,251	6,434	8,306
Quebec	7,413	10,112	15,335	21,213	26,897	33,547
Ontario	31,724	42,346	54,375	83,308	114,376	144,804
Manitoba	7,359	9,225	12,765	17,507	24,012	30,118
Saskatchewan	8,020	10,225	15,900	32,505	50,531	56,855
Alberta	4,728	5,832	9,516	20,624	29,300	34,000
British Columbia	7,628	8,360	9,457	11,645	15,370	22,420
Yukon Territory	43	69	89	93	87	89
Total	69,598	89,944	123,464	197,799	275 746	341,396

Customs statistics as regards Canada's imports of passenger and freight motor vehicles for the past four (fiscal) years show that the number and value of trucks has increased from 327 worth $423,824 in 1917, to 964 worth $1,275,179 in 1918, to 1,744 worth $2,274,748 in 1919. to 2,274 valued at $3,831,084 in 1920. At the same time passenger cars have varied, increasing from 12,037 worth $7,981,177 in 1917 to 16,318 worth $11,317,245 in 1918, then decreasing to 6,473 worth $5,326,510 in 1919, and again increasing to 10,805 valued at $11,204,461 in 1920. The averages which these summaries give show plainly the increases in both car and truck prices. Car averages are $663, $693, $823, and $1,037 for the respective years, an increase of 56.4 per cent or 18.8 per year. Trucks show these average prices $1,296, $1,323, $1,304 and $1,684, a total increase of 30 per cent or 10 per cent a year.

The Automotive Manufacturer

A consolidation of The Hub and Automotive Engineering

Published monthly by

THE TRADE NEWS PUBLISHING CO.

EDISON BUILDING, COR. ELM AND DUANE STS., NEW YORK

PAUL MORSE RICHARDS, *President* G. A. TANNER, *Secretary and Treasurer*

MORRIS A. HALL, Editor

SUBSCRIPTION RATES

United States and Mexico, one year	$2.00
Canada, one year	2.50
Foreign countries	3.00

Remittances at risk of subscriber unless by registered letter, or by draft, check, express or post office order, payable to The Trade News Publishing Co.

THE AUTOMOTIVE MANUFACTURER, a consolidation of THE HUB, established in 1858, and AUTOMOTIVE ENGINEERING, established in 1916, is an authoritative journal, presenting everything entering into the construction of automotive vehicles which is new or worthy of consideration by automotive engineers and manufacturers.

Vol. LXII OCTOBER, 1920 No. 7

The Fuel Situation

A WELL-MEANING correspondent takes us to task for our many and varied articles on the fuel situation. He says that any articles or data which point out the possibilities of fuel shortage in the near future are really a detriment to the industry, inasmuch as they may scare off prospective vehicle purchasers. In short, this correspondent asks that we gloss over or overlook entirely the facts of the situation so that a number of persons may buy cars under false representations in that they expect an unlimited supply of fuel in the future as in the past.

We hold that this position is entirely and wholly wrong. We believe that the automotive industry is headed by forward-looking men, who having the fuel situation sufficiently impressed upon them will meet it squarely, so that their vehicles can always be operated. If the fuel of the future is to be half alcohol, which requires a special design of motor, we believe the American vehicles of the future will be designed to utilize that fuel in the most economical manner, in short, when the manufacturers' whole interest has been centered upon the difficult fuel situation, they will meet it as it should be met.

The whole trouble goes back to the fact that the complete vehicle men ignored the fuel situation. They said in substance fuel supply or quality is none of our business, let the oil companies and the carburetor concerns straighten that out, we are busy building complete vehicles. The oil men, seeing that the industry was not united in the matter, would not make costly changes in equipment and methods. So the present situation was really brought about by the attitude of the vehicle manufacturers. Everything which has been published in these columns in the last 2 or 3 years bearing on the subject of fuels has been intended for those manufacturers, who previously would not listen, or listening, would not reason about the situation and act. We believe that our small efforts in this direction are now bringing results, which will benefit the entire industry.

In this connection, we suggest thoughtful consideration of the article elsewhere in this issue, dealing with alcohol. In connection therewith, it might be mentioned that the prohibition act has closed 236 distilleries and 1,090 breweries. Here are 1,326 potential producers of fuel alcohol. If they would turn out as many millions of gallons of this product as of their former products, it would make a very appreciable impression on the fuel situation, not alone for the moment, but for all time to come.

Price Situation Clearing

SINCE the time last month when the editorial entitled "Ford Does It Again" was written, the price situation has been clarified to a remarkable extent, and all concerned are looking forward to the turn of the year. To date some 29 car, 13 truck and 3 tractor manufacturers have announced reductions in prices. There have been no announcements of price changes in the last three weeks, so it may fairly be said that the reductions have run their course for the time being.

In analyzing what has been done, it must be noted that aside from Ford and one other make, those cars which have been selling best in recent months, that is quickest and easiest, are not included in the list, which aside from the exceptions just noted, include those who found it hard to dispose of their product and had in fact accumulated a surplus of vehicles for the first time in 3 or 4 years. Moreover, those which have been cut do not include the large producers (with the above two exceptions) so that the makers whose products run into the largest per annum totals have not as yet touched their prices. Considered in that light, it will be found that a very small percentage of the country's output is reduced in price at this moment. Against the 45 makers who have announced reductions, it should be noted that the United States has a total of car, truck and tractor manufacturers of about 600, so that the reducers amount to 7½ per cent of the total. Or to put it the other way around, 92½ per cent of the makers have not as yet indicated any price changes.

It is around the intentions and final actions of this larger percentage of the makers that the present interest centers. If many of them reduce later on, there is no question but the weight of public opinion and their influence combined, will force lower material prices, in fact light tendencies in that direction are already noted. It is for this reason that we repeat as our opinion the statement that the situation will clarify with the turn of the year, by which time "the other makers will be in a position to announce (or will have announced) the prices applied to their 1921 models and the presumption is that the larger number of makers will make no reductions until the announcement of the new models which will carry the reductions."

Henry and Edsel Ford have purchased the Detroit, Toledo & Ironton Railroad, a coal carrier from the mines of West Virginia, Southern Ohio and Kentucky. The road is unique in that it avoids all cities, and thus coal may be run through to the River Rouge plant without having cars held up and possibly confiscated at city terminals.

Bankers Find Motor Vehicles Business Assets

Both Rural and City Financiers Report Large Gains Through Their Use

AS a people we are progressive and think forward, of tomorrow rather than of yesterday. Our bankers however are ultra-conservative and think backwards, basing their ideas of today and perhaps of tomorrow only upon what occurred yesterday. The recent financial situation has emphasized this, for the major part of the present trouble started when western bankers ruled that automobiles, motor trucks and tractors were luxuries, at least were not essentials. Subsequently, they were obliged to deny ever making such a ruling, or in fact, ever having had such thoughts, but the fact remained that they would not lend money upon automotive paper, and in fact did everything to discourage automotive buying, and this fact speaks for itself.

This is not particularly surprising, for the banker has always been a handicap rather than a helper, to the industry. And yet even the banker must reealize that the world moves and that conditions have changed. Perhaps in 1900 the banker was justified in figuring that the automobile was an uncertain thing; it might be but a passing fad, it certainly then did not appear as the basis of a very large, most stable and extremely profitable industry. Yet in the intervening 20 years there have been tremendous changes. Today, there are approximately eight millions of vehicles in daily use, which have been manufactured by a basic industry giving employment to more than 800,000 people, while accessories and other contributing industries employ almost as many more. Engaged in the selling of and service for cars, trucks and tractors, accessories and parts, there are in this country alone approximately 32,000 car dealers, more than 18,000 truck dealers, about 42,000 supply dealers, over 42,000 repair shops, more than 36,000 garages and in excess of 4,400 charging stations. Even on an extremely conservative basis, these establishments must employ more than 300,000 people. That portion of the oil business devoted to the production, refining, transportation and sale of fuels and lubricants for automotive vehicles exclusively must include the employment of more than 100,000 people. Even if the subject be pursued no further, this totals two million people dependent in one industry or another upon automotive vehicles for their living. Adding in the two million chauffeurs, we have four millions dependent on automotive vehicles for their living, and added to the eight million owners and users, there is a total of twelve millions vitally interested in this industry. Taking the latest census figures available for the country's population, this works out to more than 1/9 of all the people. That is, considering the whole country, one person in each nine is vitally concerned in the automotive industry. Considering this it is small wonder that the ruling of the aforesaid bankers caused such a country-wide outcry.

But not all the bankers feel that way. In fact, many rural bankers go to the opposite extreme and not only admit that cars are a necessity but go enough farther to claim that they are a business requirement, and as such, a business asset.

Bankers are increasing the output of their business 33 percent through use of the automobile. Financiers in rural districts say that more loans, better inspection of properties, sounder acquaintanceship with their clients, is made possible by means of the automobile. Many country bankers estimate the increased volume of trade due to motor travel at over 50 per cent. Some put the added increment at several hundred per cent.

Thirty-four Per Cent Improve Living Conditions

These statements are based on replies to car owners of varied occupations in ten major states of the union by the National Automobile Chamber of Commerce.

The figures compiled from these replies average as follows:

Bankers

Annual mileage	6,334
Annual mileage used in business	2,185 (34 per cent)
Average increase in business due to car ownership	33 per cent
Percentage of owners improving their living conditions through motor travel	34 per cent
Mileage used instead of railroad or trolley	1950 (31 per cent

The average figures however do not tell the story very clearly because the conditions vary considerably between the city and the country bank business. The city banker uses his car comparatively little in his commercial affairs because so much of his work is within the four walls of an office. Consequently the direct gain which his car can bring him in business is small. On the other hand, the reports from urban sections show a heavy percentage of banker users who improve their living conditions through automobile travel. City dwellers are enabled to live comfortably in the suburbs through ownership of a car. This factor on the other hand, is of small interest to the country financial man who has all the fresh air and green grass that he wants.

Car Owners Increase Business 57 Per Cent

Rural bankers are not the only ones who find their business efficiency and field of operation increased or widened. More than 6,800,000 business men added 57 per cent to their productive efficiency during the past year. More than 2,300,000 families have found it possible to live in the suburbs or otherwise improve their home surroundings. A working force equivalent to 1,600,000 laborers is being applied to farming. Such is the creative effectiveness of the passenger car, as reported in replies to thousands of cards sent to car owners.

This questionnaire, conducted by the N. A. C. C. went to automobile license holders taken at random from the registration lists of ten widely diverse states: California, Iowa, Massachusetts, Minnesota, Nebraska, New York, Ohio, Texas, Virginia and Wyoming. The card asked the owner's occupation the annual mileage, the amount of mileage used for business and for recreation the amount used to supplement or in lieu of trolley or rail connection. It asked to what extent the passenger car increased the owner's business, and whether it affected his housing problem or living conditions. The present figures are compiled from answers to the first 10,000 cards of this survey which is being further extended until information on the uses of cars by all classes of owners is fully determined.

Ninety Per Cent of Cars for Business

Ninety per cent of the owners reported that they used their cars more or less for business, while 10 per cent stated that their automobiles were for recreation use only. The average increased efficiency of the car owner is 56.7 per cent. A number report but small gain in productivity, but this is heavily overbalanced by the testimony of the farmers who have added nearly 70 per cent to their labor effectiveness, and by the doctors and salesmen whose business is doubled, tripled and in some cases quadrupled through use of the car.

Net Gain of 3,000,000 Men

The use of the passenger car, accordingly, has meant a net gain to industry of 3,000,000 men. There are more than 7,000,000 automobile owners in the country, each increasing his efficiency 56.7 per cent through the use of the car, making an addition to the business productivity of the country in excess of 3,900,000 workers. As there are between 800,000 and 900,000 men manufacturing and selling passenger cars, parts and accessories, there remains a net gain of more than 3,000,000 men. If one were to add the productive efficiency of the 750,000 motor trucks now in use a still greater gain would be shown.

Farmer Greatest Gainer

The largest gain in productivity has been in farm life. There are 2,367,000 farmers owning cars. The answers from farmers reported 68 per cent increase in productivity of the owner or an addition equivalent to 1,600,000 hired men.

Big Relief in Housing

Norman Angell in "The Great Illusion" predicted that war would be impossible because it would mean national suicide. But he did not take into account the infinite ingenuity of man. In America the passenger automobile has been the great factor in solving reconstruction problems. The cessation of building during the war has meant overcrowded conditions everywhere. But 37 per cent of the car owners, 2,300,000 families, are finding the automobile a help in this situation, enabling them to live in the suburbs, and otherwise improving their living conditions.

The railroad and trolley lines which have been handicapped by war conditions are being relieved and supplemented by automobiles. Sixty-two per cent of the car owners report that they use their motor vehicles instead of traveling by rail or electric line. Over one-third of the total automobile mileage is used in this way.

Every Walk of Life Aided

The passenger car has brought increased efficiency in every walk of life. The heaviest users are farmers with physicians and salesmen next in line. Contractors, real estate dealers, and insurance men find cars especially useful. Manufacturers and merchants are among the larger classes of automobile owners.

Among the other classes who answered the questionnaire were: bankers, carpenters, mechanics, architects, barbers, teachers, clergymen, wholesalers, artists, undertakers, mail carriers, builders, plumbers, credit men, public accountants, government officials, tobacco brokers, lawyers, hotel men, theatrical men, oil men, superintendents of docks, musicians, miners, railroad executives and others.

Bankers Find Car a Utility

Forty per cent of the bankers who replied to the question card found the car a help in their business. A Minnesota banker reports that the car has multiplied his business efficiency "ten times." Another writes: Car use, even on pleasure trips, gives a banker much better understanding of his customers, particularly livestock customers." A third writes of his car's use in business: "I cannot do without it."

Makes Life More Worth While

In addition to the business use of the car comes much testimony that the owner has had much more opportunity for education, cultural things, and healthful recreation through his automobile.

One farmer writes: "If it was not for the car we could not have any social life to speak of."

Another says: "Enables me to live nearer better schools, surroundings and still do 50 per cent more business. Couldn't get along without a car."

And a third reports: "I can live in the country with all the advantages of living in town."

The balance of the report, that is the tabulation of the information from the cards received subsequently, will be awaited with considerable interest. However enough has been said previously as a result of the analysis of the earliest data to reassure anyone who might have any lingering doubts as to the stability and permanence of the country's second largest industry. As level-headed an observer as Col. John W. Prentiss, associated with Hornblower & Weeks, leading banking house, has estimated that the world will absorb more than thirty million (30,000,000) automobiles before the saturation point is reached. There are in use in the world today less than 8,500,000 automobiles. The average production of this country for four years, 1917, 1918, 1919 and 1920 (estimating 1920 liberally at two million cars), was less than 1,750,000 cars. Allotting to the rest of the world enough to make the yearly production figures of cars alone two millions, there still remain more than 11 years before the saturation point will be reached, and if allowances be made for the number of cars which will go out of service between now and then, more than 25 years.

Even at that, when this saturation point is reached, on the basis of a car being worn out so as to need replacement every 6 years, the replacement business alone will amount to 5,000,000 cars a year, so it may be seen that the industry faces a long, prosperous life.

The average value of all cars has ranged up as high as $2,635 before the war, down as low as $1,600 since then, and for 1920 was placed at $2,537. Recent reductions, and those still to come, will cut this down to less than $2,400 or perhaps to $2,350. Even if it be taken as low as $2,000, an annual production of 2,000,000 cars or more is going to mean a value of $4,000,000,000 or more a year. A total of 16,000,000 cars in use in this country (out of 30,000,000 in the whole world) at an average valuation of $700 (considering the value of the oldest as well as the newest, and all in between) would give a total public equity of $11,200,000,000. So, it can be seen that bankers are going to have plenty of profitable business from the automobile industry in the years to come.

Government Engineers Testing Effect of Trucks on Roads

New Study Being Made of Motor Trucks at Various Speeds and Loads and Their Effect Upon Various Types of Road Surface—Impact Tests

WHILE one result of the tests now being conducted by investigators for the bureau of public roads, U. S. Department of Agriculture, as to the effect of motor trucks upon highway surfaces, may be a change in taxation, that is a possible increase in truck taxation, the real value will come from the determination of the best types of road construction to resist truck road wear, and through such determination, the elimination of much waste of time, effort and taxpayer's money through the building of the wrong kinds of roads. Truck transportation is here to stay, and it is of vital importance that this fact be made prominent. This being the case, it is not so important to know that trucks do wear the roads out, that might almost be taken for granted. What is of the greatest importance in such a situation is to know what type and kind of road construction will present the greatest opposition to such wear, that is will wear the longest under such truck traffic. Knowing this, it will be possible to build the roads of this type and thus build those forms which will give the greatest all around satisfaction.

The scientific experiments include tests already made which show that increased speed of a vehicle equipped with hard rubber tires (that is solid tires as distinguished from pneumatics) tremendously increases the impact which the wheels make on the roadway where there is an evenness. On the other hand, where pneumatic tires are used increased speed adds comparatively little to the impact. It has been suggested that these tests will be of great value not alone in settling questions of truck and road design but may lead to a rational basis for determining license fees for motor vehicles.

Trucks have been used in these tests varying in size from a 1 ton truck up to a 7½ ton truck carrying an excess load. Each truck was run over a special recording device embedded in a roadway and the impact which resulted when one of the wheels made a 2 in. drop from a ledge built in the surface caused the deformation of specially prepared copper cylinders forming part of the apparatus. The magnitude of the blow was accurately ascertained in pounds by measuring the extent to which the cylinder had been forced out of shape.

Recent tests were made with a 3 ton truck of well known make with a 4½ ton load so that the total weight on each rear wheel was 7,000 pounds, the unsprung portion (that not supported by the springs) being 1,700 pounds and the sprung portion (that portion supported by the springs) 5,300 pounds. The truck was equipped first with an old solid tire that had been worn down to a thickness of 1 inch. Then, with exactly the same load on the truck, a wheel was used fitted with a new solid tire 2½ inches in thickness. And finally, the truck was equipped with pneumatic tires 42 by 9 inches and blown up to a pressure of 142 pounds per square inch. The following table shows very clearly the bad effects an old tire is likely to have on a road surface and the greatly lessened impact produced by trucks when they are equipped with pneumatic tires. The tests show that as the vehicle's speed increased the impact from the old hard rubber tire increased greatly. The impact from the new hard rubber tire was somewhat less.

Results of Impact Tests

Approximate speed	Height	Old tire	New tire	Pneumatic tire
5.7	2 in.	11,600	9,400	7,100
10.2	2 in.	18,500	14,100	7,800
14.6	2 in.	26,500	18,700	8,300

Related to these tests is another series which utilizes the figures secured in the first experiments. A number of paving slabs were tested by means of a machine designed to give impacts equivalent to those produced by the rear wheel of the heavy truck already referred to. The unsprung portion of the weight of this machine is 1,500 pounds and the sprung portion weighs 6,000 pounds. The tests were made by raising the entire weight through a height of one-eighth of an inch, allowing it to fall 500 times, then to a height of one-half inch with 500 repetitions, then three-eighths inch more in height, and so until the slab failed. To date, about 12 slabs have been tested, laid on a rather wet subgrade. A surprising difference has been found in the strength of the different types of pavements tested. The total number of blows required to cause failure have varied with the different slabs from 67 up to almost 2,000. All these data promise to be of the greatest value to engineers in selecting material for roads.

The Bureau of Public Roads is also making a study of the relative wearing qualities of different types of pavements and tests have been about completed on a short section of pavement containing 49 different types subjected to the wear of a special truck equipped with five large cast iron disklike wheels. The relative wearing qualities of hard as compared with soft brick are brought out very distinctly in this test. The resistance to wear of various kinds of stone block sections is also shown up to good advantage. A chance to compare grout and asphalt fillers for both brick and stone block is furnished by this investigation. Likewise the relative wearing qualities of concrete mixed with various aggregates is indicated.

The investigation of subgrade materials, started a few months ago with the cooperation of the district engineers and state engineers, is proceeding at a very satisfactory rate. A number of samples have been received from various parts of the country and laboratory analyses of many of these samples are partially completed. The methods being used by the division of tests will shortly be published as a paper so that any other laboratories wishing to conduct similar investigations may have some guide as to the procedure of the Bureau of Public Roads.

The samples analyzed have been taken from parts of the roads that have failed very badly as well as from adjacent parts of the same roads that have withstood heavy traffic successfully. It is hoped that by a comparison of the laboratory results on these samples with the reported behavior of the road in service differences in the subgrade materials will become apparent so that we will be able to say what physical characteristics soils must possess to give them high bearing values.

Simple Truck Body for Contractor or Farmer

IN a broad, general way, the contractor or contracting builder probably has as much use for a truck or trucks as anyone, that is the nature of the contracting business is so varied, so changeable, and includes the handling of such heavy and bulky material, that in this line of work all trucks probably are worked at capacity the maximum part of their time. Right now the call for new buildings, especially factory, office and loft buildings is very strong and there is a great deal of work done along these lines, although it is so widely distributed that the general public sees and hears little of it. Consequently, the majority of contractors are pretty busy, and as soon as prices of building material recede, as they promise to do shortly, in company with those other materials which have already shown large decreases, they will be even more busy.

While freight handling is improving rapidly, and is supposed to be much better than a few months ago, it still leaves much to be desired. This brings about a situation in which the motor truck is of the greatest utility and economy to the contractor, especially in the smaller twon, where freighting conditions are perhaps worse than in the larger cities. For these reasons there is a great demand for practical truck bodies for placement upon old passenger car chasses, says Blacksmith and Wheelwright.

A brief review of the whole situation would show: first, a big demand for building materials; second, the need for practical trucks; third, a shortage in trucks; fourth, the conversion of passenger cars to trucks by the installation of truck bodies; fifth, a big demand for truck bodies which cannot be filled by the manufacturers. Obviously then, the harvest is ripe for the small manufacturer. The individual with a small amount of working capital and a reasonable equipment of wood and metal working tools, may make money by building truck bodies.

Competition in truck bodies is reduced to a minimum, the demand is greater than the supply; profits are assured and the smith is best equipped to produce the truck bodies because he is in personal touch with the men who wish them. In different localities circumstances and conditions call for changes in construction.

The truck body reproduced in Fig. 1 below is designed especially for the contractor and builder, but should be of value to practically any farmer. It is designed to carry sand, cement, lime and the like, while at the same time it is heavy enough to carry loads of lumber and other building supplies. The body measures 8 ft. 10 in. in length, which is long enough to support 12 ft. lengths of boards. If the load is light, even longer strips may be loaded, since the rear wheels fall about midway of the body. The body overhangs the wheels and is 5 ft. 6 in. in width.

In this particular case, a Studebaker chassis is shown This machine has a wheelbase of 125 in. and is heavy enough for the purposes; however it is not feasible to carry a load of crushed rock or building blocks.

As a foundation for the body two chassis rails are provided. These rails measure 8 ft. 9 in. in length; 3 in. thick and 7 in. wide and should be spaced so as to rest upon the frame or upon the body supporting irons. At right angles to the frame members are six cross bars measuring 5 ft. 6 in. in length by 3 in. thick by 7 in. in

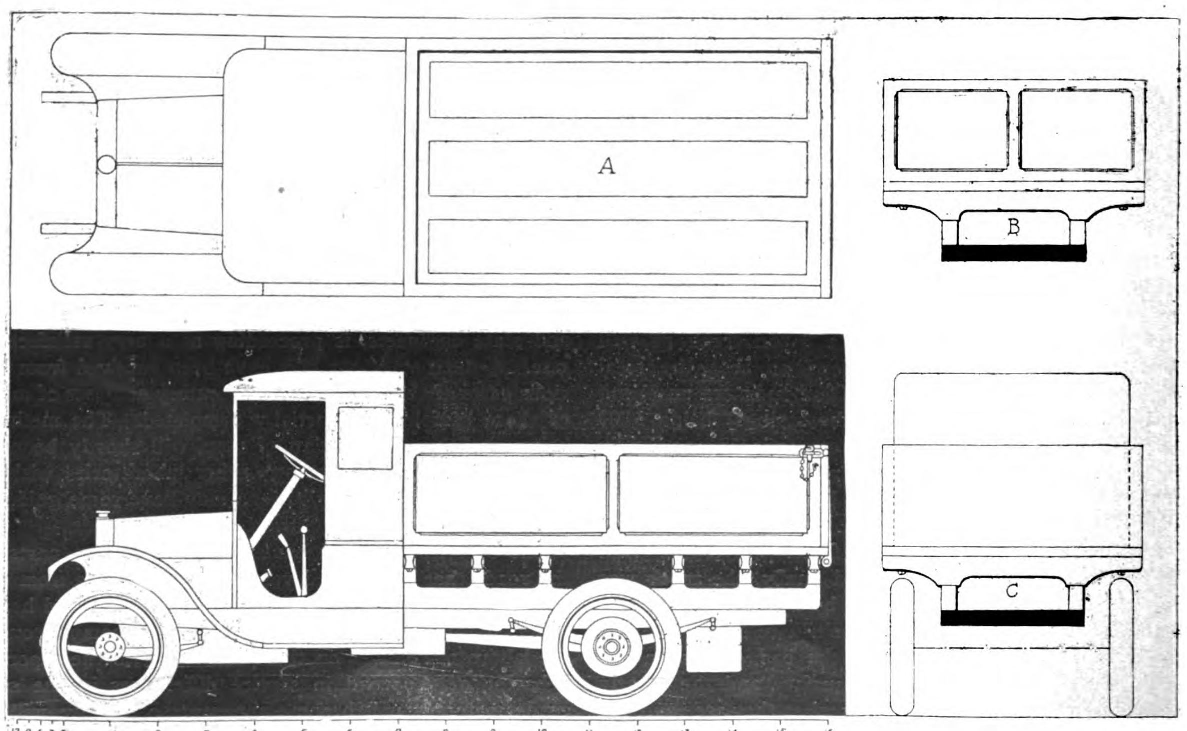


Fig. 1. Simple truck body, most suitable for contractors but handy for farm work and other. Studebaker chassis of 125 in. wheelbase

width. In placing these bars, be sure to allow clearance for the rear wheels. The bars are bolted to the chassis rails as well as to the body sills.

The body sills, four in number, measure 8 ft. 10 in. in length. The outside sills are made from 3 in. plank, 5 in. wide, while the two inside sills may be made from 2 in. plank of the same width. The end sills are 4 ft. 6 in. in length, 3 in. thick and 5 in. wide and are fastened to the body sills with lag bolts and angle irons.

The bottom of the body is made from 2 in. stock 8 ft. long. The sides of the body are constructed upon side rails 2 in. thick, 4 wide and 8 ft. 10 in. long. A practical height for the sides is 2 ft. to 2 ft. 6. A center upright on each side gives a panel effect.

Beaering in mind the fact that the body will be used for barrels or boxes it will be well to place four iron runners along the bottom.

If the body is to be used by a farmer or grocer stake irons may be placed upon the sides, thus enabling him to pile in baskets of produce or even hay in season. Since the body is placed high upon the chassis, there is ample room for tool boxes between the cross bars. A special compartment for spare tires may be built between the chassis rails at the rear if pneumatic tires are used. The body calls for no fine work or careful fitting of joints and may be done by practically any smith.

Nickel Production in Canada

The total production of nickel in 1919 amounted to 44,542,953 pounds, which at 40 cents per pound, would be worth $17,817,181 as against 92,507,293 pounds valued at $37,002,917 in 1918.

The production as usual, represents the nickel in the matte produced from the treatment of the ores of the Sudbury district and the Alexo mine at Porquis Junction, Ontario, supplemented by the recovery of a small quantity of metallic nickel, nickel oxides and other salts, as by-products in the treatment of the silver-cobalt-nickel ores of the Cobalt district.

The production of nickel-copper matte at the smelters of the International Nickel Company of Canada, and the Mond Nickel Company, amounted to 42,736 tons containing 12,098.7 tons of copper and 12,035.3 tons of nickel, the average percentage of the combined metals in the matte being about 80. The production in 1918 was 87,184 tons of Bessemer matte containing 45,885.6 tons of nickel and 23,482.3 tons of copper. There were mined in 1919 572,400 tons of ore and smelted 754,567 tons, as against 1,641,617 tons mined and 1,559,892 tons smelted in 1918.

Refined metallic nickel has been recovered in Canada since 1915, but previous to 1918 only in small quantities, and as a by-product in the smelting and refining of the silver-cobalt-nickel ores, as stated above.

The new refinery of the International Nickel Company of Canada, Ltd., at Port Colborne, Ontario, started operations in July, 1918.

The total production in Canada of refined nickel from both the Sudbury and Cobalt district ores amounted to 5,063 tons, as against 1,204.5 tons in 1918. The other products recovered were: 581.4 tons of nickel oxides valued at $340,033 as against 282.4 tons valued at $169,447 in 1918; 199.6 tons of nickel salts and nickel castings valued at $46,358 as against 186.3 tons valued at $39,598 in 1918.

The British America Nickel Corporation practically completed in 1919 the construction of its smelter at Murray mine and of the refinery at Deschenes, Quebec. The smelter started operations January 18, 1920, and the refinery will probably soon be in operation. The capacity of the plant will be about 7,000 tons of nickel and 3,500 tons of copper per annum.

Total nickel contents of matte produced amounted to 44,070,609 lbs. with no figures available for nickel in silver-cobalt-nickel ores.

Of this total, 41,016,400 lbs. were exported 30,395,400 in the form of matte or speiss, and 10,621,000 as refined nickel. The United States took 34,881,500 lbs., Great Britain 4,617,900, and the other countries of the world, 1,517,000.

Light Creosote Oils in Wood Preservation

Present shortage of all kinds of wood and high prices emphasize the need for proper preservation. Light creosote oils properly injected into wood apparently will prevent decay until the wood wears out or until it checks so badly that the untreated portions are exposed. Such is the indication of service records collected by the Forest Products Laboratory on railway ties and telegraph poles preserved with low boiling creosotes.

Creosotes used in ties from 25 to 50 years ago were for the most part oils having 50 per cent or more distilling below 235 deg. C., with a residue not to exceed 25 per cent at 315 deg. C. The ties so treated lasted from 15 to 20 years, and failure was traceable in most cases to mechanical wear, such as rail cutting and spike killing. In no case was failure found to be the fault of the preservative.

Of 1,558 telegraph poles in the Montgomery-New Orleans line, which were pressure treated with a light creosote oil, 1,049 poles were still sound after 16 years. In 91 per cent of the cases of decay, the fungi had entered the wood through checks and shakes. Representative sections in the Norfolk-Washington line showed that after 17 years' service, of the 1,614 poles inspected, 1,469 were sound, 92 decayed at the top, and 105 decayed at the ground line. The decay at the top was caused chiefly by cutting off the poles. In those decayed at the ground line, the causes of failure, as determined in 88 per cent of the cases, were checks or shakes. Here again as in the ties, the preservative outlasted the mechanical life of the wood.

Unless some other factor than protection from decay is considered important therefore there is apparently no need to specify high boiling oils. The important point is that any coal tar creosote which is not extremely low boiling or extremely high boiling will satisfactorily prevent decay, and in the selection of an oil, factors such as price, penetrability, and convenience in handling should receive greater consideration than moderate differences in volatility.

There are about 600 motors in Tientsin this year as against 400 last year. A truck line is being established from Peking to Tungchow and from Tungchow about a third of a mile to the Western Hills. Other lines are being established from Chinhaishin and from Techow to the interior of Chihli Province.

For the year ending July 31, 1920, the Ford Motor Company of Canada had net profits of $4,686,243 from a production of 55,616 cars, after deducting almost a million for taxes and other expenses. On the relatively small capitalization of $7,000,000 this amounted to 67 per cent.

Theory and Practice of Lubrication---the Germ Process

By HENRY M. WELLS and J. ED SOUTHCOMBE*

PERFECTION of lubrication in the early days of the mineral lubricating oil industry was considered to lay with the production of the purest hydrocarbon oils. It is a monument to the skill and efficiency of producers and refiners that this search for better lubricants and more scientific methods of refining has resulted in placing upon the market an enormous range of highly purified lubricating oils of every conceivable viscosity, gravity and color. This has conduced to lubricating efficiency and has been instrumental in assisting to the greatest possible degree the development of engineering design.

Nevertheless we find that for many purposes, particularly those requiring lubrication of bearings, etc., carrying heavy loads at relatively slow speeds, these pure mineral oils have not been ideally successful. The need for adding to mineral oils, animal and vegetable oils to increase their "slipperiness," has been forced upon users in all countries. To take a few examples, the specification for lubricating oils of the U. S. railways, drafted at a recent conference, recommends the addition of four to eight per cent of fatty oil. In Great Britain many large consumers of lubricating oil, the railways companies and the government departments emphatically specify oils containing as much as 20 per cent of pure ripe olive, lard, or cocoanut oils. The fact that such compounded oils possess exceptional friction-reducing properties has been shown by a large number of trials and experiments on mechanical testing devices and is supported by observations in practical lubrication.

We can testify to the importance of compounding as we shall show both as the result of our experience of practical lubrication extending over every known type of prime mover, and confirmed by a series of special laboratory tests, physical and mechanical.

It is to this peculiar friction reducing property, possessed by many animal, vegetable and compounded oils, that the term "oiliness" has been applied to express that remarkable ability to maintain efficient lubrication under conditions of high load and slow speed. This cannot be accounted for by viscosity alone and Professor Boys, a leading English physicist, has crstalized the position very happily in the following terms. Speaking in the Presidential address to the Physical Society in 1908, he said: "It was found that the lubricating property of oil depended upon something which at present is unknown—it is not viscosity—animal and vegetable oils lubricate better, that is to say, they are more slippery than mineral oils of the same viscosity and although the oil trade has known how to make good slippery mixtures, no one at present knows what oiliness is, and this is at the present time an important physical quest of the engineer.

For this reason, an extensive industry has grown up for the production of fatty oils to be used in compounding with hydrocarbons. Here again, the demand for greater purity and freedom from acidity of glycerides has been insistent and has been the means of marketing of expensive acidless tallow oils, acidless lard oils, etc. It is our object to show that such highly refined oils are not only necessary but positively ineffectual in securing the highest possible degree of friction reducing efficiency.

*Extracts from paper read before Natl. Petroleum Assn., Pittsburgh. Authors are fro mLondon, Eng.

Various Oil Properties and Their Value

In the beginning it was our object to elucidate the reason for the superiority of the fatty and compounded oils as friction reducers, and to this end we collated and studied all physical properties of the liquid which could influence its character as a lubricant. These properties are, specific gravity, viscosity, capillarity or surface tension, compressibility and tensile strength. The other commonly determined physical factors such as flash-point, volatility and fire test, important as they may be in the choice of an oil, do not materially influence the frictional properties.

Examination of these groups of physical constants show that a large number of mineral oils may possess the same specific gravity as fixed oils, but behaving differently as lubricants. This satisfied us that gravity played no deciding part. Viscosity is of course of primary significance under conditions of high speed and copious supply, but as mentioned, it does not constitute a criterion under the special conditions where compounded oils are found advantageous.

We satisfied ourselves that compressibility and tensile strength had no dominating significance, but were torced to the conclusion that the only property of importance which had not been adequately studied, was capillarity or surface tension. Consider the case of two eccentric glass surfaces which are being forced together with a drop of oil or mercury between them. Now since the mercury does not wet or spread over the glass, the meniscus will be convex to the liquid. In the case of oil which wets the surface, the meniscus will be concave. In the first case, the tendency on capillary grounds will be for the liquid to gather itself up into a drop and to pull the liquid film away from the narrower constricted area of greater pressure. In the case of oil, the opposite will be the effect. The oil, owing to its meniscus will tend to force itself into the narrow spaces.

This is exactly what is required in a lubricant, namely, that it shall penetrate into the narrow spaces between journal and bearing and from the above considerations one clearly sees that liquids which do not wet solid surfaces cannot be described as lubricants. Only the liquids which wet the solid surfaces possess lubricating power in the generally accepted sense. This convinced us that a measure of the surfaces tension would shed considerable light on the problem and to this end we devoted attention. The usual surface tension measurement is that of oil against air and we confirmed the opinions of previous investigators that the results so obtained shed no light at all on the question under consideration.

The interfacial tension between the solid metal and oil unfortunately cannot be measured. There remains one other means of getting information on this subject, namely, the interfacial tension between oil and another liquid. We measured the interfacial tension between various types of oils against water and lastly against the liquid metal mercury. The results obtained were startling in the extreme.

Fatty Acid Decreases Interfacial Tension

It was found that the infacial tension against water and also against mercury of the fatty oils and compounded oils, was much lower than was the case with any mineral oil. At this point we had succeeded in formulating a test which distiguished between the physical properties of mineral and compounded oils. The matter might have remained at this stage had we not pushed further to inquire the reason for this remarkable anomaly. After a great amount of investigation, we proved definitely that this difference was due to the presence in the fatty or compounded lubricants of small quantities of free fatty acids, absent in mineral oils. This was most surprising since it indicated that the virtue of fatty oils arose from the fatty acids which they contained, as impurities. Then we artificially prepared oils consisting of 99 per cent meneral oil and 1 per cent of free fatty acid. These gave a low surface tension. On the other hand, we removed the fatty acid from fatty oils and found that the pure fatty oils gave a high surface tension. We drew the deduction therefore that the friction reducing properties were due solely to the fatty acid content and that it should be possible to obtain the desired result by adding minute quantities of fatty acids to mineral oils.

At this point it became essential to confirm the results by direct experiments on bearing surfaces, which results have been completely confirmatory. It should be remembered that all the commercially occurring fixed oils contain notable quantities of free fatty acids and even if such acids have been removed by careful refining, hydrolysis soon sets in and free acids are formed which in even relatively minute quantities suffice to lower the surface tension. The possibility of corrosion arising from the presence of these fatty acids is negligible, and in fact, less likely than when using compounded oils, because in our case, we only add minute quantities (about 1 per cent) which are controllable and can never increase, whereas when one uses several per cent of fatty glycerides it is possible by hydrolysis to obtain very large quantities of free acids.

When it comes to laboratory testing devices we confess that we have very little faith in the usual type of mechanical friction machine. Such machines at high speeds and comparatively light loads are little better than viscometers and do not measure adequately the true oiliness of the lubricant. If the machine be designed to carry heavy loads at very slow speeds, insuring a certain amount of contact friction and if the series of oils tested possess similar viscosities and gravities, one obtains a true measure of the relative oiliness. We have proved our contentions on four distinct machines of special types arranged for investigating contact friction.

Testing Machines Used

Two were of the Thurston type with a journal 3.8 in. in diameter giving approximately 1 ft. peripheral, working under loads of 200 and 270 lbs. per sq. in. with rubbing speeds of 7 ft. and of 11 ft. per min. The machines were provided with automatic recording gear and special precautions were taken to insure true alignment of bearings and journal. One machine was operated by ourselves and another quite independently and without any suggestion from us by L. Archbutt, chief chemist of the Midland Railway Co., a prominent English authority on lubrication. The third machine was run at the National Physical Laboratory, London, and is the device invented by Mr. Lanchester of automobile fame. It consists of a worm wheel mounted on a driving shaft and engaging with a worm gear in a box pivoted at its center in such a way that the torque can be measured. From a measurement of the horsepower, the efficiency of the gear with various oils can be calculated. By means of a screw, pressure can be applied between wheel and worm up to several thousand pounds per sq. in. The fourth machine is the invention of R. M. Deeley, chief mechanical engineer of the Midland Railway and is unique in that it is designed to measure static friction.

The machine is arranged as follows: 3 pegs, each 5/32 in. in diameter are secured concentrically to a disk which can be weighted as desired and actuates a spindle to which a spiral spring and recording finger is attached. These pegs are then placed upon a bottom dish of metal which can be rotated slowly. When the lower disk is rotated, the pegs are carried with it by the friction, and when the surfaces only slip, owing to the tension of the spring, the finger then gives the frictional resistance. The movable disk upon which the pegs rest, lies in a circular dish which can be filled with oil. To insure clear surfaces, the rubbing metals are ground in water with flour of carborundum. They are then polished with fine, wet emery, rubbed well in water with a cork to remove the emery, dried with blotting paper and finally heated in an electric oven to get rid of all traces of moisture.

The broad set of tests and results from the four machines were these: Oils used were a pure mineral oil, the same plus a half per cent commercial fatty acids, the same plus 1 per cent and 2 per cent of fatty acids. These were tried out against rape oil containing 2.4 per cent of free fatty acids and neutral rape oil from which the fatty acids had been completely removed in the laboratory. In every case, on each machine, the frictional resistance when 1 per cent of fatty acids was used was reduced by 20 to 26 per cent. To achieve this reduction by the use of pure neutral rape oil it was necessary to employ as much as 60 per cent. Further experiments with olive oil show that the addition of 2 per cent of commercial fatty acids lowers the friction 30 per cent below that of a mixture containing 40 per cent mineral and 60 per cent olive. To put the matter in a nut shell, the frictional resistance shown by any mineral oil can be most definitely reduced by the addition of about 1 per cent of commercial fatty acids.

This is in complete conformity with the latest views of pure science.

All recent work points to the fact that it is the chemically reactive and unsaturated constituents of lubricants which promote "oiliness" and that they do so by forming new "composite" films on the surfaces lubricated with lower surface energy and opposing less resistance to shear.

We have hitherto confined our remarks to the effects of acids on the friction-reducing properties of oils, but there is another aspect of utmost importance. In practical use in power house or factory, lubricating oils are not used under ideal conditions and in many cases, become admixed with water. In some cases it is necessary that when the oil comes in contact with water, it shall mix with the water or emusify. Such cases are the bearings of marine engines and the guides and rods of locomotives, etc. In other cases, it is essential that the oil shall not mix or shall separate readily from the water.

We found also that it is possible to choose suitable acids which will confer upon the mineral oil these particular and valuable properties. By the addition to the mineral oil of one class of fatty acids, we induce a tendency to de-mulsify, while other groups of acids have a powerful emulsifying influence. We are therefore enabled to change the character of the mineral oil not only in relation to its properties as a reducer of friction, but also to decide its behavior under any given set of circumstances in which it may be employed.

Germ-process oils have been extensively tried out by the British Admiralty, government departments, steamship and railroad companies, without a single failure being recorded.

On large gas and oil engines, especially big horizontal units, where previously 10 per cent fatty oil was used, we have been able to substitute germ oils having 1 per cent fatty acid with complete success.

Steam Cylinder Lubrication

For "perfect" lubrication of steam cylinders with certain types of valve gear (as one example, "Corliss"), and for engines working under certain conditions—say with much condensation in the cylinder—a compounded oil is essential.

Germ process oil incorporated in very small proportion with the correct mineral cylinder oil gives equally good results on engines with Corliss valves up to 3,000 h.p. working at 160 to 170 lb. per sq. in. pressure, superheated 480 to 500 deg. F.; on horizontal engines with Corliss valves up to 750 h.p. up to 160 lb. pressure without superheat. Various mineral cylinder oil bases to correct "germs" in different but small proportions give thoroughly good lubrication on vertical and horizontal engines of many types, sizes and pressures.

Marine Steam Engine Bearings—Open Type

For a good heavy marine engine oil it has always been considered necessary to use from 10 to 25 per cent thickened or blown oil—as a rule, thickened rape oil. This gives great viscosity, also very good "lathering" properties to the oil. The standard specification for marine bearing oil for one of our semi-government departments is a compound of about 20 per cent "of fatty oil"; but the total fatty acid content must not exceed 1 per cent. This has now been successfully replaced by "germ process" marine engine oil.

On February 5, 1918, we filed our patent* for oils made on this new process, and immediately its "publication or communication" was prohibited by the Admiralty, who carried out trials over many months on about fifteen ships of the mercantile marine, including a fair proportion of liners. The result was satisfactory. The germ process gives to a mineral oil of fair merit that property lacking for some purposes, while it increases the lubricating value of a "good oil" making it still better. In all cases they become more economical.

On a cruiser the port engine was run on a straight mineral oil and the starboard on a germ process oil. It was found possible to reduce the oil feed on the latter engine and the engineer officer reports that he would be quite willing to run the engines on the germ oil with a reduction of 17 per cent consumption.

We shall not dwell upon the importance of conserving the world's supplies of fatty oils, which necessarily results from the replacement of large quantities of such fatty oils by small quantities of fatty acids. Though this is a great important matter of public interest, we shall at once pass on to the consideration of the more intimate question: what does the process mean to the oil man?

Our task is to estimate how the industry will be affected by two factors: one technological, one psychological. The first is the technological factor: namely, the demonstration of a new set of facts. In our previous remarks we have given the conclusions to which we were led by exhaustive research in the laboratory followed up by convincing measurements of frictional coefficients and confirmed by thorough trial for many months in commercial practice on the largest and most varied types of bearing surfaces. These conclusions are briefly:

(a) That 1 per cent of free fatty acid will lower the frictional coefficient of a pure mineral oil by 26 per cent.

(b) That although such "germ process" oils are only fractionally dearer than pure mineral oil, their value as lubricants is the same as, or better, than that of heavily compounded oils or straight fatty oils.

(c) That a logical reason has been given for the superior oiliness of compounded oils over mineral oils, namely, that the fatty acid present as impurity lowers the frictional coefficient.

(d) That there is no more danger of corrosion when using germ process oils containing limited amounts of fatty acids than when using compounded oils, and in many cases the danger is much less.

(e) In a word, these new facts may be summarized by saying that it is now possible to combine the oiliness of fatty oils with the cheapness of mineral oils.

The psychological factor is this: that the oil user has now found that one of his most cherished prejudices has gone by the board; namely, the old bogey of free fatty acidity. At the meeting in London large oil users were present. They admitted that the new process produced oil of superior friction-reducing properties and were in no way perturbed by the presence of a minute quantity of free fatty acid in controlled amount. The user is therefore now prepared to reconsider the whole question of specifications for lubricating oil and to revise his old standards.

These factors mean that the user has now recognized that the lubricating efficiency of pure mineral oil can be enhanced very greatly by the addition of quantities of fatty acids so minute that the difference in cost is inappreciable (only ½ per cent in money). This being so, the consumer will reflect that when he buys oil, he is buying reduction of friction, and will accordingly clamor for oils of high lubricating efficiency. In the past he could not afford such oils but now that they can be made at such low cost he will demand and producers will be forced to supply them. The user will insist on these oils, because they will reduce the friction on his bearing, after all the prime function of a lubricant, but also because with less friction he will find that: (1) his machinery will last longer, (2) his breakdowns will be fewer, as there will be fewer hot bearings, (3) and for the same reason he will use less oil.

*Eng. Pat. 130,677. U. S. A. Pat. 1,319,129 of 1919.

In some cases a saving of 15 per cent to 25 per cent of total oil can be effected by using better oil. The producer may not be impressed by economy in use of oil but when the user insists on these oils, the supply will have to be forthcoming. This demand for the new oils is already felt in England and it is bound to come all over the world, both because of their proved efficiency and for the psychological reason that users are beginning to look into the whole question of lubrication much more intensively and impartially.

This will help the refiner. He will now find that the user will listen to his views and will cooperate with him in using the lubricant best suited for its work. The refiner will now be in a position to modify the properties of his oils at will. If he wishes to reduce friction, he can do so. If he wishes to make an oil emulsify, he can do so. If he wishes to prevent an oil from emulsifying, he can do so. These modifications can all be made with minute quantities of substances which are cheap, universally soluble in all oils, and impart their beneficial effects between bearing surfaces of all metals so far investigated.

The producer will now be able to make cheaper mineral oils do the work of the more expensive ones, because he can rely less on high viscosity, and more on addition of fatty acid.

Indeed, he need not use fatty acid at all because petroleum itself, that wondrous museum of organic compounds, contains naturally the napthenic and other acids which we have proved to be effective also. This opens up new vistas in refining since the producer can utilize the natural acids of the oil or the sulphonic acids formed during the acid wash, either by leaving in a predetermined quantity, or by extracting all the acids and adding minute quantities of them to the oil in place of fatty acids.

It seems clear therefore that there are great economic possibilities in a process that yields oils which the consumer will insistently demand on account of their higher efficiency, certainty and economy, and achieves these results while facilitating the task of the refiner by enabling him to utilize cheaper products for higher-priced purposes, and securing geater control over the properties of the finished product.

Britain Requires "Made in U .S. A." Trade Mark

All exporters, and particularly automotive exporters, who have heard a great deal lately about trade marks, will be interested in the following despatch recently received by the Merchants' Association of New York:

"The American Chamber of Commerce in London is advised by its automobile section to remind American exporters not only of automobile accessories but in all lines of trade, that American trade marked articles coming into Great Britain must bear the words 'Made in U. S. A.,' or equivalent indication of the country of origin.

"This rule, the chamber desires to point out, does not apply to American goods alone, but to all foreign trade marked goods, and is one of the provisions of the Merchandise Marks Act of 1887, dating back to the reign of Queen Victoria.

"Trade marked articles not bearing indication of the country of origin being liable to seizure and confiscation, importers into Great Britain are being caused serious inconvenience, and in many cases actual losses by the failure of American manufacturers to comply with these regulations. What generally happens is that the importer is notified and warned the first time, but allowed to take away the goods, provided he stamps, stencils or otherwise marks them with the country of origin to the satisfaction of the customs authorities. Subsequent offenses however are likely to be punished by confiscation.

"British merchants who have been importing American trade marked articles for many years have of course straightened out these difficulties with their American shippers long ago, but the newer American exporters do not seem to have been properly informed. The American chamber is glad to know therefore that certain British importers have a reference to the foregoing provisions printed prominently on their order forms to the United States. As a means of making assurance doubly sure the American chamber recommends this practice to the attention of all British firms developing new American business with the United States."

Ford Official Says Price Revisions Have Been Granted

It was announced during the last week by an official of the purchasing department of the Ford Motor Co., Detroit, that not a single supplier of materials or parts manufacturer with whom the company is doing business has refused to cut existing contract prices. The official added that price reductions already recorded range from 10 to 20 per cent.

"I am not at liberty to reveal the names of concerns which have reduced their prices," said the Ford official. "Such a detailed statement might be construed as a breach of faith. I am willing to say however that every cut affects contracts that were signed months ago. Every big supply house and parts manufacturer with whom we do business has aligned itself with us in this movement to bring manufacturing conditions and costs back to normal.

"Losses must be accepted on present inventories. The firms with which we do business are willing to share such losses with us, because the ultimate goal is worth striving for. When the Ford company goes on the market for its 1921 materials and parts, and starts signing new contracts in January, I expect to see further declines. I expect to see material and parts prices down from 20 to 35 per cent by the first of the year."

Export Meeting of Automobile Manufacturers

Export managers of the National Automobile Chamber of Commerce held a convention at the New York offices, Marlin-Rockwell building, 366 Madison Ave., on Oct. 8.

As exports of automotive products already represent 8 percent of the entire United States export trade in completely manufactured articles, it is evident that the laws recently enacted to stimulate American foreign commerce will tend to increase this percentage still more. The convention tried to ascertain to what extent these new laws are facilitating export trade and discussed specific topics pertaining to foreign shipments of automobiles.

Philip B. Kennedy, who is vice president of the First Federal Banking Association, and formerly director of the Bureau of Foreign and Domestic Commerce, addressed the export managers on "How the 'Edge Bank' Can Co-operate With Automobile Manufacturers in Financing Exports."

Helpful Hints for Designers and Draftsmen

Proper Iron for Engine Cylinders

For years foundrymen have argued back and forth on the relative merits of soft or hard cast iron for cylinders. The advocates of soft iron claimed that the softer metal glazed over more quickly, and thus could be run in to produce a perfect cylinder surface more quickly. On the other hand, the advocates of hard metal, including those who favor a semi-steel, say that the soft metal is sure to be spongy, so that it will develop water jacket leaks and other troubles, even if the interior holes are not discovered in machining and testing. They claim also that while it will take longer to run the cylinders in with hard metal, that is, produce a glazed working surface, when produced this will last very much longer.

According to a recent writer in The Foundry, strong iron as hard as can be machined seems to give the best satisfaction in cylinders for gasoline engines. It must be strong since the engine has to be made as light as possible; it must be hard, and of fine close-grained iron, to withstand wear. The transverse breaking strain of the iron in these cylinders should be between 3,300 and 3,600 lbs. when the test is made on the American Foundrymen's Association standard arbitration bars.

Dry sand molds will give cleaner and smoother castings than green sand, but it is a more expensive method and is only used on the larger sizes of marine engines. If fine close sand could be used, the green sand would give just as smooth a skin; but unfortunately the very fineness of the sand interferes with the gas escaping from the mold. Mechanical analyses of molding sands indicate that the voids in fine sand are relatively larger than in that of coarser grades, but actual practice demonstrates the fact that the gases escape more readily through coarse sand, and therefore sounder castings are produced with this material.

The sands used for cores are usually lake or beach sand since a clean washed sand is one of the prime requisites of success on the jacket and smaller cores. The barrel core may be of different sand. Washed sand gives the best results. It is free from clay and other foreign matter which only tends to absorb binder. This sand contains nearly 90 per cent silica; therefore cores made of it resist the intense heat of the iron without fusing. There is no need of blacking, as they are easily cleaned out and leave a very smooth surface.

Oil binders are generally used on this class of work. When the proper proportions of oil and sand are used, a very strong open core is the result, requiring very little rodding. The venting is nearly automatic and the gas escapes very readily. Good results are obtained from a mixture consisting of one part of oil to 45 of beach sand. In order to obtain cores true to size it is advisable to use metal dryers.

Founders are aware of the wedging strain of iron and how it finds its way between two cores. It is very important that this should not take place in these cylinders. There must be an uninterrupted circulation of water around the barrel while the engine is running; therefore the two half cores for the jacket must be brought into intimate contact along the joint. To achieve this, a thin mixture of putty is applied to the joint of the core; or flour mixed with oil may be used. In some of the larger sizes a putty worm is laid between. On the still larger sizes the joint of the jacket core is usually filled with sand and dried with a torch.

Steel chaplets should not be used in engine work, as the salt water soon corrodes them and leaks develop. Copper rivets will prove satisfactory on light cylinders with thin walls. It is not necessary to make the stem of steel. Take a steel or iron rod and bore a hole in the end, in this insert the copper rivet or nail. If the iron is good and hot it will partly fuse the copper and make an absolutely tight joint.

Italian Government to Produce Aluminum

In view of the very large proportion of aluminum being used in all forms of automotive construction, and the fact that this is increasing rather than decreasing, it is interesting to note that the Italian government is understood to be making arrangements to purchase and work the large Abruzzi and Tamnium bauxite deposits. The probable intention is to manufacture aluminum wire to be used in place of copper in the electrification of the Italian railways. Italy's resources of bauxite are sufficiently large to permit production on a large scale. Other forms of aluminum than this wire will be made later.

Molybdenum in Crankshafts

In steel circles it is said that vanadium available for use as a purifier and alloying element is scarce and high in price, and that it probably will be more so. The attitude of the company governing the imports of this material is responsible for this. It is said that Britain has been practically deprived of all vanadium as a result of the new policy. The fact that a similar situation may be brought about here, due to the witholding of this metal from the market, leads to renewed consideration of molybdenum, which was used so successfully during the war.

One of the claims made for it was that it would replace vanadium and produce superior results. One of the uses for which it was tried with great success was crankshafts and other parts for Liberty engines. The crankshaft steel showed the following average composition and test results:

Carbon	Manganese	Silicon	Chromium	Nickel	Molybdenum
0.236—0.305	0.50—0.69	0.08—0.52	0.74—0 98	2.85—3.05	0.32—0.54

(on finished shaft)

Elastic Limit	Tensile Strength	Elongation, Per cent	Red of Area, Per cent	Izod Ft. Lb.	Brinell Hardness
130,000	142,000	20.5	65	67	303

This chrome-nickel molybdenum steel was made by the United Alloy Steel Corporation, Canton, Ohio, for Liberty motor crankshafts and connecting rods, under the jurisdiction of the Aircraft Production Department of the United States Government.

These results on the chrome-nickel molybdenum steel, obtained on test pieces taken from the finished crankshaft, are the more remarkable when it is borne in mind that a drawing temperature from 1,150 to 1,200 deg. F. is permissable. The high drawing temperature removes quenching and forging strains with the elimination of straightening operations during machining. Experience in making these finished Liberty motor shafts showed that the additional cost of the molybdenum was much more than offset by the savings brought about in the general shop practice. This is a matter of record.

Electro-Percussive Welding Promises Much

In a paper read at a meeting of the American Institute of Electrical Engineers recently, D. Miner described a new apparatus for welding metals on the percussion system. Percussion welding consists in fusing the ends of the sections to be joined by creating a spark discharge between them and almost simultaneously bringing them together in a percussive engagement. In the apparatus hitherto used the spark is obtained from an electrostatic condenser; hence it has only been possible to weld thin sections such as wire, as larger sections would require a condenser of prohibitive size. In the apparatus described by Mr. Miner electro-magnetic energy replaces electrostatic energy. The pieces of metal to be joined form the electrodes of the secondary circuit of a reactance coil. When the primary circuit of this coil is closed by a switch, an electro-magnet draws the electrodes into contact with one another, and the current in the secondary circuit excites another electro-magnet which draws the forging hammer into position ready to deliver its blow. The operating switch is then opened and the hammer magnet is thus de-energized. The hammer falls, and on its downward path operates a trip switch which throws open the primary circuit. The breaking of the primary current de-energizes the magnet holding the electrodes together and causes them to separate. At the same time the collapsing field in the primary circuit transfers energy to the secondary and an intense arc is formed between the electrodes, i.e., the pieces of metal to be welded. By the time the hammer has reached the end of its stroke and delivered its blow the metal is sufficiently melted to form a strong weld. The time taken for the whole operation is about one-tenth of a second, and the current consumed is only about one-sixteenth of that used in butt welding. In the experimental tests the work done included the welding of a one-quarter inch copper rod to a steel disc, a one-quarter inch steel rod to a steel disc, a five-sixteenth copper-copper weld, and a nickel-steel valve head welded to a cold rolled steel stem. All the results were satisfactory, a weld strength of 96.000 lb. per sq. in. being obtained for a steel-to-steel weld, and 40,000 lb. per sq. in. for copper to copper. Microphotographs confirmed the quality of the weld, and indicated interpenetration of the metals without visible alloying and a thorough fusion without oxidation

What Anhinga Is

This fiber, which occurs in Brazil, seems destined to play an important part in industry. Comparatively small quantities have thus far made their appearance, but the fiber is said to be suitable for the production of paper similar to that obtained from linen and to serve as a raw material for the production of a cotton-fiber substitute superior to cotton in some respects. A new process has been devised for the treatment of the fibers to make them suitable for textile purposes and at least one mill is reported to be producing something more than one thousand pounds of the treated fiber daily.

Data on Monel Metal, a Useful Alloy

A booklet on this alloy has recently been issued and gives a great deal of interesting data. That an ore, which might otherwise have presented a problem in refining, should have been found to yield a metal with so many important characteristics is fortunate, and constitutes another argument in favor of research and careful experimentation. Monel metal contains approximately 67 per cent of nickel, 28 per cent of copper and 5 per cent of other metals. It is tough and ductile, and can be machined, forged, soldered, brazed and welded. It has high tensile strength, resists corrosion and deoxidization, even in the presence of hot gases and superheated steam. As scientific data and results of practical experience are placed in the hands of engineers, a continually increasing variety of uses is found for this interesting alloy, and in some industries, such as dyeing, entire machines are now being constructed wholly of Monel metal.

Materials Handling Section Organized by A. S. M. E.

Four hundred members of The American Society of Mechanical Engineers have organized themselves into a professional section on Materials Handling and will provide primarily a common channel of intercourse between all the technical and industrial organizations cooper-
all the technical and industrial organizations cooper-
with the handling and distribution of materials and products.

Probably the greatest economic need of civilization today is the devising of means and a more intelligent application of proper and coordinated methods whereby materials of one kind or another may be handled more swiftly and to better advantage.

Industrial and railroad congestion has been almost intolerable and with these continued conditions have come mounting costs until better, more efficient and more adequate systems must come into being if the cost differential that is now being reflected in the soaring prices of all goods is to be modified.

The burden of this necessity made it imperative that a professional section composed of those whose interests and whose expert knowledge brings this problem close to them, should assume this work as its obligation to the technical fraternity and its contribution toward the solution of our national economic problem.

This section will aim to be a bureau of information—complete in its scope, specific in its knowledge of the physical and economic conditions and unbiassed in its conclusions. This will be done by having special meetings on particular subjects, meetings jointly with other sections, other organizations or associations, by taking part in all local and national problems relating to the purpose of this section.

A. S. M. E. Organizes Aeronautic Section

To the end of promoting in a large way the broad engineering development having to do with the future of aerial navigation regarded as an essentially international science, art and business, the members of The American Society of Mechanical Engineers interested in aeronautics have organized themselves into a professional section on this subject.

Howard E. Coffin, Jesse G. Vincent, Orville Wright, C. F. Kettering, Elmer A. Sperry, James Hartness, John R. Cautley, Lionel S. Marks, Miller R. Hutchinson, Charles E. Lucke and Joseph A. Steinmetz, all prominent in the aeronautic field during the war, are among those who have registered in the section.

The New and Unusual in the Automotive Field

G. B. C. Controller Protects Battery Against Overcharging—Temme Exhaust Heater Makes Cold Cars Comfortable—Memo Rust Remover Quick and Efficient

It will be the policy of Automotive Manufacturer (as in Automotive Engineering) to present on these pages each month some car, truck, aeroplane, boat, tractor, engine or other unit which presents unusual and decidedly different engineering features

G. B. C. Automatic Battery Controller

Recognizing as the whole industry does the need for some device to automatically protect the battery, generator and circuits against damage due to various causes, the Battery Appliance Corp., New York, has perfected the G. B. C. Controller shown in Figs. 1 and 2. This simple apparatus protects the entire electrical system of the car by automatically reducing the rate of charge to battery when overcharging begins; it automatically prevents overheating of the battery; it protects all circuits against overvoltage which might blow out the fuses and perhaps burn out a generator armature or field, and besides preventing and giving visible warning of these troubles, it indicates when the electrolyte level drops below a safe point.

As shown in the accompanying illustrations, this simple protecting device employs three auxiliary electrodes, which project through the ordinary cell caps so that the bottom of each electrode is just above the respective cell plate tops. Connections are provided from these electrodes to the dash instrument and connections from the latter to the generator. The dash instrument is essentially a combination of three electromagnets which operate three signals: one marked "low," another both "low" and "safe"; the third marked "off." This latter indicates whether the battery is being charged or not; the signal "off" indicates reduced generator output, while a blank space in the same window indicates normal charging.

Overcharging, the greatest battery evil, is prevented in a most simple way by appreciation of the fact that the condition becomes serious only when the battery heat has reached 110 deg. F. Therefore the controller protects the battery from overcharging by basically controlling the temperature.

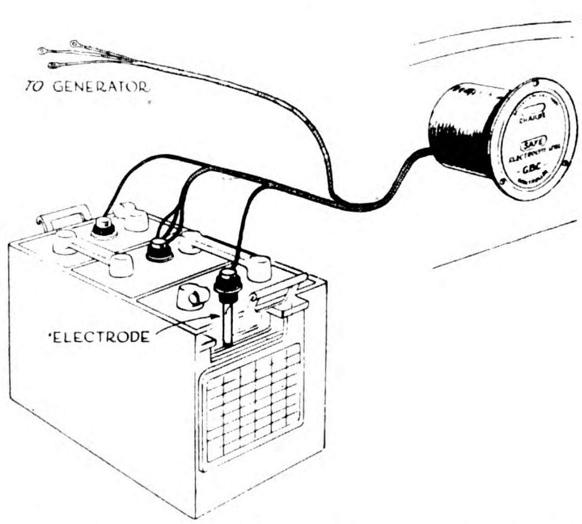


Fig. 1. General arrangement of battery system with G. B. C. Controller in use

The detail of operation is as follows: Three electrodes, one per cell, are connected by wires to the instrument on the dash. Safe level obtains as long as the electrodes are in contact with the electrolyte. If for any cause whatever the level in any cell of the battery falls out of contact with its electrode, the level indicator immediately flashes the sign "low" on the instrument dial and the driver at once knows the cells need water.

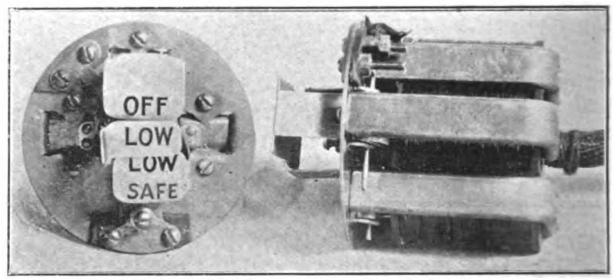


Fig. 3. Arrangement of Temme exhaust heater in car for cold weather use

The middle electrode is hollow and contains a small, rugged thermostat, adjusted to expand a specific amount when the battery attains a temperature of 110 deg. F. If the battery suffers the beginning of an objectionable overcharge, the temperature reaches this limit and immediately the action of the thermostat is conveyed by electrical leads to the instrument on the dash and it automatically changes the generator adjustment to reduce the charge, and thus compels the battery temperature to fall below 110 deg. F.

Should battery connections break loose or slowly corrode without the device, the generator voltage no longer is stabilized by the battery and it rises with increased car speed to values which may burn out the lamps, ignition coil and finally the generator itself. Fuse protection, if employed, saves the equipment but stalls the car. High voltage due to overcharge in the wintertime may also cause trouble. With the device no such danger exists. The controller has a coil in the instrument on the dash, which sensing this rising voltage or excess voltage due to any cause, immediately adjusts the generator output so that it can only develop the voltage needed for the lamps and ignition; thus protecting these auxiliaries and allowing the car to function.

Temme Exhaust Heater

Within the past year an automobile heater of the exhaust type has appeared on the market, which apparently possesses considerable merit. Employing as it does pure waste gases manifestly it will find popular favor with the motorist who enjoys winter time motoring or who demands the maximum dividends from his investments.

This new improved heater by having three radiator coils scientifically constructed, possesses 98 fin-like leaves affording a heating capacity of 384 sq. in. which as guaranteed by its manufacturers, the Temme Spring Corp., Chicago, will comfortably heat the largest gasoline car built up to the present time. Other unique features of merit claimed for this device are: a control operated direct from the instrument board; a floor-plate flush fitting with the car floor; a clean-out door instantly accessible, thereby assuring sanitation at all times; an adjustable valve that in addition to offering the possibility of changing from one make and model car to another, is provided with a positive locking device which serves

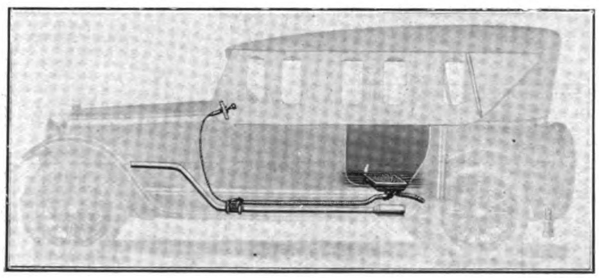


Fig. 2. Two views of the indicating element of the G. B. C. Battery Controller

as a complete choke-off when no heat is required. The radiator of one solid piece construction allows for no possibility of gas escapage into the car.

That this heater will have much to do with stimulating year-round motoring, and incidentally more than double the riding season is evident. Particularly will this device appeal to business houses who from actual experiment know an investment which pays a well worth while profit.

Memo Rust Remover

A new preparation known as "Memo" Rust Remover and Cleanser has recently made its appearance on the market, and it is one that bids fair to be a boon to all concerns and individuals engaged in or allied to any metal products industry, inasmuch as it appears to be a most important labor saving invention. The inventor of the preparation is a chemist of wide experience who, realizing that the methods employed to remove rust, corrosion, etc., from machines, engines, tools, parts and all metal surfaces, required considerable time and involved high labor costs, set before himself the task of devising a much better and more economical cleansing method, and devoted many years to unceasing research and experimentation with the result that "Memo" Rust Remover and Cleanser was invented.

That it is efficient to a high degree is proven by enthusiastic endorsements from those who have used it. The name "Memo" is derived from the Latin and means "less work." It is a scientific combination and blending of certain chemical ingredients, which in combination produces an electro-chemical action that rapidly loosens and dissolves rust, corrosion, grease, oil, dirt, carbon, paint or any other foreign substance that is adhering to the metal—irrespective of its age or hardness—and its action automatically ceases when contact between the cleanser and the metal is established, and this is as far as it will go, for it will positively not injure or mar the surface of the metal itself in any way.

There are two methods of using the preparation as follows: (1) Apply it to the machine or part with a brush and allow it to remain for a short time, then brush or rub it off and it leaves the metal bright and clean. (2) Mix the preparation in a vat, tank or container with water, then attach the machine or parts to wire or chain so that they will hang in the solution. No further attention is required since the process of cleaning goes on while the parts are immersed.

It is stated that the preparation is absolutely safe in every way and that it will not burn or explode. Another important point in its favor is that it will not cause corrosion or rust to form, for in fact, it protects the metal and makes it exempt from corrosive or disintegrating action for a long period after it has been treated by this preparation, and there need be no fear of injury to the most delicate part no matter what metal it is composed of. The preparation is an economical one to use as the same solution may be used many times over as it does not deteriorate or lose its cleansing power. Peter A. Frasse & Co., New York, are the sole distributors.

Transportation to Be Keynote of A. S. M. E. Meeting

At the forthcoming annual meeting of the American Society of Mechanical Engineers Dec. 7 to 10, the keynote session will be concerned with transportation. This will be discussed by authorities in the following phases: Railroads, motor trucks, waterways, feeders, N Y. terminal problems.

In addition there will be professional sessions concerned with fuels, machine shop, management, railroad, textile and power, and special sessions devoted to woodworking, research, design and miscellaneous matters.

A tentative program has been drawn up but more complete information will be available early in November. All sessions will be held in the Engineering Societies' Building, 29 West 39th street, New York.

Additional Notes of Body Builders

Schmidt & Storck Wagon Co., West Bend, Wis., manufacturer of heavy duty wagons, trailers, etc., will build a one story brick and concrete factory, 100 x 270 ft., costing about $90,000 with wood and metal working equipment, including forges, hammers, etc. Bids for the construction are being taken by Buemming & Guth, architects, 521 Jackson street, Milwaukee.

Phineas Jones & Co., 305 Market street, Newark, N. J., manufacturer of automobile and truck wheels, demountable rims, etc., has broken ground for the first unit of its proposed new plant at Liberty and Hillside avenues, Hillside. It will be a one story brick, and will give employment to about 200 persons. The company has seven acres of land at this location.

New York Auto Top & Supply Co., 260 Halsey street, Newark, N. J., manufacturer of automobile bodies, tops and other equipment has acquired property at 1168-70 Broad street, near Astor street, 63 x 118 ft., as a site for a new plant. Plans are being prepared by Backoff, Jones & Cook, architects, 9 Clinton street.

Standard Top Co., Walnut street and Wyoming avenue Scranton, Pa., manufacturer of automobile tops, has completed plans for a new one story plant, 40 x 100 ft., to cost about $10,000, exclusive of equipment. G. N. Edson, Connell Building, Scranton, is architect.

Stewart Body Building Co., Flint, Mich., has awarded a contract to the Realty Construction Co., Flint, Mich, for a new one and two story plant, 85 x 130 ft., for the manufacture of automobile bodies, estimated to cost about $100,000, including machinery.

Ideal Body Co., Madison, Wis., has been organized to manufacture open and closed passenger car bodies, truck bodies, cabs, etc. The building formerly occupied by the Fox Motor Sales Co., at Madison has been equipped for quantity production of bodies.

Builtwell Auto Body Co., 59 Jackson street, Brooklyn, has awarded a contract to Miller Brothers, 668 Saratoga avenue, for a new one story plant at Morgan avenue and Lombardi street, 100 x 100 ft., to cost about $25,000. B. Stillwell is president.

Current Automotive Metal and Supply Prices

General Conditions Business generally has been disturbed by recent price cutting of automobiles and trucks otherwise it is on the mend. Election is cutting less of a figure. Car supply movements are very much better. Call money is back to 6 per cent. Foreign buying holds up in quantity and is expected to for some months holds up in quantity and is expected to for some months by manufacturers, despite English coal strike.

Iron and Steel Ford and other automotive producers are beginning to press for lower iron and steel prices, with some success. The steel and iron men expect and concede lower levels, but are slow to yield ground. Unfilled orders are less, some mills and furnaces have shut down, and there is considerable unemployment. Valley irons are down $2.50-$3 from last month. Sheets of all kinds show big reductions. Steel bars in large lots can be placed at $3.25.

Copper and Aluminum Copper has recently dropped below 16 cents, and some metal is reported to have been sold at 15¼, both without bringing out any latent demand, so that producers, with fairly large stocks, are in a bad position. The present figures approximate present production costs, and it is doubtful if any metal available now was mined and smelted before labor costs went up, so any further downward movement (and it is possible) means an actual loss. Aluminum is unchanged with foreign metal quoted at 29 to 30c, N. Y., against a domestic price of 35c, which is shaded on large lots. Large buying before turn of year should reduce prices.

Lead and Tin Lead is very quiet with more metal offered than there are buyers for it. The leading interest quotes 7.75c N. Y., against foreign metal available duty paid at 7.59c. Early in October tin had a slight revival followed by a reduction to 41 cents for spot Straits. Later American buying in London increased prices there.

Zinc and Other Metals Recent buying of zinc has left light stocks and consequently prices are firm around 7.50c N. Y. This is said to have been shaded to 7.35c but producers claim the bottom has been reached. Demand for antimony is light, manganese is very quiet, quicksilver is down to $60 a flask, silver for export has reached 74c (on Oct. 19, 74 a 74¼), and other metals are either low or moving downward.

Other Materials Cotton, that is, raw cotton, has reached and gone below 18 cents for spot, in the past week. A reaction carried the price up to 19½c, but supplies are still very much in excess of demand. Southern planters are burning stocks in an attempt to increase prices. Yarns and woven goods show little of this marked reduction as yet, especially tire fabrics which have had very small reductions. Rubber seems to get worse each week, and up-river Para first quality can now be bought for 25 cents, with the possibility of approximating 24 on large quantities. Oil is unchanged with the single exception of dark lubricating. All fuel prices are stationary. Hides are weak with Bogotas quoted at 25c.

Every effort is made to have the following prevailing prices (compared with last month's) accurate but none is guaranteed. They are obtained through trade sources and may not be realized on small quantities:

	Sept. 13	Oct. 12
Acid, Sulphuric, 66°..........ton	$18.00 —20.00	$18.00—20.00
Alcohol, Ethyl, 97 p.c.........gal.	6.00 — 7.00	6.00— 7.00
Alcohol, denatured, 190 proof, gal.	1.05 — 1.10	1.05— 1.10
Aluminum No. 1 99% carloads.lb.	.35 — .38	.35
Ammonium Chloride (Sal-Ammoniac) white, granular....lb.	.17 — .18	.17— .18
Babbitt Metal, best grade.....lb.	.90	.90
Babbitt Metal, Commercial....lb.	.50	.50
Beeswax white ....lb.	——	.60— .65
Carnauba No. 1 Wax..........lb.	.90 — .95	.90— .95
Caustic Potash (85-92 p. c.)..lb.	.29 — .33	.29— .33
Caustic Soda, 76 p. c......100 lb.	5.75 — 6.00	4.25— 4.50
Pumice, Ground (domestic)....lb.	.04 — .07	.04— .07
Shellac, Orange, superfine....lb.	1.40 — 1.45	1.10— 1.20
Tin, Metallic straits pig......lb.	.45	.42
Turpentine, spirits of crude.....	1.49	1.20
Zinc, Western Spelter.........lb.	.10 — .11	.08
No. 9 base casks, open......lb.	.15	.14

IRON AND STEEL, PIG, BARS, ALLOYS, OLD METAL

	Sept. 14	Oct. 17
Pig, per ton—		
No. 2 X, Philadelphia§..........	$53.51	$53.51
No. 2, Valley furnace†..........	50.00	47.00
Basic, delivered, eastern Pa.....	51.26	51.26
Basic, Valley furnace..........	48.50	46.00
Bessemer, Pittsburgh	50.46	50.46
Malleable, Valley	50.00	48.40
Refined iron bars, base price....	5.75c	5.50c
Soft Steel—		
¾ to 1⅞ in., round and square..	3.63—5.40c	3.48—4.75c
1 to 6 in. x ¼ and 5/16..........	3.73—5.40c	3.58—4.75c
Rods—⅝ and 11/16..............	3.68—5.45c	3.53—5.45c
Bands—1½ to 6 x 3/16 to No. 8..	4.33—7.00c	4.18—7.00c
Sheets		
Black, No. 28, Pittsburgh.......	7.50c	6.75c
Galvanized, No. 28, Pittsburgh..	9.00c	8.25c
Blue Annealed, 9 & 10...........	5.50c	5.00c
Tin Plate, 100 lb. box, Pittsburgh	$9.00	8.50c
Ferromanganese, 76% to 80% del.	$165.00—170.00	160.00—$170 00
Spiegel, 18% to 22% furnace, spot	80.00	80 00
Ferrosilicon, 50%, spot, delivered	75.00— 80.00	75.00— 80.00
Old Metal		
Heavy steel scrap, Pittsburgh...	28.50	28.00
Heavy steel scrap, Philadelphia..	26.50	23.00
No. 1 cast, Pittsburgh..........	42.00	40.00
No. 1 cast, Philadelphia........	40.00	39 00

†Silicon, 1.75 to 2.25. §Silicon, 2.25 to 2.75.

BOLTS AND NUTS

(Discounts are from Nov. 1, 1919)	Sept. 14	Oct. 14
Machine bolts, c.p.c. and t. nuts, ⅝ x 4in.; Smaller and shorter..	10	30—10
Carriage bolts, ⅜ x 6 in.:		
Smaller and shorter, rolled threads	20	30—10 to 20
Cut threads	20	30 to 20
Semi-finished hex. nuts:		
⅝ in. and larger.................	40	50—10 to 40
9/16 in. and smaller.............	40	50—10 to 40
Tire bolts	50	50

BRASS, COPPER SHEETS, SHAPES, VIRGIN METAL, SCRAP

	Sept. 14	Oct. 12
Copper, Lake, ingot...........lb.	$0.19	$0.17
Copper, Electrolytic ....lb.	.186	.17
Copper, Casting ....lb.	.18½	.16¾
Copper sheets, hot rolled......lb.	.33½	.29½
High brass wire and sheets....lb.	.30¼	.30¼
High brass rods...............lb.	.27	.27
Low brass wire and sheets....lb.	.28½	.28½
Low brass rods................lb.	.29	.29
Seamless brass tubing.........lb.	.33	.33
Old Metal—		
Copper light and bottoms........	.12½	.12
Brass, heavy	.09½	.07
Brass, light	.07	.06
No. 1 yellow brass turnings.....	.08½	.07
No. 1 red brass or comp. turnings	.12½—.13½	.12
Aluminum, cast..................	.20—.20½	.19
Aluminum, sheet	.20—.20½	.19

CRUDE RUBBER

	Sept. 16	Oct. 20
Para, Upriver fine.............lb.	$ .28¼	$ .25
Upriver coarse ....lb.	.19½	.17
Upriver caucho ball.........lb.	.18½—.19	.17½—.18
Plantation, first latex crepe...lb.	.26	.25 —.25¼
Ribbed smoked sheets.......lb.	23½	.23 —.23¼
Brown crepe, thin, clean....lb.	23¾	.20

PETROLEUM PRODUCTS

	Sept. 16	Oct. 20
Oil—Pennsylvania Crude	$ 6.10	$6.10
Kansas and Oklahoma Crude..	3.50	3.50
Gasoline, Motor, garages, steel bbls..	.31	.31
Consumers, steel bbls..........	.33	.32
Lubricating Oil, black, 29 gravity	.28—.33	.29—.33
Cyl. light filtered.............	.90—.95	.90—.95
Dark filtered	.83—.85	.80— 83

MEN OF THE AUTOMOTIVE INDUSTRY

Who They Are What They Are What They Are Doing

Edward O. Goss has been elected president of the Scoville Mfg. Co., Waterbury, Conn., to fill the place made vacant by the resignation of Mark L. Sperry. Mr. Goss will also retain the general managership of the concern. Mr. Sperry has been associated with the company for fifty-eight years, and is now retiring entirely from active business affairs

George H. Mueller, formerly with the J. I. Case Plow Works Co., Racine, Wis., has become associated with the Termaat-Monahan Mfg. Co., Oshkosh, Wis., as vice president and general manager. During the war Mr. Mueller served as chief engineer of the Curtiss Aeroplane Motors Corp., which built the original Liberty motor under his supervision.

Arthur T. Murray, president of the American Bosch Magneto Corp., Springfield, Mass., has been elected president of Gray & Davis, Inc., Boston. This follows the arrangement recently made by the stockholders of the latter organization whereby the American Bosch Magneto Corp. assumes immediate executive control.

Otto L. Lewis, chief engineer of the Southern Motor Manufacturing Association, Houston, Texas, has resigned. Lewis has voiced his intention of remaining in Houston to develop a line of power farming machinery which is particularly adapted to the needs of the southern farmer.

Walter M. Lipps, who was formerly assistant general manager of the Victory Tractor Co., Greensburg, Ind., is now associated with the United Engineering Co., also of that city, and is located at its general sales office at 1607 Merchants Bank Building, Indianapolis.

Charles F. Willard, who was formerly chief engineer of the aeronautical department of the Aeromarine Plane & Motor Co., New York City, has become consulting engineer for Witteman-Lewis Aircraft Co., 140 West 58th street, also of that city.

Walter H. Barling has accepted a position as supervisory engineer for the Wittemann-Lewis Aircraft Co., Hasbrouck Heights, N. J. He was formerly aeronautical engineer in the engineering department, air service, McCook Field, Dayton, O.

J. D. Siddeley, managing director Armstrong-Siddeley Motors, Ltd., Coventry, England, manufacturer of the Armstrong-Siddeley car, is spending a month in the United States visiting automobile factories and studying problems of production.

G. J. Lang, vice president of the American Bosch Magneto Corp., Springfield, Mass., has been elected vice president and general manager of Gray & Davis, Inc., Boston. He will in the future divide his time between the two organizations.

Charles A. Trask has resigned as mechanical superintendent with the Rockwood Mfg. Co., Indianapolis, and has accepted a position as factory manager for the National Metal Products Co., which is located in the same city.

H. W. Christensen has accepted a position as production manager of the Highway Motors Co., Defiance, O. He was formerly chief draftsman in the truck engineering department of the Packard Motor Car Co., Detroit.

James F. Donahue, western sales manager of the Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y., has been appointed vice president and general manager of the Foster Bolt & Nut Mfg. Co., Cleveland.

H. Putnam Wood has accepted a position as general superintendent of the Universal Body Corp., Mishawaka, Ind. He was formerly in charge of mechanical body design with Brewster & Co., Long Island City, N. Y.

Alberto de Lavandeyro has been elected vice president of production of the Prado Automobile Co., 25 Church street, New York City. He was formerly consulting engineer for Bausch Machine Tool Co., Springfield, Mass.

A. A. Brevaire has been appointed chief maintenance engineer of Hare's Motors. Mr. Brevaire comes from the Pierce Arrow Motor Car Company where he was technical engineer for the service department.

John W. Dissette has been elected president and treasurer of the Sure Spark Ignition Corp., Washington. He was formerly chief of the aircraft section in the office of the Director of Sales, also in that City.

T. W. Morgan has resigned as president and general manager of the Lorain Motor Truck Co., Lorain, O., which was organized last November, and will be succeeded by M. J. Henninger, vice president.

E. V. Higbee has joined the production department of the Stanley Works, New Britain, Conn. He was formerly assistant research engineer with the Locomobile Co. of America, Bridgeport, Conn.

R. L. Johnson, formerly chief metallurgical engineer of the Exeter Machine Works, Pittston, Pa., has accepted a position with the American Non-Ferrous Metals Corp., 713 Crozer Building, Chester, Pa.

A. B. Webb has accepted a position as chief engineer of General Tractors, Inc., 675 Old Colony Building, Chicago. He was formerly chief engineer of the Monarch Tractor Co., Watertown, Wis.

Alexander Matheson has been elected vice president of the Motor Parts Co., Boston. He was formerly a member of the faculty of the Motor Transport Training School, Camp Holabird, Baltimore.

W. C. Rosenthal has accepted a position with the Aladdin Products Co., 312 North May Street, Chicago. He was formerly in the engineering department of the Packard Motor Car Co., Detroit.

Fred A. Bigelow has been promoted to the presidency of the Carpenter Steel Co., Reading, Pa., succeeding W. B. Kunhardt. The latter has been made chairman of the board of directors.

G. R. Petri has severed his connection with the Newport News Shipbuilding & Dry Dock Co., Newport News, Va., and has accepted a position with the Reynolds Truck Sales Co., Detroit.

F. W. Trabold has recently been made general sales manager of J. H. Williams & Co., Brooklyn, N. Y. He formerly held the office of vice president and general manager in the same company.

Fred A. Clock has resigned as chief engineer of the Watson Products Corp., Canastota, N. Y., to accept the position of chief engineer with the Capital Motors Corp., Fall River, Mass.

C. B. Lord, formerly general superintendent Wagner Electric & Mfg. Co., St. Louis, has become works manager of the Advance-Rumely Co., Battle Creek, Mich., agricultural implements.

G. W. Beyerle has accepted a position as engineer with the Wadsworth Sand Cutter Corp., 8610 Hough Avenue, Cleveland. He was formerly a consulting engineer at Independence, O.

H. L. Butterworth is no longer assistant in the experimental laboratory of the Nordyke & Marmon Co., Indianapolis, but is affiliated with the Alena Steam Products Co., also of that city.

William Wolfred has accepted the position of plant manager of the Bahmann Iron Works Co., Dayton, O. He was formerly works manager of the Pawling & Harnischfeger Co., Milwaukee.

John V. Schafer has accepted a position as engineer with Fairbanks, Morse & Co., Beloit, Wis. He was formerly assistant engineer with the Caskey-Dupree Mfg. Co., Marietta,O.

Joseph B. Cary has been elected vice president of the American Malleables Co., Lancaster, N. Y. He was formerly operating manager of the Air Reduction Sales Co., New York City.

Samuel W. Gray, who was formerly mechanical engineer with Reed & Glaser, Indianapolis, has accepted a position as production manager of the Acme Works, Inc , also of that city.

William Harrower, formerly chief engineer of the Collins Motors, Inc., Huntington, N. Y., has accepted a position with the Everlasting Valve Co., 65 Fisk Street, Jersey City, N. J.

H. F. Patterson has been appointed assistant chief engineer of the Supreme Motors Corp., Warren, O. He was formerly a designing engineer with the Rutenber Motor Co., Marion, Ind.

N. E. Hildedth has resigned as superintendent of the Cushmna Motor Works, Lincoln, Neb., to accept the position of works manager of the Witte Engine Works, Kansas City, Mo.

H. F. Peavey has resigned as assistant chief engineer of Stevens Duryea, Inc., Chicopee Falls, Mass., to associate himself with the American Bosch Magneto Corp., Springfield, Mass.

Alf C. Boock has severed his connection with the Pan Motor Co., St. Cloud, Minn., and accepted a position as layout draftsman with the Waterloo Gasoline Engine Co., Waterloo, Ia.

Everett Cavanaugh, who was formerly sales engineer with the Bimel Spoke & Auto Wheel Co., Portland, Ind., is now factory manager of the Imperial Wheel Co., Flint, Mich.

F. C. Goldsmith has resigned as chief engineer of the New Departure Mfg. Co., Bristol, Conn., and became affiliated with the Willys-Overland Corp., New York city on July 1.

Charles S. Dahlquist has resigned as chief engineer of the Timken-Detroit Axle Co., Detroit, to accept the position of director of engineering with the Eaton Axle Co., Cleveland.

W. H. Diefendorf has severed his connection with the Weekes-Hoffman Co., Syracuse, N. Y., and is now president and treasurer of the Diefendorf Gear Corp also of that city.

Henry M. Leland, president of the Lincoln Motor Co., Detroit, received the degree of doctor of engineering at the recent commencement of the University of Michigan.

Ralph H. Sherry has resigned as metallurgist of the General Motors Corp., Detroit, and has accepted the position of metallurgist for the Willys Corp., Elizabeth, N. J.

William S. Stockton has resigned as assistant chief engineer of the New Departure Mfg. Co., Bristol, Conn., to accept a position with the Willys Corp., Elizabeth, N. J.

Walter O. Lum, president of the Gould Motor Parts Co., York, Pa., has also been made general manager of the New Era Mfg. Co., 2033 Fifth Avenue, New York city.

Harry A. Oswald has accepted a position with the Hamilton Motors Co., Grand Haven, Mich. He was formerly chief engineer of the Quaker City Corp., Philadelphia.

H. L. Beckwith who resigned as service manager of the General Motor Truck Co., July 1, has been made general manager of the King Trailer Co., at Ann Arbor, Mich.

B. Russell Shaw, who was formerly general manager of the Aeronautical Instrument Co., New York city, is now connected with the Lawson Airplane Co., Milwaukee.

Clarence F. Jamison, formerly assistant general manager of the Elgin Motor Car Corp., Argo, Ill., has accepted a position with the Comet Automobile Co., Decatur, Ill.

George N. Duffy, formerly with the Curtiss Aeroplanes & Motors Ltd., Toronto, Ont., is now production engineer with the Willys-Overland, Ltd., West Toronto, Ont.

George L. Sexton, formerly connected with the Sexton Agricultural Tractor, Detroit, is now a designer with Sexton & Long, 56 bis Rue de Chateudun, Paris.

Charles G. King has returned from England and accepted the position of manager of the Miles Piston Ring Sales Co., 90 Mason Street, Milwaukee.

W. F. Pfander, formerly chief engineer of the Allen Motor Co., Fostoria, O., has accepted a position with the Chevrolet Motor Co., New York city.

Clarence M. Foss has received his discharge from the Army where he held the rank of major in the ordnance department at Washington.

Balfour Read, formerly of Marion, Ind., has accepted a position as assistant chief engineer of the Barley Motor Car Co., Kalamazoo, Mich.

Eugene M. Bournonville, who has devoted all of his time in recent years to the development of his rotary valve engine, has organized the Bournonville Rotary Valve Motor Co., a $300,000 New Jersey corporation having headquarters in Jersey City, N. J. where the inventor's home is. Bournonville will be recalled as the developer of the widely used oxy-acetylene cutting and welding system brought into existence b ythe Davis-Bournonville Co., and also as the introducer into this country of the compressed acetylene system generally known under the Prest-O-Lite name.

Howard Greene, M. E., a writer on motor topics, an inventor, and formerly on the editorial staff of several automobile magazines has been appointed editor of the department of animated mechanical drawings of the Harry Levey Service Corp. Mr. Greene was technical editor of Automobile Topics, technical editor of Motor World, and was on the editorial staff of The Automobile and Horseless Age. He was associated with the late H. F. Donaldson in starting The Commercial Vehicle, and is the author of a book entitled "Every Man's Guide to Motor Efficiency."

Guy P. Henry has been appointed chief engineer of the Studebaker Corp., South Bend, Ind., succeeding F. M Zeder, resigned. Henry has been connected with the Studebaker company for nine years in executive positions in the manufacturing and engineering departments, and is thoroughly familiar with the products and policies of the corporation. Vincent Link, the designer of the new Studebaker Light Six, remains with the corporation as consulting engineer with increased responsibility.

William A. Leonard of Chicago has been elected vice president and general manager of the Imperial Brass Mfg Co. of that city, makers of Imperial oxy-acetylene welding equipment and a general line of automobile accessories and brasswork. Until recently Leonard was associated with Belding Brothers & Company, of Chicago and New York as organization and sales promotion manager. This election completes hte sales organization.

C. W. McKinley, lately identified with the Willys-Overland Co., has been appointed sales engineer of the Tillotson Manufacturing Co, Toledo. McKinley's association with the Willys-Overland organization covers a period of many years, during which time he acted as chief designing engineer, consulting engineer at Washington on war work, and more recently as production engineer.

Harry A. Biggs has been appointed a director and vice president of the Studebaker Corp., in charge of domestic sales. E. H. McCarthy, his chief assistant as general sales manager, is made assistant to the vice president. L. J Ollier, director and vice president, will take charge of export sales. His assitant, H. S. Welch, is given the title of assistant to the vice president also.

Jackson H. Simms has resigned as vice president and general manager of the Simms Motor Car Corp, according to announcement by the board of directors. Other changes in the company's personnel are to be announced later, according to the board. Simms has sold his entire holdings in the company and is succeeded as vice president and general manager by H. L. Innes.

J. W. Peterson production and factory manager of the King Motor Car Co., Detroit, Mich., has resigned to join the Disteel Wheel division of the Detroit Steel Products Co. As Peterson's successor, the King company has chosen R G. Hendricks, who has spent five years in foreign lands working for the Rolls-Royce, Sunbeam, Isotta and Diesel car manufacturers.

John Tainsch, for the past four years sales manager of the Mitchell Motors Co., Racine, Wis., has been placed in executive charge of Mitchell sales by the company's board of directors. He thus takes up the complete control of the Mitchell selling department, succeeding in that branch of the work, R. C. Rueschaw, who has resigned as vice president of the company.

Lieut.-Col. C. M. DuPuy, president of the Pennsylvania Rubber Co., was unanimously elected chairman of the board of directors of the Chelsea Exchange Bank of New York City. Among the industry's prominent men making up the Chelsea Bank's directorate are John Willys, of the Willys-Overland Co., and W. W. Mountain, of the Mountain Varnish Co

Ralph C. Garland well known throughout the motor truck field, has become identified with the Wisconsin Parts Co. as chief engineer During the past four years Garland has been in the engineering department of the General Motors Corp., specializing on ball bearing applications in many lines of the automotive industry.

Frank W Ruggles comes into trade notice again as head of the Ruggles Truck Co., Alma, Mich., and London Ont., a company which he has recently formed. Ruggles was identified with the Republic Motor Truck Co. as president and general manager, and retired from that company several months ago.

Carl H. Peterson, superintendent of the axle division of the Olds Motor Works, Lansing, Mich., has severed his connection to become general superintendent of the Jackson Motors Corp., Jackson, Mich. Before going to the Oldsmobile plant, Peterson had been connected with the Locomobile and Studebaker companies.

E. S. Foljambe, well known in the trade publication field, has joined the forces of the Goodyear Tire & Rubber Co of California, at Los Angeles, as a special representative of the motor truck tire department. Foljambe's new duties will be along the line of educational speech making in "motorize the farm" campaigns.

Jules Haltenberger, for the last five years chief engineer of the Briscoe Motor Corp., Jackson, Mich., and designer of the new Briscoe model first shown at the New York show of 1920, has resigned. Haltenberger's resignation will take effect October 1. He has not yet disclosed the nature of his plans for the future.

Albert J. Romer, who developed the original designs of the Roamer and Murray motor cars, is now associated with the Northway Motors Corp., and is devoting his time to the designing and production of the chassis and bodies for the line of passenger cars which this Massachusetts company plans to produce.

J. G. Culbertson, president of the Wichita Motors Co., Wichita Falls, Texas has been nominated for governor by the Republicans of Texas. The platform adopted by the Republican party declares for the open shop. Culbertson is a member of the board of governors in the Southwestern Open-Shop Association.

Joseph Jandasek has been appointed chief engineer for Bollstrom Motors, Inc., St Louis, Mich. He was formerly tractor and truck engineer with the Paige Detroit Mortor Car Co. and was also connected with F. C. Austin Co., Chicago; Plano Tractor Co., and Laurin Klement, Prague, Czechoslovakia.

Ralph C. Chestnutt has resigned as designing engineer with the Bethlehem Motors Corp. He was formerly with the North American Motors Co., and came to Bethlehem when these companies merged. He designed the engines now used in Bethlehem trucks

R. H. Scott, general manager of the Reo Motor Car Co. Lansing, Mich., was elected president of the Novo Engine Co., recently Other officers are. C. E Bement, vice president and general manager; D. R. Hoadley, secretary; E. J. Bement, treasurer; E. P. Teel, general superintendent

Arthur H. Blanchard, professor of highway engineering and highway transport at the University of Michigan, will now lend his experience and knowledge to the road builders of that stae. He has recently been appointed consulting engineer to the Michigan State Highway Department.

George C. Hubbs has assumed the position of vice president and general manager of the Grant Motor Car Corp., Cleveland. For the past six years he had been connected with the Dodge Bros organization, and previous to that had been connected with the United States Tire Company.

W. B. Burgess, formerly of the Texas Motor Co., has joined the Southern Truck & Car Corp., Greensboro, N. C., as production manager. Since the organization of the Southern Truck company about two years ago, J. A. Norford, president, has been serving as production manager.

Finley R. Porter, recently resigned as chief engineer of the Curtiss Aeroplane Corp., and during the war who served as chief engineer at McCook Field, Dayton, O., has opened general engineering offices under the name of Finley R. Porter & Co., 56 Pine street, New York City

C. C. Hanch, until recently general manager of the Maxwell Motor Co., is expected by those in close touch with him to open offices in New York and Detroit at the head of an organization formed for consulting work on the general problems of automobile factory administration.

C C. Cox, until recently chief engineer of the Jackson Motor Corp., has joined the engineering staff of the Commonwealth Motors Co., Chicago, Ill. Cox will take entire charge of the designing and experimental work for the Commonwealth company.

T. B .Funk, who has been chief engineer of the Moline Co., Moline, Ill., and later founder and head of the Engineering Development Co. of the same city, has been appointed chief engineer, Utilitor Division, Midwest Engine Co., Indianapolis, Ind.

W. P. Chrysler and J. R. Harbeck, both identified with the Willys Corp. as vice presidents, have been formally elected directors of the U. S. Light & Heat Corp. Niagara Falls, N. Y., which company is included among the list of Willys enterprises

A. G. Bruswitz has been appointed president and manager of the Reliance Motor Truck Co., Appleton, Wis., with which company he has been a stockholder and director since its inception. Bruswitz was formerly county highway commissioner.

Alois Hauser has been made assistant to the works manager in charge of engineering of the Timken Roller Bearing Co., Canton, O. For several years past, Hauser has been efficiency engineer at the Saucon plant of the Bethlehem Steel Co.

P. L. Emerson, president and general manager of Jackson Motors Inc, the selling company of Jackson Motors Corp. (the manufacturing company), has resigned to give his complete time to the distributing companies which he controls.

H. F. Wardwell has been elected president of the Briscoe Motor Corp. Jackson, Mich., succeeding F. Cowin. Wardwell was formerly a railroad man, and for the past few years has been president of the Burnside Steel Co.

C R. Teaboldt, for the past four years with Gaston, Williams & Wigmore, New York City, first as assistant to the general manager of the automotive division, severed his connections with that company on September 1.

Joseph B. Armitage has joined the engineering department of the Kearney & Trecker Co., Milwaukee, Wis. Armitage resigned from the Aluminum Manufactures, Inc., with whom he held the post of mechanical engineer.

R. M. Graham has taken over the factory management of the Chillicothe Tire & Rubber Co., succeeding C. C. Cushman. Graham was formerly an efficiency engineer with the Goodrich company at Akron

Cory P. Green, who has been with General Motors Corp. and also in foreign automobile factories has been appointed chief engineer and factory superintendent, Jackson Motors Corp., Jackson, Mich.

Walter M. Jones, formerly with the Torbensen Axle Co., and also for many years identified with the Sheldon Axle Co., has been appointed chief engineer of the Indiana Truck Co. at Marion, Ind.

Donald S Michelsen, formerly general manager of the Worcester Pressed Steel Co, Worcester, Mass., has been made general manager of the Globe Machine & Stamping Co. Cleveland.

A. E. Borie, chaiman of the Savage Arms Corp., Sharon, Pa., has resigned from the directorate. It is reported that he has gone abroad for a stay of about six months.

Harry F. Lee, treasurer and general manager of the Morton-Simmons Hardware Co., Wichita, has been appointed receiver for the Jones Motor Co., Wichita, Kan.

Richard "Dick" Miles, for a number of years chief metallurgist of the Maxwell Motor Co., has resigned that post. He is returning to the Studebaker Corp.

A. G. Herreshoff has resigned as chief engineer of the Bethlehem Motors Corp., Allentown, Pa. Nothing definite has been revealed as to his plans

Charles A Cook, formerly chief engineer for the King Motor Car Co., Detroit, has accepted a position with the Haynes Automobile Co., Kokomo, Ind.

OBITUARY

William R. Innis of New York, formerly a director and an official of the Studebaker Corp., died suddenly Oct. 21. Mr. Innis retired from active business several years ago. He was 61 years old in 1884 he married a daughter of Peter Studebaker, and later became an important executive in the Studebaker firm. He also held a vice presidency and a directorship of the Chicago & South Bend Railroad. Business interests brought him to New York, and most of his time of recent years had been spent here. He was a director of the New York Life Insurance Company, of the O'Rourke Engineering Construction Company, and a trustee of the Union Dime Savings Bank.

ACTIVITIES OF AUTOMOTIVE MANUFACTURERS

Where They Are Located — What They Are Doing — How They Are Prospering

Frank B. Ansted, president of the Lexington Motor Company of Connersville, Ind., and his associates, United States Automotive Corporation, with an authorized capital of $10,000,000 of preferred stock, and 300,000 shares of no-par-value common stock, of which 100,000 shares are Class A and 200,000 shares Class B, has been organized. The new alliance includes in addition to the Lexington Motor Company, the Ansted Engineering Company, the Connersville Foundry Corporation and the Teetor-Hartley Motor Corporation. Frank B. Ansted is the president of the United States Automotive Corporation. George W. Ansted, also president of Ansted & Burk Milling Company at Springfield, O., is a vice president; Fred I. Barrows, also president of the Teetor-Hartley Motor Corporation at Hagerstown, Ind., is a vice president; and Emery Huston, also vice president of Lexington Motor Company, is a vice president. LeRoy A. Hanson, also secretary and treasurer of the Lexington Motor Company, is secretary and assistant treasurer. James M. Heron, also secretary and treasurer of the Rex Mfg. Company, is the treasurer. Directors of the company also include: William B. Ansted, president of the Central Manufacturing Company; John C. Moore, chief engineer of the Lexington; Charles C. Hull, president of the Rex Manufacturing Company; Arthur A. Ansted, president of the Indiana Lamp Company; Elmer J. Hess, former president of the Western Spring & Axle Company and a capitalist of Cincinnati, O., and O. A. Eberhart, former governor of Minnesota and general counsel of H. W. Dubiske & Company, Chicago.

W-S-M Tractor Corporation, Akron, O., has acquired a 20 acre site southwest of Akron, on the Akron, Canton & Youngstown Railroad and on the Akron Belt Line, and arrangements have been completed for acquiring 91 additional acres. The first unit will be erected shortly, at a cost of $250,000, and machinery and accessories will be installed amounting to approximately $200,000. The corporation is affiliated with the Wellman-Seaver-Morgan Co., Cleveland, which has been conducting experimental work on farm tractors for some time. Edwin S. Church, president Wellman-Seaver-Morgan Co., is also president of the tractor corporation, and for a number of years was associated with the International Harvester Co.

Kennedy Corporation, Baltimore, recently incorporated with $2,000,000 capital stock, and of which Joseph P. Kennedy is head, has bought the plant of Fairbanks, Morse & Co., and also the entire capital stock of the Baltimore Malleable Iron & Steel Casting Co., the price for both being $1,850,000. The Kennedy Corporation was formed to specialize in automobile agricultural tractors and railroad castings and the two additional plants adjoin its property. It was recently stated that the Baltimore Malleable Iron & Steel Casting Co. planned extensions and the installation of equipment which would double its capacity.

Nash Mtors Co., Kenosha, Wis., has engaged in regular production in its new works on Clement avenue, Milwaukee, of which B. W. Twyman is general manager. The force numbers 1,000, which will be increased to 2,000 by Jan. 1 to make possible a first year's prduction of 10,000 four cylinder Nash passenger cars. Most of the equipment has been purchased and installed but additional tools are being contracted for from time to time. G. E. Bechtel is works manager.

DuPont Motors Co., Commerce and Dock streets, South Wilmington, Del., will commence operations at once in its new plant at Moore, Pa. It will be used for the most part for assembling work, and it is proposed to develop an output of about 150 automobiles per month. The South Wilmington plant will be operated for the present for the manufacture of motors, and body production will be conducted at a plant in Philadelphia.

American-La France Co., Elmira, N. Y., manufacturer of motor driven fire equipment, has increased its capital from $4,950,000 to $5,950,000. It is operating at capacity and is said to have orders on hand to continue maximum production for the next five months. Contract was recently let to the Foundation Co., New York, for a new plant at Bloomfield, N. J., to manufacture motor trucks, and construction has begun.

Thomart Motor Co., Akron, O., has been formed to build the Akron Speedwagon designed to carry truck loads at high speeds. The company takes its name from the first and last parts of the names of W. G. Thompson, president, and J. L. Stewart, vice president and general manager, both of whom have been with the International Harvester Corp. in its automobile division.

Foster Motor Car & Mfg. Co., Ltd., has recently been formed to manufacture the Foster motor car, to be equipped with the Herschell-Spillman motor. A site has been secured in the east end of Montreal, where a plant will be established. The head office will be at First avenue and Ernest street. Captain M. L. Fitzgerald will be in charge of the company.

Peters Motor Corporation, Trenton, N. J., recently organized, is planning for the establishment of a local plant for the manufacture of a popular priced automobile. A site is now being selected and details of the project are being arranged. Preliminary work has been conducted at the factory of Fitzgibbon & Crisp, Inc., Calhoun and Durnham streets.

Menominee Motor Truck Co., Clintonville, Wis., has completed its new works and the transfer of its equipment from the former plant at Menominee, Mich., and is operating at the rate of 50 trucks per month, which will be increased to 100 by May 1, 1921. The output to Jan. 1 has been sold. Practically all equipment has been provided. James A. Bell is vice president and general manager.

Dort Motor Company's $3,500,000 motor transmission and machining plant occupying a 77 acre site east of Flint will be completed by the middle of November. The plant which has been under construction for several months will be operated by direct motor driven appliances and will give employment to approximately 1,000 men.

Fageol Motors Co. of Ohio, Cleveland, has been incorporated to build Fageol trucks, tractors and pleasure cars in the east. F. R. Fageol, founder of the parent western company, is president of the new concern which has leased the building formerly occupied by the National Bronze & Aluminum Co., containing 25,000 sq. ft.

Trego Automobile Co. have been investigating sites of two and three acres with railroad sidings for a plant in the vicinity of New Haven, Conn. Nothing definite has been decided and no engineer has been selected for the work. Temporary quarters have been established in the Liberty Building, New Haven.

Research Engineering Co., Dayton, O., has been formed to manufacture a moderate priced air cooled automobile, named the Spencer after its designer, O. H. Spencer. It is said to include a new type of transmission and springing, the latter including four full cantilever springs. Mr. Spencer is president.

Steinmetz Electric Motor Car Corporation, Baltimore, which recently acquired property on Kate avenue, fronting on the Western Maryland Railroad, Arlington, for the manufacture of electrically operated motor trucks, s enlarging its plant to include the manufacture of gas operated tractors.

Bethlehem Motors Corp., Allentown, Pa., manufacturers of trucks, are preparing to turn out a light passenger car for the English market in quantities. Arthur T. Murray of the company is said to have accepted an order while in England for 10,000 of these.

Stockton Tractor Co., Stockton, Cal., is having plans prepared by Frederick S. Harrison, architect, People's Bank Building, Sacramento, Cal., for the erection of a new one story brick and concrete plant at West Sacramento to cost about $75,000.

William Small Co., Indianapolis, Ind., is now in the hands of receivers, asked for by the management of the company. Liabilities are estimated at $900,000 and assets at half that amount. The Monroe automobile was the product.

Vim Motor Truck Co., Twenty-third and Market streets, Philadelphia, has awarded a cntract to the Truscon Steel Co., Commonwealth Building, for four new machine shops at Fox street and Roberts avenue, to cost about $48,000.

Ford Motor Co., Detroit, is considering the establishment of a new factory branch at Williamsport, Pa., to be equipped for assembling and other features. The proposed works will be used for service throughout this district.

Pioneer Truck Co., Valparaiso, Ind., is contemplating the erection of a new one story plant for the manufacture of automobile trucks 100 x 300 ft., to cost about $100,000 including equipment. O. M. Frier is president.

Haverford Cycle Co., Los Angeles, has been incorporated with a capital of $50,000 by Samuel Redmond, Samuel Eidelson and Hubert Starr, 309 Stimson Building, to manufacture motorcycles, bicycles and parts.

Ford Motor Car Co., Detroit, is taking bids for its new one story assembling plant, 175 x 535 ft., at Tenth and Winchester streets, Kansas City, Mo., estimated to cost in excess of $350,000, including equipment.

Lafayette Tractor & Machinery Co., Lafayette, Ind., has been incorporated with $100,000 capital stock to manufacture tractors. The directors are Floyd A. Loop, Larry B. Harris and Abner E. Werkhoff.

Mutual Truck Co., Sullivan, Ind., manufacturer of motor trucks, has awarded contract to the M. J. Hoffman Construction Co., Evansville, Ind., for a two story building, 80 x 100 ft., to cost about $75,000.

A. C. Motor Truck Co., Rochelle Park, N. J., has been incorporated with capital of $50,000 by C. S. Bentley, William J. Aitken and H. C. Chambers, Rochelle Park, to manufacture motor trucks and parts.

Parts Makers

Hartford Automobile Parts Co., Hartford, Conn., has acquired the Acme Universal Joint Mfg. Co., Kalamazoo, Mich., which has been in operation about 10 years and employs about 300. It will hereafter be known as Plant K, and E. L. Pollock, Jr., assistant treasurer will represent the home office at Kalamazoo. Most of the heavy work will be done in the Hartford plant, while assembling and lighter work will be carried on at Kalamazoo. The company is placing on the market a new hydraulic compensation clutch which is a rotary shock absorber installed on the propeller shaft that absorbs all starting shocks.

Universal Products Company, Sandusky, O., and Oshkosh, Wis., has increased its capital to $500,000. The plans include the purchase of the H. C. Doman Company of Oshkosh, Wis., and the removal of the main offices from Sandusky to Oshkosh. The new company will continue to manufacture the Universal Products electric lighting and power plant and the Doman marine engines. Officers are L. E. Willson, president; R. K. Schriber, vice president; Charles H. Eichinger, secretary, and Louis Schriber, treasurer.

Vacuum Muffler Corp. of America is moving the offices and factory to the new building, 220 Fifth street, Bridgeport, Conn., and on and after Thursday, October 14 can be reached at that address.

C. S. Shuman, general manager of the company, will move to Bridgeport, and the general offices will be located at that place. Erling Christophersen and Oluf Kiaer, president and treasurer, respectively of the company, will remain in New oYrk where they are also connected with another concern.

Trenton Patent Mfg. Co., Trenton, N. J., recently organized, has acquired a building on Somerset street, Hopewell, N. J., formerly occupied by the Smith Mfg. Co., which it will equip for the manufacture of pistons for motor car service, garden appliances and other metal products. William J. Jaeger is president and William E. Leedom, secretary. The Smith company, manufacturer of registers, parts, etc., will continue operations in a new building, recently erected.

Wyman Gordon Co., Worcester, Mass., has taken over the plant of the Ingalls Shepard Forging Co., Harvey, Ill., which will hereafter be known as the Ingalls Shepard Division of the Wyman Gordon Co. The Harvey property is at 147th street and Page avenue and consists of seven acres improved with shops and 15 acres adjoining.

Lycoming Foundry & Machine Co., Williamsport, Pa., manufacturer of gas and gasoline engines, automobile parts, etc., has awarded a contract to J. V. Bennett & Co., Williamsport, for a one story addition, 240 x 560 ft., and construction has begun. The new building is estimated to cost in excess of $300,000, including equipment.

American Piston Co., Bowling Green, O., recently incorporated with a capital stock of $100,000, has been formed as a holding company to license the manufacture of a new type of piston for automobile motors. H. H. Elwood is president and treasurer; C. C. Freeman vice president and general manager and Earl D. Bloom, secretary.

Valley Electric Company which recently purchased the St. Louis Electrical Works has moved into its new buildings on South Kingshighway. The offices and automotive departments are in the new location, but all motor manufacturing is still being done at the old plant at 4060 Forest Park Boulevard.

Ramstack & Sons Mfg. Co., 1826 Brown street, Milwaukee, manufacturer of spark plugs and other gas engine specialties, has increased its capitalization from $100,000 to $200,000 to accommodate its growing business. The enlargement of the shop is being completed.

Willard Storage Battery Co., Ltd., Simcoe street, Toronto, has been incorporated with a capital stock of $200,000. It is the intention to start work this fall on the erection of a plant for the manufacture of storage batteries, supplies, electrical goods, etc. John T. Foster is the attorney.

Alemite Lubricator Co. of Maryland, 106 West Mount Royal avenue, Baltimore, has been incorporated with a capital of $50,000 by Samuel K. Smith, Charles F. Eck and Ernest W. Beatty, to manufacture lubricating devices, automobile oiling equipment, etc.

Apple Electric Mfg. Co., Dayton, O., has been incorporated with a capitalization of $500,000 to manufacture electric motors and dynamos. Vincent G. Apple, who holds the patents of the motors and dynamos, is one of the incorporators.

Fyrac Mfg. Co., manufacturer of the Fyrac spark plug, Rockford, Ill., will erect a four story plant on Eighth street, between Nineteenth and Twentieth avenues, next spring. The site has been bought and the building will cost $100,000.

Lockport Motors, Inc., Lockport, N. Y., has been incorporated with a capital of $27,500 by S. I. Classon, C. E. Williams and M. O'Grady, 359 Van Buren street, Brooklyn, to manufacture automobile motors and kindred equipment.

Toquet Carburetor Co., Westport, Conn., has been incorporated with a capital of $500,000 by B. L. Toquet, G. A. Gauthier and G. P. Williamson, to manufacture carburetors for automobile service and other ignition equipment.

Dominion Motor Castings, Ltd., Windsor, Ont., has applied for a charter with a capital stock of $250,000. It is constructing a factory at Windsor with 23,000 sq. ft. of floor space, to manufacture castings for automobiles.

Detroit Carburetor Corporation has been organized by Thomas W. Halloran, 120 Milford avenue, Detroit, and others, to manufacture carburetors and motor accessories. It is capitalized at $100,000.

Kelly Tire & Rubber Co., New Haven, Conn., manufacturer of automobile tires, has increased its capital from $5,000,000 to $50,000,000. A new plant is in course of construction.

Bound Brook Oil-less Bearing Co., Bound Brook, N. J., manufacturer of oil-less bearings, etc., has increased its capital from $150,000 to $1,150,000.

Indestructible Wheel Co., Lebanon, Ind., is taking bids for a new plant to cost about $50,000. A power house will also be built.

Stearns Motor Mfg. Co., Ludington, Mich., has filed plans for a new one story foundry, 80 x 150 ft., to cost about $50,000.

Clark-Turner Piston Co., 1246 South Los Angeles street, Los Angeles, has filed plans for a new one story foundry.

Body Builders

Central Auto Top Co., Indianapolis, Ind., organized as a partnership in 1912, has been incorporated under the name of Central Auto Top & Leather Co., and will continue the same line of business, such as belts, fan belts, automobile clutch leathers, leather specialties and belt repairing. The original company made automobile tops, victoria tops, seat, tire, radiator and hood covers, dust hood, door hand pads, back pads and repairing.

Woodward Mfg. Co., Austin, which is converting the building formerly occupied by the Radio Artillery School into a plant for the manufacture of automobile bodies, railroad box cars and other equipment, has just been incorporated with a capital of $500,000. D. J. Woodward, San Antonio, is president and the directors include D. J. Woodward, Jr., J. A. Nichols and R. R. Ogden, San Antonio, and Sam Sparks, Austin.

Kentucky Wagon Manufacturing Co., Louisville, Ky., plans additions to its plant costing $1,000,000, doubling its capacity and more than doubling the number of employees. Eleven acres of land belonging to the Industrial School of Reform adjoining the company's plant on South Third street, will be bought when merging of the school with the Parental Home is accomplished.

Baltimore Buggy Top Co., 107 West Mount Royal avenue, Baltimore, Manufacturer of automobile tops and operating a machine works for automobile parts manufacture and repairs, has awarded a contract to John F. Kunkie, 29 South Linwood avenue for a two story plant 90 x 150 ft., at Guildford avenue and Chase street, to cost about $150,000, including equipment.

Hale & Kilburn Corp., Philadelphia, stockholders have accepted the plan whereby that company is to be taken over by the American Motor Body Company, a $20,000,000 merger including the Wadsworth Mfg. Co., Detroit. The American company gives preferred and common stock in exchange for the plant and business of Hale & Kilburn, but the latter concern continues to act as a holding company.

Southwick-Pom Company, general building contractors, who have been manufacturing motor truck bodies at their No. 2 plant, 472-480 West Lafayette Boulevard, Detroit, have disposed of their body building interests to the Bennett-Sustrich Co., which concern will continue the business at the above address.

Delker Brothers Buggy Co., Henderson, Ky., has been incorporated in Delaware with capital of $300,000 by F. H., M. J., and A. G. Delker all of Henderson, to manufacture wagons and wagon parts, automobile equipment, etc.

Carvan Coach Works, New York, N. Y., has been incorporated with a capital stock of $50,000 by J. C. Hines, A. H. Seymour and F. L. Welliver, 43 Exchange Place, to manufacture automobile bodies.

Index To Advertisers

WANTS

WANTED—Mechanical draftsman or designer familiar with tractor or truck. Write giving age, experience and salary expected. Emerson-Brantinghan Co., 2723 University Ave., S. E. Tractor Works, Minneapolis, Minn.

PATENTS

Patents—H. W. T. Jenner, patent attorney and mechanical expert, 622 F St., Washington, D. C. Established 1883. I make an examination and report if a patent can be had and exactly what it will cost. Send for circular.