MAXIMUM MILEAGE POSSIBILITIES OF EXISTING TIRES AND AVAILABLE TIRE-BUILDING MATERIAL

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SYNOPSIS

In the critical transportation situation now confronting us, the conservation of tires and of tire-building materials is of paramount importance. However, this conservation must be so organized and so applied that it contributes most effectively to the over-all and nation-wide war effort.

Reduced speed with its benefit on treadwear has received wide publicity, and is now a matter of regulation While a still further reduction of legal speed would promote still slower treadwear, this factor must be balanced against impairment of necessary traffic movement. It is suggested, however, that, since the reduction of speed is particularly beneficial on curves and in stop-and-go areas, this fact should receive further emphasis and possibly be the basis of additional regulation

Of equal importance, particularly in the commercial field, is the matter of load. While passenger car tires are not liable to be unduly overloaded, in large commercial tires the reduction of speed may, unless strict regulation can be organized, be the signal for higher overloads on truck tires than has heretofore been the practice. This might well neutralize, from a conservation standpoint, the benefits of slower speed

The importance of maintaining proper pressure, of frequent inspection of tires for cuts and bruises, and the prompt repair of same, of proper matching or "mating" in the case of dual-mounted truck tires; of frequent inspection of brakes, of wheel alignment, and of the maintenance of wheels and rims is emphasized.

Satisfactory tires for moderate speed passenger-car service are now being produced from reclaimed rubber, and this material is also feasible as a "recap" for certain classes of truck tires Successive reclamation or "re-claiming" is practicable, although only with a progressive loss of quality.

Among tires made from rubber substitutes which can be manufactured from materials wholly available within the continental United States, passenger-car tires of Buna "S" are considered substantially equivalent to those of natural rubber. In the truck tire field, however, only a measure of success has yet been secured, due to the fact that Buna "S" has higher hysteresis than natural rubber and therefore causes a higher temperature level in the tire Tread compounds of Buna "S" are somewhat more susceptible to cutting, chipping, and cracking than natural rubber compounds. Buna "S" can be blended in all proportions with natural rubber or with reclaimed rubber

Butyl, Flexon, and Thiokol also have been developed for and tested in passenger tires, and in tubes None of them possesses abrasion resistance comparable to natural rubber or Buna "S," but they compare favorably with reclaimed rubber. To obtain adequate adhesions and satisfactory behavior at high and at very low temperatures, it is probable that some degree of blending with natural or reclaimed rubber, or with Buna "S", may be required Investigations along these lines are being vigorously carried out.

In this paper an attempt will be made to bring out the many technical facts, together with some opinions and recommendations, relating to this very critical subject. It will not touch upon either the political or the economic aspects of the situation; nor will it attempt to guess at any phase of post-war conditions and their possible bearing on current policies.

The basic question in which every one is interested, is: How may we avail ourselves of the maximum amount of *service* from tires which now exist, or can be produced from available or procurable materials? It will be noted that this phrasing of the question refers to service rather than mileage It is perhaps well to begin this discussion by stating the meaning of the term service, so used.

We can agree that the word service shall mean the maximum contribution to the over-all war effort To save rubber or to provide miles—either of these is too limited an objective, if not indeed pointless; we must enlarge that meaning to say that these materials must be expended and these miles utilized so as to aid the war effort in the largest and most effective way.

There are numerous factors whose effects should be evaluated and whose influence should be carefully appraised in arriving at a basis for offering recommendations and adopting policies and making rulings These factors may be grouped into those which are:

(1) Conditions external to the tire.
(2) Features or aspects of the tires themselves

EXTERNAL CONDITIONS

These, of course, refer to such things as speed, load, weather, roads, vehicles, etc, all of which affect in some manner or degree the performance of tires The first of these to discuss is the effect of speed on rate of treadwear

Speed

During the past year, this factor has received a vast amount of discussion and publicity, and rightly so, for its direct effect on rate of treadwear is very great. Tire engineers have received innumerable requests for data, graphs, etc, delineating this relationship Of course, there is no single precise answer; for, as in most other functional relationships, the various auxiliary and accessory conditions have themselves important individual and combined effects on the relationship being evaluated.

Figure 1 shows this relationship in a form which has proved to be easily grasped by the average non-technical vehicle operator. The graph, as shown, is perhaps as good as any, for the main thing is not so much to offer precise values as to impress upon every driver that the effect of speed is indeed very great and that the nation-wide speed-limiting regulations are founded on technical fact rather than on political or administrative whim.

With this graph in view, we may be led to question whether the currently authorized limit of 35 m.p.h. represents the most effective contribution to the total war

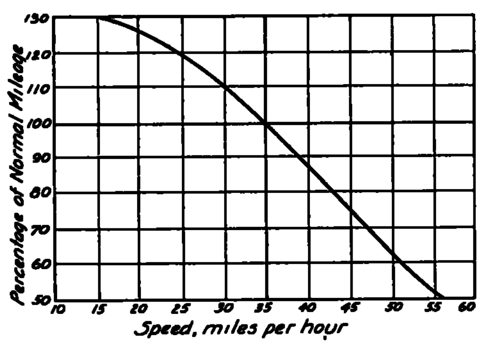

Figure 1. Effect of Speed on Tire Wear

effort. Presumably, a 5 m p.h. reduction would prolong the available mileage by 10 per cent, but it would likewise slow down traffic movement and probably increase congestion in just those areas of concentrated war production, where one of the big problems is to get back and forth to the job.

Without pursuing this point further, one more question should at least be raised. It is well known, that where frequent starting and stopping are involved, the effect of speed is greatly augmented. Consequently, there is justification, from the standpoint of tire wear, in establishing lower speed limits in such areas. On the other hand, these may be just the areas where traffic movement should be facilitated as much as possible. Obviously, a lot of administrative wisdom is entailed in balancing these several contradictory considerations at the optimum point

Load

It is well known that tires of all types and sizes have specific load ratings These ratings represent the combined and cumulative judgment and experience of the tire-engineering profession, formalized and published by The Tire & Rim Association, Inc, as to the loads under which standard-grade tires can be counted on to give satisfactory service, and, if not abused, to wear out before any structural breakdown is likely to occur.

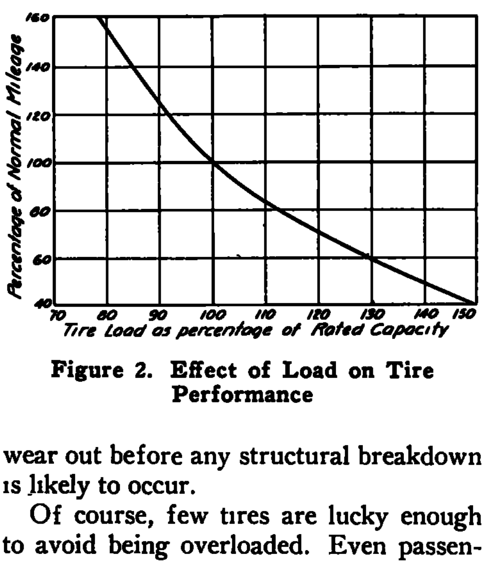

Figure 2. Effect of Load on Tire Performance

Of course, few tires are lucky enough to avoid being overloaded. Even passenger-car tires occasionally suffer Figure 2 indicates the general type of relationship involved, although, even more than in the case of Figure 1, this relationship is very greatly affected by ambient conditions. It is also to be understood that this graph represents, especially in the region of high overloads, tire mileage limited by other things than worn-out treads Particularly in the case of the larger sizes of commercial tires, heavy overloads are apt to cause premature structural failures because of high temperature, failures known variously as heat fatigue, heat blowout, heat ruptures, etc.

Recently, the rubber conservation program has led to a study of the real ability of various types of tires as transportation units. This ability, or figure of merit, may be expressed as the total number of ton-miles per unit of material involved Current interest is for this figure to be in ton-miles per pound of natural rubber utilized This is not necessarily proportional to ton-miles per dollar of cost, which has, of course, been the pre-war commercial "measuring stick." These studies indicate that. for pre-war tires under pre-war conditions of speed, competition, highway restrictions, etc, the "figure of merit" ranges from 1200 to 1600 ton-miles per pound of crude rubber These values are based on the mileage developed during the tires' original period of service, that is, it does not include any mileage after recapping or retreading The lower figure applies to the fastest type of service, such as inter-city buses, the higher to the somewhat slower speeds typical of inter-city trucking operations

It is of interest to note that the figure of merit for passenger-car tires is probably somewhere near the 1200 value for buses "Probably" is as close as this statement can be made, for the records of loads and of miles are vague and uncertain

In the test schedule on hard roads carried out by Professor Moyer under his Project 219 at Iowa State College, calculation shows that the average figure of merit was approximately 1600. In Test Fleet operations of the tire companies, values of 1400 to 1600 are typical, even at the sustained high road speeds used in such tests in pre-war days In both of these cases, the high performance figure can be largely attributed to utmost care with regard to tire inflation and inspection, steering gear adjustment, brake maintenance, etc

Pressure

Most commercial fleet operators have long since learned the importance of careful pressure maintenance. Perhaps the single-truck owner or operator, with less opportunity to schedule and standardize his loads and routes, is less likely to maintain optimum pressures.

Of course, it is generally true that tires are designed to operate at a closely limited degree or "per cent" of deflection On this basis, the ideal condition would be for the pressure at all times, whether the tire is hot or cold, to be approximately in proportion to the load Practically, this is very difficult to realize The best that can be hoped for is to fit the pressure to the average load anticipated for the interval between pressure observations or adjust-

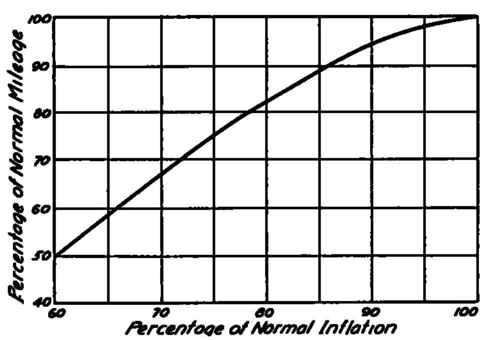

Figure 3. Effect of Inflation on Tire Performance

ments. On long hauls, with full payload in one direction, empty in the other, it is certainly to be recommended that the tire pressures be appropriately lowered for the empty trip, to reduce bouncing and spinning. This is better both for vehicle and for tires.

In Figure 3 is shown a graph which seems to represent fairly well the general relationship of rate of treadwear to the inflation pressure

"Bleeding," or letting air out during a trip to hold the pressure constant as the tire warms up, also maintaining a differential of pressure between the two tires of a dual assembly, are practices which have had a certain vogue Theoretically, these are both in the right direction; although, in the case of duals, which way the differential should be depends, among other things, on the type of vehicle, the degree of crown of the road, and the prevalence of broken or depressed shoulders of the pavement. Practically, they are not to be recommended unless there is some assurance that all aspects of the recommendations are going to be meticulously followed.

In passenger cars, pressure recommendations as established by the car manufacturers have been governed by considerations of riding quality, of noise, of car handling, etc., as well as of maximum treadwear. However, it is the opinion of tire engineers that the current crisis does not call for pressures more than 2 psi—certainly not more than 4 psi—above the pre-war levels. Too high a pressure may augment bruising and cutting troubles, it also tends to wear the tread abnormally along a narrow center zone. The important thing to impress on the driver of a passenger car is frequent pressure checks. The ordinary passenger-tire tube will lose about 10 per cent of its pressure per week; checks as often as semi-weekly would be necessary to assure pressures within 5 per cent of the desired level, and to catch any abnormal loss as an indication that the valve core is leaking or that the tube itself needs attention.

Certain types of safety tube, in addition to the safety feature, are of thicker gauge rubber and have less stretch when inflated in the tire. These two things reduce the rate of diffusion, so that tubes of this type should lose less than 5 per cent of their air per week. Even so, frequent pressure checks should be a definite part of the car user's responsibility for the duration If his own self-interest is inadequate to accomplish the purpose, perhaps there is some way in the gas and tire rationing administrative set-up whereby it can be brought about, although it is no part of the purpose of this paper to suggest any means or method.

Temperature

What is the effect of temperature on tire wear is a question frequently asked It is difficult to single out this factor from other aspects of weather; but the best available evidence indicates that the rate of wear increases approximately 10 per cent with each 15-deg F increase of temperature

Of no less importance is the effect of heat on the carcass, particularly in the case of the larger tires in high-speed commercial service It has already been mentioned that high overloads develop excessive temperatures in the tires Obviously, the actual temperature level within the material of the carcass will also depend on the ambient temperature, and the tendency to premature heat failure will correspondingly depend on the atmospheric temperature This basic fact may ultimately find some application, under war conditions, in some type of control of speed or of load or of both, in terms of the average regional temperature A tire will not carry as much load as fast in Texas in July as it will in Michigan in January.

In this connection, it will be of interest to explain the current regulations applying to the manufacture of various types and sizes of tires These regulations are based on considerations dependent, to a certain extent, on tire temperature levels In pre-war days, large commercial tires of nearly all types were of compounds containing natural rubber These can be referred to as of "A" grade, whether it be a compound used in the carcass, or a different type of compound used in the tread Thus, pre-war tires were "A" carcass and "A" tread construction By current WPB regulations, certain sizes and types must contain either "B" carcasses or "B" treads, or both, in which "B" refers to a lower grade of compound arrived at by replacing specified amounts of the natural rubber content by reclaimed rubber or other material. As a general proposition, such replacement means less abrasion resistance for a tread compound, less resistance to separation for a carcass or cushion compound, and greater development of hysteresis heat in both cases.

Thus, currently the tire industry is authorized to furnish to their mileage accounts tires of "AA" construction; larger highway tires sold to the customer (10 plies or more) may have "A" carcass but must have "B" tread; highway tires of 8 or fewer plies must be "B" throughout In Earth-Mover tires, which do not get as hot as highway tires, even the very largest ones must have "B" carcass compounds; but they may have "A" treads because in this service treads are demolished by cutting and chipping rather than by ordinary road abrasion. WPB also requires these free-rolling Earth-Mover tires to have reduced non-skid groove depth and tread thickness.

Without going into further detail, it will be clear that these WPB directives are based largely on the industry's experience as to the thermal aspects of tires in the various types of heavy commercial service.

Roads and Vehicles

In grouping these two under one discussion heading, it is merely to say that, since the two of them together are responsible for tire expenditure, both should be so used and so maintained and so serviced as to develop the slowest possible rate of that expenditure consistent with the required war-effort contribution.

As for roads, which will probably see little expansion for the duration, it seems to me the principal problem is one of meticulous maintenance, meticulous even if it be of a temporary character Certainly no road, important to the war effort, either for goods-transport or for war workers to get to their jobs, should be allowed to become broken up or deteriorated so as to become a bruising hazard to tires. Resurfacing should as far as practicable utilize types of materials known to have minimum abrasive action Non-skid characteristics, if incompatible with minimum abrasion, should be given second-place consideration in view of the fact that reduced speed will of itself greatly minimize skidding hazards

The effects of vehicle condition particularly adjustment and equalization of brakes, and precision alignment of wheels and steering geometry, are well known Here they need only emphasis, but that emphasis cannot be made too strong in view of the prospect of an increasing shortage of experienced mechanics competent to make these adjustments

In this connection may be mentioned briefly a proposition tried out some years ago for prolonging treadwear It has long been known that tires wear much less rapidly on wet than on dry roads It has also been established by test that high-speed hot-running truck tires can have their treadwear, and in fact their general "figure of merit," substantially augmented if they are kept wet continuously The water may be sprayed on or brushed on, the latter being the preferred method because it is more economical of water. However, application of this idea requires a fairly elaborate and expensive installation, especially on the typical tractor semitrailer vehicle with ten tires on the road, also frequent and regular attention en-route In pre-war days, this idea was carefully appraised, and it was decided that it was not practicable under normal commercial conditions, even on the expectation of a 50 per cent increase in tire service During the past several months, it has received further try-out, with the result that the small benefit actually found is at too high a cost in material necessary for the installation, in time and attention on the part of the driver, and in loss of payload capacity because of the amount of water which must be carried

Many other suggestions for extending the tire life have been brought to the attention of tire engineers, but so far no auxiliary equipment or magic treatments have proved to have merit The well-known and well-established methods and practices survive, the big problem is to get them universally accepted and applied

In addition to the items already covered, there are other factors or practices which justify brief mention

Rotation, or the changing of each tire from one wheel position to another at regular mileage intervals and on a specified schedule, is strongly recommended In the bus and tractor-trailer commercial field, some operators have been able to increase their average tire mileage as much as 50 per cent by such means It is also effective in prolonging the average life of passenger tires, and in minimizing various types of uneven and irregular wear

It is true that these mileage improvements have been secured almost entirely under pre-war speed conditions, but even with a 35 m p h speed ceiling substantial benefits should result

The particular rotation schedule to be followed depends on the type of vehicle, and, in some cases, on the loads, pressures, and types of tires as well The spare tire should be included in the rotation schedule, so that all tires share in the car mileage

Use of Odd-Sized Tires The question has frequently been asked. What about using tires of different sizes in one or more wheel positions? In the case of passenger cars, this is not to be generally recommended, mostly because of adverse effects on the vehicle Perhaps the effective rolling radius of a nearly worn-out 6 50 tire, for instance, is not too different from that of a fairly new 6 25, but fairly large differences in rolling radius may not only cause undue wear on the differential assembly, or on brakes, but may react to worsen the tire wear itself

Mating of Duals In the "mating" or matching of tires for dual assembly on trucks, it is particularly important that the well-established practices be meticulously followed Here again, each vehicle seems to be almost an individual case, so that no general rule can be established. Many fleet operators have worked out specific practices which have been found to give maximum mileage under their particular conditions Type of vehicle (tractor or trailer), load distribution, tire pressures, the crown of the road, prevalence of hills and curves, and even the typical condition of the pavement shoulders—all of these have a bearing on the way to mate duals so as to get optimum results

Curb Riding Many drivers of both passenger cars and commercial vehicles are guilty of this practice It not only is bad for the tires because it damages the sidewall and thereby promotes unnecessary deterioration of the carcass, but it is a factor in disturbing wheel alignment

Loose Bearings In the case of the trailer wheels on commercial vehicles, irregular and abnormal treadwear has been definitely associated with loose or worn wheel bearings

It is also the belief of most servicemen that worn front wheel bearings, as well as loose steering gear bearings, particularly of the king pin, are responsible for abnormal wear on front tires This statement applies to passenger cars as well as commercial vehicles.

Bad Rims Particularly in the case of heavily-loaded commercial vehicles, bent, distorted, irregular, or eccentric rims are a definite cause of reduced tire mileage, both in effect on treadwear and in promoting premature breakdown in the bead region There is certainly no justification for permitting rim equipment to be the cause of premature failure of the beads or the lower sidewall of the tire, because such a condition is practically impossible to repair and the tire therefore cannot be recapped or retreaded.

Grease-free Floors It should by this time be universally known that the rubber of pneumatic tires is deteriorated by grease or oil. This means that garage floors should not be allowed to become greasy or oily; that bearing grease should not be allowed to drip or exude so as to come in contact with tires, and that practices like squirting oil or kerosene around the beads to facilitate mounting or dismounting should never be countenanced

Alignment Although this point has been covered previously, it cannot be emphasized too strongly that frequent checks on wheel alignment, by experienced and "know-how" mechanics, should be made. There is no single cause of unnecessarily fast treadwear in either the passenger or commercial vehicle field as important or as responsive to correction as wheel alignment

FEATURES AND ASPECTS OF THE TIRES THEMSELVES

Since types, sizes and designs of all varieties of tires, at least of those available for private use, are practically "frozen" for the duration, this part of the discussion will deal almost entirely with materials, particularly those whose characteristics qualify them as possible substitutes for natural rubber Excepting rubber, the other materials involved in pneumatic tires are all produced within this country, and are not particularly critical

In a paper of this kind, it will obviously not be possible to discuss all of the very many materials whose use in this connection has been explored, nor to give more than highlights of the vast amount of technical effort which has been devoted by the tire and allied industries in the attempt to sustain automotive transportation

It is peculiarly true of the tire industry that, over the years, methods of manufacture and types of manufacturing equipment have been developed in terms of the characteristics of uncured rubber and rubber compounds One of the most striking features of the whole program of developing substitutes for natural rubber is the difficulty of adapting processes and equipment to the satisfactory and efficient handling of these substitute or alternative materials

Considerations of this sort, when large-scale production is contemplated, are no less important than the qualities of the finished product itself, especially under emergency conditions which do not afford the normal time for the design and development of new methods and equipment This point is indeed so important that, in the appraisal of possible substitute material at this critical time, no consideration should be given to any material which cannot be adapted to current manufacturing equipment. For this reason, mention will hereafter be made only of materials which have a reasonable prospect of such adaptation.

Synthetic Rubber

This term has come to be accepted as referring, at least in relation to pneumatic tires, to the type of butadiene-styrene product known as Buna S That restricted usage will be followed here Buna S is also currently referred to as Government Synthetic

Buna S resembles natural rubber in many ways, but differs from it in some important respects It behaves similarly in compounding and in mixing, in some types of processing, and in curing or vulcanization In the uncured state it lacks the "tackiness" which is such an important characteristic of natural rubber, and therein lies one of the greatest problems of manufacturing synthetic tires by methods and with equipment developed on the basis of natural rubber.

Buna S can be blended in all proportions either with natural or with reclaimed rubber; this fact is obviously of great value in processing. The properties of the cured material of such mixtures or blends are approximately in proportion to the percentages of the respective ingredients.

In resistance to oil and to the aging effects of light and heat, Buna S is comparable to natural rubber. Also, at very low temperatures (−30 to −40 deg F), it retains its elastic and flex characteristics, practically the same as natural rubber.

Tread compounds of Buna S are approximately as resistant to the ordinary road abrasion as those of natural rubber, which means that, in ordinary highway tires, the rate of treadwear is substantially the same. However, on very rocky terrain synthetic treads are somewhat more subject to cutting, chipping, and cracking.

Buna S, as a compounding material in tires, has somewhat higher hysteresis than natural rubber. This is of no particular consequence in the passenger tire field, but in large, high-speed truck tires, where heat is already the limiting factor of performance with natural rubber, it means that parity is not yet fully realized

When we remember that it has taken 20 or more years to develop modern tire compounds with natural rubber, there should be no pessimism because as yet rubber technologists have not brought the synthetic product quite to parity in these two respects. Indeed, for all normal and reasonable types of service, Government Synthetic "as is" affords an acceptable substitute for natural rubber. Military requirements will be well taken care of by it. In no sense should it be considered merely as an "ersatz" material at an "ersatz" level

Rubber technologists confidently expect that, in time, it will be so improved as to be actually superior to natural rubber for tires, as has already been accomplished for numerous other products.

Reclaim

For many years, the economic place of reclaimed rubber, of which there are numerous grades, has been well established Its use in tires was mostly confined to those in the lower price level However, very satisfactory tires, at least for moderate speed passenger car service, can be constructed of reclaimed rubber, with only traces of new or natural rubber needed as cement during certain assembly operations Otherwise, the processing of reclaimed material for tires offers no particular problem

Tread compounds of reclaimed rubber will provide 30 to 40 per cent as much wear as natural rubber compounds. Compounds of reclaim have somewhat higher hysteresis than those of natural rubber, as well as less toughness and ability to stand up under flexing and shearing stresses These facts limit its use, except in small percentages, to passenger tires or to the smaller, lighter loaded truck tires

Its low temperature behavior is comparable to that of natural rubber

Neoprene

Neoprene, as a synthetic material with characteristics similar to natural rubber, has recently been given attention as material for tires. It has, of course, long had a very important place in other products, principally because of its excellent resistance to oil and to ageing From the standpoint of tires, it is difficult to process and has poor flex performance at low temperatures

Butyl

This is a synthetic product, possessing the all-important characteristic of becoming cured or vulcanized by heat Its manufacture on a fairly large scale has been authorized.

In a tread compound, Butyl is rated as being 50 to 60 per cent as good as natural rubber, or as Buna S. It possesses "tackiness," although other characteristics bring up certain manufacturing difficulties. It cannot be blended with nor made to adhere directly to natural or reclaimed rubber, and this fact has offered considerable difficulty to programs of using it as a retread or a recap for worn tires It has a quite high level of hysteresis, although as a tread or sidewall compound it has excellent resistance to cracking It retains its elastic characteristics at moderately low temperatures, although not as satisfactorily as natural rubber in the very low range mentioned above

Flexon

This may be described as a variety of Butyl, with characteristics so closely similar that no additional statements need be made concerning it

Thiokol

This is a different type of synthetic material, but one which also possesses the property of becoming cured or vulcanized. The factory problems in processing and in curing are still different for this material; but in its cured state it is sufficiently rubber-like to be of interest for recapping passenger-car tires, when operated at sufficiently low speed so that high temperature is not developed The abrasion resistance of tread compounds of Thiokol is 20 to 30 per cent of that of natural rubber.

Thiokol treads are more susceptible to cracking than natural rubber, or than Buna S. At very low temperatures, Thiokol compounds become rigid or crystallized, so that Thiokol tires which have been kept at low-temperature levels for considerable periods will break up when they start to run under load. Blending with reclaimed rubber seems to be a fairly effective way of improving this low-temperature deficiency

RÉSUMÉ

Here, then, is the picture, both as to practices and materials. Practices, good and bad, materials, both good and not so good—how can they all be blended into the best possible ensemble of war-serving transportation for the nation?

This is a tremendous question calling for the most competent and resolute and inflexible leadership in all strata of administration, and for a country-wide, almost military discipline in the enforcement of policies and rulings To answer any part of this tremendous question is not a purpose of this paper Its sole justification is that it reiterates and emphasizes the technical facts on which a reasonably satisfactory answer must be based.

DISCUSSION ON MILEAGE POSSIBILITIES OF TIRES

MR BURTON W MARSH, *American Automobile Association* I infer from what Mr Evans said that it would be a reasonable recommendation to passenger car drivers that they over-pressure their tires from 2 to 4 lb When tires were plentiful, there was presumably a tendency to recommend a pressure on the low side which would give greater riding comfort even at the sacrifice of some tire life Now it is not a matter of comfort, but of securing maximum tire life The public should now be told if, as I assume, longer tire life will result from maintaining tire pressures slightly above those formerly recommended

Of course there are other factors which affect the air pressure which should be put into a tire For example, if air is added on a cold morning at the start of a long trip, the tire pressure will build up as the tire is flexed in use and as the weather gets warmer How important is this?

PROF R A MOYER, *Iowa State College* Our test car No 3 was operated at 60 and 65 miles an hour on some long trips to Kansas, Missouri, and Wyoming After starting cold in the morning at the recommended pressure of 28 lb., the pressures would build up to 33 lb I have noticed that the treads of the tires on this car were worn more in the center by an appreciable amount than the treads on the other test cars which were not subjected to that type of driving. It is my opinion that if the tires are over-pressured by more than about 4 lb., the center of the tread will wear off faster than the side of the tread I believe that the best mileage will be obtained at a pressure about 2 lb. or not more than 4 lb higher than that which normally has been recommended. This means that 30 lb should be used for 6 00 by 16 tires to obtain the best tire mileage Today many car owners drive their cars for short trips only and so infrequently that tire pressures are not likely to be maintained at this recommended value For this type of driving a pressure, when airing tires, of 32 lb. would probably provide the best mileage for 6 00 by 16 tires

MR C N CONNER, *Public Roads Administration* Is there some minimum mileage that tires should be used in order to keep them in good condition?

PROF. MOYER: Within the limits of our tests it is our observation that a tire that is not over four years old is practically not at all affected by age If the car is stored or used infrequently, it is very important that the tires are kept in a protected place They should not be subjected to the direct rays of the sun, nor the intense heat of summer. They should not be in a wet place whenever there are small cuts or bruises into which the water can get and attack the fabric

If a car is to be stored for any length of time, the important thing is to take the weight off the tires There appears to be a fatigue effect that weakens the fabric of the tires if the car is stored in this way.