

TANK, TRACTOR AND TRAILER DIVISION

WAR DEPARTMENT

ERJ/HDD

OFFICE OF THE CHIEF OF ORDNANCE
XXXXXXXXXXXXXXXXXXXX

PRODUCTION DIVISION

WASHINGTON

October 31, 1919

TO INSURE PROMPT ATTENTION.

IN REPLYING REFER TO:

O.M.T. NO. 370.2

ATTENTION OF 76

From: 1st Lt. E. R. Jackson, Ord. Dept., Ordnance Observer.

To: Col. L. B. Moody, Ord. Dept., U.S.A., Tank, Tractor
& Trailer Div.

Subject: Report on First Transcontinental Motor Convoy.

1. INTRODUCTORY

Pursuant to travel orders MT-79 (O.M.T. 210.482/105), dated July 3, 1919, the writer reported as Ordnance Observer to the Expeditionary Commander, Transcontinental Motor Convoy at Camp Meigs, Washington, D.C., 8 a.m. July 7, 1919, and accompanied this truck train the entire distance from Washington, D.C. to San Francisco, Cal.

The Convoy departed from Camp Meigs at 8:30 Monday morning, July 7, 1919, proceeding to The Ellipse in Potomac Park, opposite the south front of the White House, where the Zero Milestone was dedicated by the National Highways Association in the presence of the Secretary of War, the Chief of Staff, general officers of the Army, and several senators and congressmen. Following his acceptance of the Zero Milestone on behalf of the President of the United States, Mr. Baker formally directed the Convoy to proceed over-land to San Francisco, California, via the Lincoln Highway.

2. OBJECTS

The four purposes of the trip were as follows:

a) The War Department's contribution to the Good Roads movement for the purpose of encouraging the construction of through-route and transcontinental highways as a military and economic asset.

b) The procurement of recruits for the enlisted personnel of the Motor Transport Corps, or any other branch of the U. S. Army, young men to be enlisted with the train as candidates for the Mechanical Training Schools opened under the direction of the Motor Transport Corps.

c) An exhibition to the general public, either through actual contact or resulting channels of publicity of the development of the motor vehicle for military purposes, which is conceded to be one of the principal factors contributing to the winning of the World War.

d) An extensive study and observation of terrain and standard army motor vehicles by certain branches of the army, particularly the Field Artillery, the Coast Artillery, the Air Service, the Corps of Engineers, and the Ordnance Department.

3. ITINERARY

The following table shows the scheduled control points, mileage and dates of arrival as issued by the Motor Transport Corps, several days before the Convoy started. It also shows the actual itinerary mileage and dates.

Scheduled Arrivals			Actual Arrivals	
Control Point	Mileage	Date	Control Point	Mileage
Washington, D.C.	Starting Point	7/7/19	Frederick, Md.	46
Frederick, Md.	46	7/8/19	Chambersburg, Pa.	62
Chambersburg, Pa.	62	7/9/19	Bedford, Pa.	57
Bedford, Pa.	57	7/10/19	Greensburg, Pa.	63
Greensburg, Pa.	63	7/11/19	Sewickley, Pa.	48
East Palestine, O.	81	7/12/19	East Palestine, O.	35
*Sunday Rest Period	0	7/13/19	Rest Period	0
Wooster, O.	83	7/14/19	Wooster, O.	83
Bucyrus, O.	63	7/15/19	Bucyrus, O.	63
Delphos, O.	70	7/16/19	Delphos, O.	70
Ft. Wayne, Ind.	51	7/17/19	Ft. Wayne, Ind.	51
South Bend, Ind.	76	7/18/19	South Bend, Ind.	76
Chicago Heights, Ill.	78	7/19/19	Chicago Heights, Ill.	80
*Sunday Rest Period	0	7/20/19	Rest Period	0
De Kalb, Ill.	80	7/21/19	De Kalb, Ill.	82
Clinton, Ia.	84	7/22/19	Clinton, Ia.	90
Cedar Rapids, Ia.	87	7/23/19	Cedar Rapids, Ia.	87
Marshalltown, Ia.	75	7/24/19	Marshalltown, Ia.	75
Jefferson, Ia.	81	7/25/19	Jefferson, Ia.	81
Denison, Ia.	68	7/26/19	Denison, Ia.	68
*Sunday Rest Period	0	7/27/19	Rest Period	0

Scheduled Arrivals

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Actual Arrivals

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Service

Control Point	Mileage	Date	Control Point	Mileage
Council Bluffs, Ia.	72	7/28/19	Council Bluffs, Ia.	72
Omaha, Neb.	5	7/29/19	Omaha, Nebr.	5
Columbus, Neb.	83	7/30/19	Columbus, Neb.	83
Grand Island, Neb.	64	7/31/19	Grand Island, Neb.	64
Lexington, Neb.	82	8/1/19	Lexington, Neb.	82
North Platte, Nebr.	64	8/2/19	Gothenburg, Neb.	30
*Sunday Rest Period	0	8/3/19	North Platte, Neb.	34
Big Springs, Neb.	75	8/4/19	*Rest Period	0
Kimball, Neb.	86	8/5/19	Ogallala, Neb.	53
Cheyenne, Wyo.	66	8/6/19	Big Springs, Neb.	22
Laramie, Wyo.	57	8/7/19	Kimball, Neb.	86
Medicine Bow, Wyo.	59	8/8/19	Cheyenne, Wyo.	66
Rawlins, Wyo.	62	8/9/19	Laramie, Wyo.	57
*Sunday Rest Period	0	8/10/19	Rest Period	0
Tipton Station, Wyo.	58	8/11/19	Medicine Bow, Wyo.	59
Green River, Wyo.	60	8/12/19	Rawlins, Wyo.	62
Fort Bridger, Wyo.	63	8/13/19	Tipton Station, Wyo.	58
Evanston, Wyo.	35	8/14/19	Green River, Wyo.	76
Salt Lake City, Utah	88	8/15/19	Fort Bridger, Wyo.	63
Orr's Ranch, Utah	74	8/16/19	Evanston, Wyo.	35
*Sunday Rest Period	0	8/17/19	Echo, Utah	41
Sheriden's Ranch, Ibapah (Detour on new road saving 25 miles)				
Nev.	80	8/18/19	Ogden, Utah	52
Ely, Nev.	84	8/19/19	Salt Lake City, Utah	73
Eureka, Nev.	83	8/20/19	Orr's Ranch, Utah	52
Austin, Nev.	70	8/21/19	Granite Rock, Utah	15
Westgate, Nev.	70	8/22/19	Black Point, Utah	36
Fallon, Nev.	54	8/23/19	Anderson's Ranch, Utah	51
*Sunday, Rest Period	0	8/24/19	Ely, Nev.	77
Carson, Nev. (Detour on new road)	66	8/25/19	Pinto House, Nev.	46
Myers, Cal.	34	8/26/19	Willow Spring, Nev.	44
Placerville, Cal.	50	8/27/19	Austin, Nev.	60
Sacramento, Cal.	52	8/28/19	Eastgate, Nev.	80
Stockton, Cal.	48	8/29/19	Fallon, Nev.	66
Oakland, Calif.	80	8/30/19	Carson City, Nev.	66
*Sunday, Rest Period	0	8/31/19	Rest Period	0
San Francisco, Cal.	Terminus	9/1/19	Meyers, Cal.	34

Scheduled Arrivals

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Actual Arrivals

Control Point	Mileage	Date	Control Point	Mileage
		9/2/19	Placerville, Cal.	50
		9/3/19	Sacramento, Cal.	52
		9/4/19	Stockton, Cal.	48
		9/5/19	Oakland, Cal.	76
		9/6/19	San Francisco, Cal.	8
T o t a l	3239		T o t a l	3251

Orders were given by the Secretary of War and Brig. Gen. C. B. Drake, Chief of the Motor Transport Corps, to hold to the schedule as closely as possible, and it will be noted that the Convoy arrived at Lexington, Nebr., almost exactly half-way across the continent on August 1st, on time., thanks to the good roads of Pennsylvania, Ohio, Indiana and Illinois, and to the fact that the gumbo roads of Iowa were dry and hard, there having been no rain in that State for several weeks previous to our arrival. From this point west, however, the roads grew steadily worse except in the vicinity of Salt Lake City, Utah, until the Convoy reached the palm-lined boulevards of California, and it became increasingly difficult to get the heaviest trucks through the soft, sandy roads and over the bad grades. The greater part of the Convoy trucks could not have reached San Francisco without the assistance rendered by the Militor and the 5-ton Artillery Tractor.

4. PERSONNEL

The personnel of the Convoy consisted of Companies E and F of the 433d Motor Supply Train comprising of 12 officers and 210 men; Service Park Unit #595 - 1 officer and 38 men; Company E, 5th Engineers - 2 officers and 30 men; One Medical Detachment; One Field Artillery Detachment; and 17 commissioned officers detailed to duty as Staff Observers. The roster of officers is as follows:

Lt. Col. C. W. McClure, Inf.	Expeditionary Commander
Capt. Wm. C. Greany, M.T.C.	Statistical Officer
Capt. Bernard H. McMahon, M.T.C.	Train Commander
1st Lt. Kenneth C. Downing, M.T.C.	Adjutant
Capt. Arthur W. Herrington, M.T.C.	Pilot
1st Lt. Ralph W. Enos, M.T.C.	Pilot
1st Lt. Daniel H. Martin, M.T.C.	C.O. Co.E, 433d M.S.T.
2nd Lt. James W. Giffin, M.T.C.	Co. E, 433d M.S.T.
1st Lt. Martin W. Cavanaugh, MTC	C.O. Co.F, 433d M.S.T.
2nd Lt. Joseph R. Johnson, M.T.C	Co. F, 433d M.S.T.
2nd Lt. G. M. Bissell, QMC	C.O. S.P.U. #595
Capt. A. E. Ritchey, C.E.	C.O. Co.E, 5th Engr.
1st Lt. Robert E. Calvin, C.E.	Co. E, 5th Engr.
Lt.Col. Taylor E. Darby, M.C.	Train Surgeon
1st Lt. Arthur V. Murtha, M.C.	Medical Officer
1st Lt. William F. Scheumann, D.C.	Dental Officer

Capt. Richard Gurvine, M.T.C.	Mess Officer
Capt. James W. Murphy, Inf.	Recruiting Officer
1st Lt. Howard G. Shockey, M.T.C	Supply Officer
1st Lt. Wm. Doron, F.A.	Publicity Officer
Col. Ralph McV. Pennell, F.A.	Observer
Col. Karl C. Greenwald, F.A.	"
Col. Wm. T. Carpenter, C.A.C.	"
Lt.Col. John Mather, C.A.C.	"
Lt.Col. Pierre V. Kieffer, C.A.C.	"
Lt.Col. Whitman R. Conolly, F.A.	"
Lt.Col. Dwight D. Eisenhower, T.C.	"
Lt.Col. Wm. H. Shepherd, M.T.C	"
Lt.Col. Lloyd P. Horsfall, G.S.	"
Maj. Wm. H. Welch, G.S.	"
Maj. John C. Gray, G.S.	"
Maj. Chas. K. Berle, M.C.	"
Maj. Otto A. Tandrop, S.C.	"
Maj. Mat. J. Farrell, M.T.C	"
Capt. Earl G. Harper, A.S.A.P.	"
1st Lt. E. R. Jackson, O.D.	"
Maj. S. E. Brett, T.C.	"

The duties of the Ordnance Observer were somewhat hampered because of his rank, as he was, with the single exception of the Air Service Observer, the only Staff Observer below the rank of major. At times this made it difficult for the Ordnance Observer to follow his own inclinations in the matter of making observations as the passenger vehicles provided for the use of the observers were always under the direction of the senior observer.

The success of the Convoy was due in some measure to the tireless energy of the Expeditionary Commander, Lt. Col. Chas. W. McClure, who handled the undertaking very ably from a transportation standpoint. However, many of the smaller but highly important details frequently escaped his attention, and he was decidedly unpopular with the enlisted men. This resulted in a certain lack of cooperation, although the men in general did their work very effectively and willingly.

On the other hand, the Train Commander, Capt. Bernard H. McMahan, was the idol of his men and always had their interests at heart. He conceived the idea of the Convoy some time in February 1919, worked up the plans for the expedition and was to have been the Commanding Officer until, on July 4, 1919, Lt. Col. McClure was assigned to that duty. This placed Capt. McMahan in a rather delicate position and his hands were "tied" so to speak, but the wholesome effect of his personality on the morale of the enlisted men was a factor which contributed in a very large degree to the ultimate success of the expedition.



Of the Train Officers, 1st Lt. Daniel H. Martin, commanding Co. E of the 433rd Motor Supply Train was by far the most capable and efficient. The other officers seemed to have very meager knowledge of company administration matters, handling men in the field, and the duties of officers in general.

The majority of the enlisted men of Co.'s E & F of 433rd Motor Supply Train were raw recruits with little or no military training, many of whom had not driven a motor truck before although they all claimed to have had experience with passenger vehicles. Considering this fact, the success of the Convoy is quite remarkable as the roads encountered through the mountains of the West required driving skill of the highest order. The men were poorly equipped at the start due to the fact that many of them joined the outfit at the very last minute.

The enlisted personnel of Service Park Unit #595 was of a higher order as most of these men had been in the service for a year or more and many of them were very excellent automotive mechanics.

The Supply Officer, 1st Lt. Howard G. Shockey, also acted as Mess Officer until the Convoy reached North Platte, Neb. with the result that he was considerably over-worked, and both assignments necessarily suffered. At North Platte, however, Lt. Shockey was relieved by the assignment of Capt. Richard J. Gurvine as Mess Officer. Capt. Gurvine is an old soldier and his long experience as a regular army mess sergeant resulted in excellent meals being served during the second half of the journey.

The work of the Publicity Officer, Lt. Wm. Doron, in preparing the people along the route for the arrival of the Convoy was in a large measure counteracted by the exaggerated and misleading statements which he issued or permitted to be issued through the public press. It is to be regretted that after having read the newspaper accounts of the Convoy, the people of many communities were somewhat disappointed when the train of trucks arrived.

Co. E of the 5th Engineers was easily the best disciplined and the most efficient organization of the Convoy, and too much credit cannot be given the Commanding Officer, Capt. A. E. Ritchey, for his ability as an officer, and to his men for the extremely valuable work which they did under his direction in repairing roads and bridges, without which the expedition must have failed.

The excellent health enjoyed by practically the entire personnel during the whole trip was unquestionably due to the effective work of Lt. Col. Taylor E. Darby and the Medical Detachment under his command. All matters of camp sanitation and precautionary measures were handled in extremely satisfactory manner. This was also a well disciplined and efficient unit.



As the ranking officer of the Staff Observers, Col. R. McT. Pennell, did much to foster the fine spirit of cooperation which existed at all times among that group of officers, thus enabling them all to work more effectively.

A discussion of the personnel would be incomplete without commenting upon the valuable assistance rendered by Mr. Edward A. Reis, a civilian employee of the Ordnance Department detailed from Haritan Arsenal, to accompany the 5-ton Artillery Tractor carried by the Convoy and to operate it whenever necessary. While this comprised the only duty to which Mr. Reis was assigned and although he was the only civilian officially attached to the Convoy, he gained the highest regard of all the officers and men by his constant willingness to help whenever there was any mechanical difficulty to be overcome. His mature experience as an automotive mechanic was invaluable, and it is doubtful if some of the trucks would have reached San Francisco without the skilled attention which they received from him.

5. DISCIPLINE

During the early weeks of the trip, discipline among the enlisted men of the Motor Transport Corps was conspicuous by its absence. Most of these men were rookies with no conception of military discipline, and although their conduct in general was good they had no idea of military courtesy, and their attitude toward the officers was altogether undesirable. The Company Officers apparently made little or no effort to remedy this condition and it became quite customary for officers and men to address each other by their given names or nick names in the most familiar fashion. Lt. Martin was the only exception and while he was a rather strict disciplinarian, he was held in respect by his men.

After Lt. Col. Wm. H. Shepherd joined the Convoy at North Platte, Nebr., there was a marked improvement in the discipline of the entire outfit, and it steadily improved until the final objective was reached. Although it was very difficult to keep the enlisted men in restraint on an expedition of this character, their behavior when on leave at the various control points was excellent and frequently commented upon favorably by the town's people. The discipline in Co. E of 5th Engineers and Medical Detachment was good at all times, setting an excellent example for the enlisted men of the Motor Transport Corps to emulate.

6. EQUIPMENT

The following is a list of the 81 motor vehicles and trailers which constituted the first Transcontinental Motor Convoy.

NAME	TYPE	TONS	SERIAL NUMBERS			GROSS WEIGHT POUNDS	
			U.S.A.	CONVOY	CHASSIS		KCTOR
Cadillac Passenger		7 pass.	111157	-	-	57V945	5710
"	"	7 "	18852	-	-	57V687	5930
Dodge	"	2 "	111422	-	303882	351400	3160
"	"	5 "	19960	-	288948	340352	3425(c)
"	"	5 "	110219	-	282472	333654	3600
"	"	5 "	110228	1	276723	327205	2900
"	"	5 "	110602	-	1288952	340405	3525
"	"	5 "	110228	-	276723	327205	3525
White	Observation	7 "	111316	54	TEBO-50732	5438	6900
"	"	7 "	111506	53	TEBO-46631	3354	6900
"	Reconnaissance	12 "	111505	55	TEBO-50490	5230	7225
Stand."B"	Cargo	3	414678	29	10344	15443	17125
"	"	3	414693	25	10112	12485	14750
"	"	3	414674	33	10506	14671	14900
"	"	3	414795	30	10515	11704	16600
"	"	3	47986	31	B16867	B-8343	17000
"	"	3	414672	32	10434	18303	18750
"	"	3	47905	24	B16963	B17488	16450
"	"	3	414676	21	10027	11588	15700
"	"	3	48047	20	17174	8330	15700
"	"	3	414673	23	10172	12796	15450
"	"	3	414664	22	10376	11508	15800
"	"	3	47971	50	B16814	B14218	17300
"	"	3	48043	8	17071	8279	18050
"	"	3	410715	19	B16800	B8131	14400
"	Mach.Shop	3	414319	47	11041	15520	20625
"	Spare Parts	3	414683	49	10356	18266	17200
"	"	3	414668	48	10145	12322	17250
"	Gas Tanker	750 gals	80214	42	14052	1462	17800
"	"	750 gals	80215	28	15952	8126	17350
"	Water	750 gals	80216	26	11047	9575	15925
Cadillac Searchlight		1	6075	2	-	57x735	8200
Dodge	Lt.Del.	3/4	26990	-	292047	343540	3300
Dodge	"	3/4	26675	27	289889	341361	3510
"	"	3/4	26991	11	290515	341856	3525(c)
"	"	3/4	26989	41	288637	340046	3800
F.W.D.	Cargo	3	415766	15	8175	9979	11000
"	"	3	415768	13	13325	21426	12350
"	"	3	415767	14	8044	9371	12050
Garford	"	1 1/2-2	39732	39	-	25182	10200(a)
"	"	1 1/2-2	39734	40	-	25144	10150
"	"	1 1/2-2	39733	37	-	25013	10250
G.M.C. Amb.Trailers		2 pass.	-	-	-	-	300
"	"	2 "	-	-	-	-	300
"	Ambulances	1 1/2	39304	-	30222	68451	5675(a)
"	"	1 1/2	39735	43	30209	65079	5725
"	"	1 1/2	39736	44	30224	69092	5425
"	"	1 1/2	39303	45	30217	62372	5525
"	"	1 1/2	24212	46	34226	59604	5525
"	Cargo	1 1/2	39305	52	24637	66320	6675
"	"	1 1/2	39306	-	24629	64524	6675(a)

MAKE	TYPE	TRUCK CAPACITY TONS	SERIAL NUMBERS				POUNDS
			U.S.A.	CONVOY	CHASSIS	MOTOR	
Harley-Davidson	Motorcycle	Side Car	614053	61	-	19T2872	525
"	"	"	614052	60	-	19T2941	525
"	"	Solo	Private	-	-	-	498
"	"	"	"	-	-	-	515
"	"	"	614057	56	-	19A6107	515
Indian	"	Side Car	614055	58	-	74M245	875
"	"	"	614054	59	-	86K498	(b)
"	"	"	Private	-	-	-	950
"	"	Solo	614056	57	-	74M423	525
Liberty	Kitchen Trailer	2 wheel	None	-	-	-	2675
"	" or "	" 2 "	"	-	-	-	2675 (a)
Maxwell	Art. Tractor	5	"	-	-	-	9530(b)
Militor	Wrecker-Winch	3	"	51	6	AU955	11000(a)
Loder	Pontoon Trailer	-	-	-	-	-	10000(a)
Mack	Machine Shop	5 $\frac{1}{2}$	None	5	1131180	54081	18700
"	Blacksmith "	5 $\frac{1}{2}$	"	4	1131140	54087	18575
"	Cargo	5 $\frac{1}{2}$	51482	3	1131633	57640	14665
"	"	5 $\frac{1}{2}$	51483	7	1131837	55693	15700
"	"	5 $\frac{1}{2}$	51481	6	1131539	54552	22450
Packard	"	1 $\frac{1}{2}$ -2	36168	16	1226	107700	10600
"	"	1 $\frac{1}{2}$ -2	36246	17	1145	107951	8500
"	"	1 $\frac{1}{2}$ -2	36277	18	4785	107857	9700
Riker	"	3	415011	9	5304	5193	12300
"	"	3	415009	10	5171	5031	15380
"	"	3	415010	12	5188	4954	12450
Trailmobile	Kitchen Trailer	4 wheel	1042	-	332	-	2000(a)
"	"	"	"	-	336	-	2000(a)
White	Cargo	1 $\frac{1}{2}$ -2	39022	35	53529	26137	7950
"	"	1 $\frac{1}{2}$ -2	39021	34	53681	26272	9100
"	"	1 $\frac{1}{2}$ -2	39020	36	53476	26218	7475

(a) indicates - retired from service before completion of trip, weight estimated.

(b) indicates - carried as cargo, weight estimated.

(c) indicates - absent when train was weighed, weight estimated.

7. OPERATIONS

The performance of the various types of motor equipment listed above is one of the chief points of interest to the Ordnance Department, inasmuch as it affords a most excellent opportunity for making valuable comparisons as to the ability and reliability of the several makes of motor vehicles and trailers. Practically all of the equipment was new when the Convoy left Washington, the exceptions being the Militor and the 5-ton Artillery Tractor, so that insofar as the condition of the vehicles was concerned, all had an equal chance of successfully completing the long journey across the continent.

While the cargoes carried varied somewhat from day to day, it may be said that in general the trucks hauled capacity loads. The most uncertain factor in the operation of these motor vehicles especially during the first few weeks of the trip was the inexperience of the drivers, all of whom were new to convoy work. Even during the first half of the trip where the roads were generally good, some drivers had considerable difficulty in keeping their trucks on the road, while others fell asleep at the wheel and ran their trucks into the ditch, over-turning several with slight damage. On the fourth day out, in a terrific mountain thunder storm one G.M.C. cargo truck (#39306) skidded over the road on the Laurel Hill descent near Ligonier, Pa. and was lost down the mountain side beyond hope of recovery.

In consideration of these facts, it is a truly noteworthy achievement that there were no trucks lost on the very dangerous mountain grades of the Rockies and Sierras, and that the final objective was successfully reached.

After the Train Officers had had ample opportunity to observe the comparative ability of the men for a few weeks, the best drivers were each assigned to one of the motor vehicles with an assistant driver and made fully responsible for the operation of their equipment. Immediately upon arrival at the control point for the night, it was the duty of the driver to see that his truck was at once filled with gasoline, oil and water, cleaned, and any needed adjustments or repairs made. Three officers of the Motor Transport Corps inspected each vehicle every morning before the Convoy left camp, to see that this work had been properly done. This resulted in a very marked lessening of mechanical troubles on the road, and a much more efficient operation of the entire equipment.

As the Convoy proceeded across the country, the men gained experience with their trucks and confidence in themselves so that by the time the mountains and deserts were reached, most of them were equal to the difficult tasks encountered there, and when the train reached San Francisco many of the men were really competent drivers and their development as such is deserving of favorable comment.

We cannot leave the subject of operations without commenting most favorably upon the excellent work done by the two Pilots, Capt. Arthur W. Herrington and 1st Lt. Ralph W. Enos. These two officers, each riding a Harley-Davidson solo motorcycle, left camp each morning about one-half hour in advance of the Convoy to see that the road was clear and to report any obstructions or deviations to the Expeditionary Commander.

The simple road marking system used by the Pilots proved to be a great success. The markers consisted of salmon colored paper isosceles right angle triangles, 11" base by 5½" altitude, which were tacked on a conspicuous post or fence at each turn of the road or intersection. When the apex of the triangle pointed up it indicated that the route was straight ahead; apex pointing to the right, indicated right turn; apex pointing left, left turn; and two triangles tacked up base to base, thus forming a square, indicated the location of the camp site. Without these markers considerable difficulty would have been experienced in following the route through cities, on detours, in the absence of official Lincoln Highway Markers, or where these were interspersed with other Highway markers.

We will now proceed to a consideration of the operations of the various makes and types of equipment individually. No mention will be made of the various unimportant minor adjustments required in the operation of all motor vehicles and which were generally made by the drivers or assistant drivers.

(a) CADILLAC: In general, the operation of the two Cadillac Touring cars and Search-light Truck was satisfactory, and these three vehicles required but little attention. Although the Cadillac (#111157) used by the Expeditionary Commander covered approximately double the mileage of the trucks, but few adjustments were required and only two minor troubles experienced. Toward the end of the trip the tension spring on the fan clutch broke and the cork float in the carburetor became saturated requiring drying out and recoating with shellac. Some trouble was also experienced with the auxiliary air valve spring sticking, on account of the excessive dust encountered on the trip. The engine of the other touring car (#18852) became noisy and examination showed that this was due to the timing chain stretching, replacement being made at Sacramento. One connecting rod bearing in this car also began knocking badly two days before the end of the trip and had to be taken up. The Search-light Truck (#6075) developed a bad transmission, due to misalignment, on the fourth day and new parts costing \$140.70 were installed. The Delco system of ignition was used on the Cadillacs and generally gave satisfaction.

(b) DODGE: The performance of the ten (10) Dodge cars used by the Convoy was quite satisfactory although there are a number of points on this vehicle which required some attention. The hood fasteners are too light and quite a large number of these were missing

at the end of the trip having broken off enroute. The chief trouble with the Dodge engine was due to the starting chain stretching, and on one light delivery truck (#26991) this chain stretched to such an extent that it finally broke disengaging the oil pump drive so badly that it was necessary to install a new pump and oil pan. The principal difficulty experienced with the Dodge cars was due to the Stewart Carburetor which continually gave trouble after the Convoy encountered dusty roads. Dust accumulated in the dash pot and on the sliding air valve piston to such an extent that the valve stopped functioning altogether, remaining locked in one position anywhere between the maximum and minimum openings. This necessitated disconnecting and disassembling these carburetors, thorough cleaning, reassembling and reinstalling, consuming from 20 minutes to one hour. Where the dust nuisance was worst this operation had to be performed several times a day on some of the Dodge cars. Some difficulty was also experienced with the dash adjustment for this carburetor caused by the wire breaking. In a number of cases where this wire was again attached to the carburetor, it was found to be shortened to such an extent that the mixture was continually too rich. One Dodge Light Delivery blew out a cylinder head gasket.

The dust also caused trouble with the Simms Magneto used on these cars, requiring frequent cleaning and adjustment, otherwise this magneto was very satisfactory. In two instances the ring gear and driving pinion gave trouble due to the teeth breaking out. Replacement was made at Bucyrus, Ohio on the Engineer's Touring car (#110228) and later to the light delivery truck (#26991). In several instances the steering arm pinch bolt loosened up permitting the arm to work loose on its shaft. This resulted in considerable play in the steering wheel, the cause of which was not fully understood at first by the drivers and mechanics.

The brakes on the Dodge required frequent adjustment and the radiator of one light delivery car (#26991) was badly damaged and had to be replaced due to the fact that the brakes on this car did not hold on a steep down grade. The rear wheel on one Dodge car had to be replaced because of the spokes working loose in the hub flange.

(c) WHITE: The cooling system of the six White Trucks operated very efficiently with the exception of the Reconnaissance Car (#111505) which showed a tendency to overheat toward the end of a long pull. There were no apparent defects in the design or construction of the White motors with the exception of the oiling system which appears to be too complicated and absolutely unsuited for work over dusty roads, it being necessary to stop frequently to clean out the feed pipes which became clogged up from the accumulation of dust. On a few occasions the carburetor and gas lines also became obstructed with dust. Two days before the end of the run, a White 1½-ton truck had to be towed in to camp on account of a knock developing in the engine and it was found that the bearings required taking up. The driver of this vehicle showed great interest in his truck and it was due to his attention that the adjustments required were of a simple nature.

The steering column on all of these trucks worked loose after about 2000 miles had been covered, and required tightening up. The right rear wheel bearings on one Observation Car (#111316)

broke up and locked the wheel making it necessary to load this vehicle on one of the trucks and haul it into camp where necessary repairs were made. Observation car (#111316) also had the front wheels spread and adjustment was requested at Cheyenne, but in Salt Lake City the White agent claimed that the wheels were in alignment. The Observers insisted that they be examined more closely and the representatives of a tire company in Salt Lake City measured the wheels and found they were out 3/8", resulting in unnecessary wear on the tires. They were properly aligned at this point. The rear radius rod brackets frequently shifted their position and threw the rods out of adjustment. Some means should be taken to make this bracket more rigid as the one nut now holding it is insufficient.

(d) STANDARDIZED "CLASS B": The Standardized "Class B" Military truck was the most towed truck in the Convoy, both actually and in proportion to the numbers of other makes of trucks comprising the Convoy. The towing of the Standardized "Class B" trucks began on the day the Convoy left Washington, and one or more of these trucks was towed almost daily until the Convoy left Stockton, Cal, two days before the end of the trip. The many causes for these breakdowns will be mentioned below.

The "Class B" truck clearly demonstrated its superiority so far as radiator area and general cooling efficiency were concerned. However, two cases of leaky radiator developed in these trucks. In one instance three tubes became loosened at their lower ends where they were soldered into the lower frame. In another radiator the gaskets (#3006) did not hold between the lower tank flanges. This, however, is not due to faulty design but rather to the poor material which was used for gaskets, paper being employed instead of the proper packing.

The fan belt (#3505) on the "Class B" truck gave considerable trouble on account of their stretching quite rapidly when being first used. The leather evidently was not of the best quality as the belts frequently broke at the point where the metal fasteners were applied. The range of adjustment (#1450-1135) on the fan bracket was not sufficient to take up the slack in the belt, consequently the metal fasteners had to be pulled out, the belt shortened and replaced. The hood fastener (#8224-8242) pulled out of a number of Class B trucks. It appears that the machine screws which retained the lower part of the fastener loosened up permitting the entire assembly to pull out. The socket into which the plunger (#8227) fits occasionally wore out permitting the plunger to pull through.

The engine in the Class B trucks was fairly reliable. The difficulties experienced with it being generally more in the nature of adjustments. One trouble developed in this engine was the cylinder head gaskets blowing out and usually in the same place, between the water ports on the valve side of the engine where the bearing surface is very narrow.



The valve lifters (#1079) were responsible for the greater part of the delays experienced with this truck. The steel valve tappet rollers (#1080) crystallized and broke up, and the lock nuts (#1083) loosened permitting the lifter assembly to drop down. In many cases the guides (#1078) broke at the lower end permitting the pin (#1081) to turn at an angle to the cam. The valve springs (#1011) also gave a considerable amount of trouble frequently breaking into three or more pieces on account of crystallization. The end of the valve stem where it is turned down for the spring lock (#1013) sometimes broke off.

One piston (#2213) collapsed on the Class B machine shop truck while coasting down grade at too great speed. This accident was peculiar inasmuch as an examination of the cylinder and the piston indicated that they were without oil, both being heavily scored although the other pistons and cylinders showed perfect lubrication. There was a large supply of oil in the crank case and the oil pump was apparently in perfect working order. Lack of time made it impossible to make a more careful study of the cause of this accident.

The U.S.A. carburetor gave trouble because of the float valve adjustment loosening up. This is held in position entirely by solder and the excessive vibration of the engine resulted in the needle separating from the collar (#1372). Some trouble was also experienced with the low speed adjustment screw (#1359) working loose and dropping out of the carburetor. The air choke valve also gave trouble on account of the pinch screw (#1395) loosening up, permitting the disc (#1381) to close the air entrance into the carburetor. The throttle lever (#1354) also became loose on account of pinch screw (#1395) working out. This prevented the carburetor from being opened fully. While these difficulties are obvious to any one experienced with carburetors, they seem very mysterious to the average enlisted driver or mechanic.

The low speed adjustment screw of the Zenith carburetor frequently loosened up and fell out. The air choke valve also worked loose from the controlling links and partially closed the air intake into the carburetor.

The Bosch magneto, type L-T.4 was used on the Class B trucks and gave considerable trouble especially during the first four weeks of the Convoy. A static condition developed between the distributor block and the high tension conducting pencil, resulting in a short circuit which stopped the ignition in all cylinders. Temporary repairs were made by roughly reaming out the distributor (#62683) so that a greater air space existed between the pencil and distributor block. At Chicago Heights the Bosch representative turned over to the Convoy three of the new Bakelite type distributors and although it was necessary to dismantle the magnetos in order to install them, they were used with very satisfactory results.

The Oldham fibre coupling on one magneto shaft broke within the first 50 miles. The automatic impulse coupling also failed to give satisfaction. On account of the excessive dust present some of it worked into the points which required adjustment and cleaning more often than would have been necessary under normal conditions. This is not considered of course, to be a defect in the magnetos as this trouble was common to all types of ignition; but, the distributor and pencil clearance should be corrected very carefully so that no further trouble will develop along these lines. The magneto on the Class B truck is located in a very inaccessible position and most adjustments cannot be made without removing the magneto from the engine.

The steering arm (#7507) became loose on its shaft on several trucks but not enough to cause serious trouble. The tie rod (#6033) pulled out from the clamp (6035) on several occasions. The Commanding Officer of the Service Park Unit claimed that it was impossible to draw up the bolts (#6068) tightly enough.



A few Class B trucks had their front axles bent slightly out of alignment due undoubtedly to the steering knuckle arm (#6029-6030) being bent by the wheels striking some road obstruction. No attempt was made to straighten these arms as the damage was not great enough to interfere with steering.

Very little trouble was experienced with the Class B clutch or transmission. On one occasion however, a gear shift finger broke off and at another time the eight rivets (#5761) which secure the two gears (#5564-5565) to the sliding yoke, all sheared off.

(c) F. W. D.: The three (3) Four Wheel Drive Trucks were, in general, the most satisfactory in the Convoy and of all the various makes represented, the F.W.D.'s alone were able to pull through all the bad, muddy and sandy stretches of road in Nebraska, Wyoming, Utah and Nevada, absolutely unaided. This is a rather enviable record, and the few mechanical difficulties experienced with this truck were of a very simple nature.

A considerable number of fan belt breakages occurred until a shipment of endless belts was received and installed, after which no further trouble was experienced. The upper radiator support studs sheared off several times and should be increased in size or otherwise strengthened.

Instead of the Model G Stromberg Carburetor, one of the plain type, Model M, was installed on an F.W.D. (#415768) at the suggestion of the Observers, and gave much better satisfaction, increasing the miles per gallon about 25%.

On three occasions, one F.W.D. (#415766) burned out #4 connecting rod bearing, due in two instances to coasting down a steep grade at an excessive speed, although using the motor as a brake. The third case was due to lack of proper lubrication, and although the amount of oil in all of the trucks was checked up carefully every morning, in this instance the quantity of oil remaining in the crank case was not only insufficient for splash lubrication, but there was hardly enough oil to permit the pump to function properly, indicating that this truck had not been properly inspected before starting in the morning, or had been overlooked altogether. The engine had been used to retard the speed of the vehicle without assistance from the brakes, which were badly worn and needed relining.

The Eiseman Magnetos used on these trucks were very satisfactory, requiring only an occasional cleaning and adjustment of the interrupter points.

The main drive shaft in an F.W.D. (#415766) was twisted off at the rear transmission bearing, when an inexperienced driver threw in reverse gear and dropped in the clutch while coasting down hill at high speed, intending to use the motor as a brake.

The clutch alignment joints required a few adjustments.

The F.W.D. is a difficult truck to steer, especially where the road is rough on one side and good on the other, as it has a decided tendency to run into the bad spots. However, these trucks went all the way on their original tires, which are still in excellent condition.

(f) GARFORD: Of all the makes of motor trucks comprising the Convoy, the three Garfords proved to be the most unsatisfactory, and developed the most serious mechanical troubles, making it necessary to ship one Garford (#39732) back to Washington by freight on account of the engine being damaged beyond repair.

The radiators gave continual trouble on account of the tubes leaking at their lower ends, and considerable difficulty was experienced in soldering these tubes properly.

The fan bracket assembly on this truck is not suitable for military purposes, and the spring take-up on the fan belt is not sturdy enough. One fan bracket broke, permitting the fan to fall forward, damaging the radiator and wrecking the fan, thus putting the vehicle entirely out of commission.

Inspectors and drivers alike were constantly worried by the Garford motors, all of which were very noisy, and especially the timing gears of one of them. Connecting rod bearings were frequently burned out, and in two instances let go altogether, with the result that the rods punched holes in the crank case or cracked the cylinder block by pushing the piston through.

On one occasion the petcock in the bottom of the oil reservoir backed out permitting the entire supply of oil to be lost on the road. This engine also had difficulty with the float indicator of the oil level gage, as either the glass broke or became so dirty that it could not indicate the amount of oil in the crank case. Consequently the inspection for oil level consisted in racing the engine, and if a quantity of smoke issued from the exhaust pipe, it was considered that the engine had the proper quantity of oil. Lack of power was frequently experienced because of poor compression, and the valves required frequent adjustment.

The Rayfield Carburetor used on the Garford trucks is not suitable for military use because of the ease with which improper adjustment may be made, and the large number of parts subject to wear. The float valve mechanism in this carburetor became worn to such an extent that it prevented proper functioning, and replacement of these parts had to be made at Salt Lake City. This carburetor employs the Bowden wire control for changing the quality of the mixture, and this loosened up in a short time, permitting the adjustment to change with the result that the mixture became too rich.

The most satisfactory feature of the Garford trucks was the Dixie Magneto, which only required an occasional cleaning.

Clutches required frequent adjustment, and the steering gear arms became loose on their shafts, damaging the serrations to such an extent that it was impossible to keep them tight.

The axle on one truck was sprung at about 1000 miles, permitting the front wheels to spread, buckling up the tie rod also. Although the road conditions were very rough at this point, no other vehicles experienced this trouble.

(g) G. M. C.: Of the five (5) G.M.C. Ambulances and two (2) G.M.C. 1½-2 ton cargo trucks, one of each type failed to complete the trip. On July 10th, a G.M.C. truck (#39306) skidded off the road and down the mountain side near Ligonier, Pa., and was damaged beyond hope of repair by the Convoy. On July 19th, a G.M.C. Ambulance (#39304) ran off the road and overturned in the ditch as the result of careless driving, just a few miles east of Chicago Heights, Ill. The body was so badly cracked and the frame kinked to such an extent that this Ambulance was exchanged for another (#24212) at Chicago. Aside from these two accidents these vehicles had very little trouble.

The principal difficulty was experienced with the Marvel Carburetor, largely due to the fact that the mechanics and drivers did not understand how to make necessary adjustments. They seemed to depend entirely on the air adjustment, because they were not familiar with the fact that there is a gasoline adjustment in the lower part of the carburetor. The cork float in one carburetor became saturated, and the air valve springs were made of poor material which took a permanent set, thus preventing the making of a satisfactory adjustment.

Two front universal joints were burned out from lack of lubrication, and careful examination seemed to indicate that these universals had never had any lubricant, as the vehicles were new when the Convoy started and the joints were absolutely dry and clean.

The only other adjustments required were of a simple nature including valves, magneto, spark plugs, brakes and wheel bearings.

(h) ARTILLERY TRACTOR, 5-TON: The 5-Ton Tractor was carried as cargo on a Mack truck (#51481) except when it was necessary to utilize it, or where such heavy grades were encountered that the Mack truck could not proceed until the tractor was unloaded. But for the Tractor's ability to pull heavy loads through deep mud or sand, most of the larger trucks in the Convoy would never have reached San Francisco.

On August 5th, while pulling one of the trucks out of a quicksand hole 10 miles west of North Platte, Nebraska, one of the track shoes was broken. This was quickly replaced, and is the only mechanical trouble experienced by the Tractor, in spite of the many hours of hard work which it performed.

(i) MILITOR; The Artillery Wheeled Tractor, or Militor as it is popularly known, was unquestionably the most valuable vehicle in the entire Convoy, and as a "wrecker", for which purpose it was chiefly used, it served with distinction. On the road the Militor always brought up the rear of the train, and rescued any vehicles that had gone into the ditch, or took in tow those that were disabled. Hardly a day passed without the Militor doing some towing, and as many as nine trucks have been chained together behind this vehicle for tow. The power driven winch was extremely valuable in extricating vehicles which were mired in deep mud or sand, and while endeavoring to rescue other trucks the Militor was itself ditched on two or three occasions, but succeeded in pulling out under its own power, applied thru the four wheels or the winch.

This vehicle was comparatively free from all difficulties until Utah was reached, and west of Salt Lake City the fan belt, radiator support stud, carburetor, governor and #4 connecting rod bearing developed trouble simultaneously. After the fan belt and radiator support stud had been repaired, the carburetor and governor replaced, and only the loose connecting rod bearing remained to be repaired, the Expeditionary Commander ordered the Militor returned to Salt Lake City, there to be shipped to San Francisco by rail. This action is believed to have been entirely unwarranted, and has been made the subject of a special report under even date.

(j) MACK: The five (5) Mack 5½-Ton Trucks were the heaviest in the train, and their performance was quite satisfactory on the good roads east of the Missouri River, although they consistently showed the greatest water consumption, amounting to more than fifty gallons per day on one occasion, the result of a continual tendency to overheat.

Some trouble was experienced with the "V" fan belt employed on the Macks, but it is easily installed and its application was thoroughly understood by the Engineer Detachment which used these vehicles.

The Blacksmith Shop (#4) engine had one connecting rod break at the upper end across the eye through which the wrist pin passes, and the broken end of the rod caught the lower edge of the piston, which it forced upward through the cylinder head, cracking it badly. Temporary repairs were made by welding the piston in place, and filling the cylinder head with cement at Glenbrook, Nevada, on the shore of Lake Tahoe. From this point, with the assistance of the Tractor on up-grades, this Mack limped into Sacramento on three cylinders, where a new cylinder block, piston, etc. were installed.

Stromberg Carburetor, Model C, was used on these trucks, and it employs an automatic air valve, from which the nut which holds the spring in position was stripped off the valve stem, after about three weeks' running. This trouble was experienced only on the Mack trucks.

The Dixie Magnetos gave excellent service on these trucks, except one which was replaced by a Bosch, Type D.-U.4.

The chief mechanical difficulty on the Mack Trucks was with the clutches, all of which were replaced at least once during the trip.

Experience gained on this trip proved conclusively that the Mack truck is not suitable for use over poor roads, because of its chain drive. Mud and sand frequently packed between the chains and sprockets so that they became locked, and it was only possible to tow these vehicles backwards, under these conditions.

The steering tie rod on the Mack truck is placed ahead of the axle, and on two occasions this rod was struck by stones, or other road obstructions, so that the wheels were thrown out of alignment.

Of all the trucks in the Convoy the Macks were the hardest on tires, as many as four replacements being made on some of these vehicles during the journey.

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(K) PACKARD: The operation of the three (3) 1 $\frac{1}{2}$ -2 ton Packard trucks was quite satisfactory throughout the trip, and very little trouble was experienced with them.

One or two fan belt repairs were made, and the carbon removed and valves ground in all three of these trucks at Omaha.

The Dixie Magnetos gave generally satisfactory service on the Packards.

The clamp (#56919) which holds together the steering gear shaft and the steering wheel shaft became loosened on one Packard, and permitted the key to fall out, making it impossible to steer the vehicle until replacement had been made.

The Timken roller bearing in the right front wheel of one Packard broke up in service, probably because of defective material in the rollers, which alone were damaged. This bearing did not contain a graphite lubricant.

(1) RIKER: Of all the heavy, rear-drive trucks in the train, the three (3) Rikers made the best showing, and it is believed they are the most satisfactory trucks in their class adopted by the Army. Very little trouble was experienced with these vehicles.

This truck also employs a "V" fan belt, which gave some trouble due to the machine screws which fasten them together pulling through the leather, or breaking, a complete replacement being generally required. The installation of this "V" belt was not thoroughly understood by the men, and frequently the belts were stretched and twisted before they learned how to install the belt properly.

The wrist pin lock screws in one piston of a Riker engine fell out, permitting the wrist pin to creep in its bearing, and resulting in the piston cracking through an oil groove. The driver, however, was able to note the trouble before any serious damage had been done to the cylinder.

The Ball & Ball Carburetor used on this truck had the automatic air valve pulled from its fastening, and the valve and spring were apparently lost in the carburetor or in the engine, thus preventing the engine from idling. As no extra parts were carried for this carburetor, a makeshift repair was made by tying cheese cloth over the air intake, with satisfactory results. This carburetor is not suitable for military purposes because of the exposed cams, rollers, and levers, which are subject to excessive wear.

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Berling Magneto were used on the Hiker Trucks, with an auxiliary battery coil for starting, located on the dash. The interrupter points on this magneto are very sensitive to dust and wear, and require the attention of a mechanic who is familiar with the magneto. It is not easily removed from the engine for examination or adjustment.

(m) MOTORCYCLES: Observations made during the course of the Transcontinental Convoy indicate that the present 28"x3" motorcycle tire is not large enough to give the desired amount of service in work of this nature. This contention is borne out by the fact that during the trip a great amount of rim and spoke trouble was noted upon the rear wheels of both Indian and Harley-Davidson motorcycles. This was caused by the fact that the three inch tires do not present a sufficient amount of air cushion for a vehicle of this weight. The solution of the problem is by using the 26 inch C.C. Motorcycle rim now used on the large side-car type motorcycle. Apply to this a 27"x3 1/2" tire, which will give the desired air cushion without bringing about the necessity for extensive structural changes in the vehicle, and increasing rather than decreasing the present mud guard clearance. The overall outside diameter of a 27"x3 1/2" tire is one-half inch less than the same dimension of a 28"x3". The Firestone Tire & Rubber Co. of Akron, Ohio, are at present in production upon a tire of this size.



The medium weight Harley-Davidson motorcycles, known by the catalog name of "Sport Model", are fitted with a 26"x3" tire. These machines weigh approximately 100 lbs. less than the standard side-car type Harley-Davidson. They gave absolutely no spoke or rim trouble in spite of the fact that the tires on both machines were ridden, throughout the entire trip in an under inflated condition. The 28"x3" tire upon the large machine is overloaded to such an extent that it is necessary to carry a full 60 lbs. of air to prevent the rim from being dented by rocks. Carrying such a high pressure causes the wheel to bounce at average road speed, setting up a grinding action upon the tread which wears it out very rapidly.

The Schebler carburetor produced by the Wheeler-Schebler Mfg. Company, Indianapolis, Ind. is standard equipment upon all motor cycles in Military use. It is the only carburetor up to date that has been satisfactorily laid out to be used in production quantity.

Considerable trouble was noticed with all Schebler carburetors on this trip due to the fact that the throttle shaft wore very rapidly in the cast brass carburetor body. This causes an air leak around the throttle shaft, upsets the mixture and causes the motor to race and overheat when an attempt is made to throttle down. This throttle shaft should be made of larger diameter and should be carried in bushings pressed into the carburetor body proper.

Classification and
of the Government
Preservation purposes.

Auxiliary Air Valve shafts also gave a considerable amount of trouble, due to wearing and leaking air. The correction of this difficulty will require some study as the functioning of the carburetor depends upon the proper vibration of this particular valve.

Difficulty was also observed in sandy country caused by the sand passing down beside the needle valve and upsetting the carburetor adjustment. This difficulty was not experienced upon the medium weight Harley-Davidson motorcycles on account of the fact that the Schebler carburetors with which they were fitted had a small felt washer at the point where this sand generally passed down. It is recommended that this washer be applied to all Schebler carburetors.

One machine gave trouble due to the small cork washer on the bottom of the carburetor bowl breaking up and getting into the carburetor, clogging up the same and causing considerable trouble.

All of the motorcycles used on this trip were equipped with half inch wide, 5/8 inch pitch roller drive chains. On the large side-car type machine these chains run in the open and are not protected from road dirt except by those guards which are provided to prevent the driver's clothing from becoming caught. Thru out the entire trip it was necessary for all of the motorcycle drivers to readjust their chains for stretch and wear at least once every two days. When the stretches of alkali dust were reached, the chains would dry out, a crust of dust would be pressed into the bottom of each sprocket tooth, building up to such an extent as to make it necessary to stop and either clean it out or loosen the chain. A number of chains on both Indian and Harley-Davidson motorcycles were completely replaced during the trip on account of this condition.

The two medium weight Harley-Davidson motorcycles are equipped with the same type drive chain with the exception of the fact that it is completely enclosed in a dust proof case. These chains were adjusted four times between Washington and San Francisco and at the end of the trip were perfectly clean, well lubricated and showed no signs of any excessive wear. The sprockets were in perfect condition.

All saddles supplied by the manufacturers with their motorcycles have proven very unsatisfactory and show every evidence of very poor material and workmanship. This applies to the Mesinger spring saddle and also to the Troxel spring saddle. The Mesinger special air cushion type saddle gave very satisfactory service. The additional cost of this saddle however, is an unnecessary expenditure and could be saved if proper attention was given to details in the production of the spring type saddle.

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All magnetos were found to have had considerable breaker point trouble. This was first noticed upon a Berling magneto on a medium weight Harley-Davidson motorcycle. It was caused by the fine alkali dust getting between the magneto points, holding them apart just a small distance and causing them to arc across burning up the points. The trouble was afterwards noticed upon the Dixie magneto upon an Indian motorcycle. After that upon a Bosch magneto upon one of the Harley-Davidson side-car type motorcycles.

(n) LIBERTY KITCHEN TRAILER: So far as may be judged from the experience gained by the Convoy, this two-wheel rolling kitchen is entirely unsatisfactory, and should be discarded as a military vehicle. It is poorly constructed, and the ranges on both kitchens sheared their bolts and fell off the chassis on excellent paved roads. On poor roads the cans frequently jounced off, and it was practically impossible for a man to retain his seat on this vehicle. The front extension of the frame, which formed the drawbar, broke off both kitchens, and one spring was broken. Neither of these kitchens lived through the trip.

(o) TRAILMOBILE KITCHEN; These four-wheel kitchens were built on the right principle, and rendered a much better service than the Liberty Kitchens, but they should be of much heavier construction and standard tread, in order to stand up satisfactorily on unimproved roads. The springs, spring brackets, wheels, wheel bearings and draw-bars, all broke frequently under the strains to which they were subjected. The cans and stacks were jolted off occasionally also. Until the roads became too rough, two men rode on this trailer and prepared the mess enroute. The first Trailmobile Kitchen went to pieces August 28th, near Austin, Nevada, from which point it was shipped to Washington. The other one lasted four days longer and was shipped to San Francisco from Placerville, California.

(p) PODER PONTOON TRAILER: This vehicle was towed by one of the Mack trucks as far as Omaha, Nebr., at which point it was deemed advisable to drop this vehicle from the Convoy. As this trailer weighed about four tons, the roads encountered west of Omaha proved the wisdom of this decision.

(q) G. M. C. AMBULANCE TRAILERS: These very light two-wheel vehicles, each designed to carry two standard litters bearing one man each, stood up remarkably well. However, on rough roads these trailers frequently overturned and were dragged along on their sides, in spite of the fact that they were each loaded with two 150 pound sand bags, to represent the weight of the two men they were designed to carry.

8. MAINTENANCE The maintenance and repair of the Convoy vehicles was the principal function of Service Park Unit #595, 2nd Lieut. G. N. Bissell, Commanding, and the fact that only three trucks were retired from service enroute bears tribute to the effectiveness with which they did their work. Even one of these three vehicles could have easily been repaired by this unit, if

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purposes.

the Expeditionary Commander had permitted the work to be done. Included in this detachment were expert mechanics on motor-cycles, motors, carburetors, magnets, radiators, and tires, machinists, painters, welders, blacksmiths, and carpenters; each man a specialist in his own line of work. These men did very excellent work in general, frequently working all night in order to have some truck ready to run under its own power when the Convoy broke camp in the morning, and some very clever repairs were made with the facilities available. New connecting rod bearings were fitted frequently, damaged cylinder blocks replaced, cracked crank cases repaired, new clutch assemblies installed, and even babbit bearings were poured on the roadside in a very satisfactory manner.

Each Sunday morning in camp was spent in examining radiators, crank cases, transmissions, differential housings, wheel bearings, etc., cleaning them out and refilling with proper lubricants whenever necessary. In this connection it should be noted that the following six vehicles were lubricated throughout with Dixon's Graphite Greases, for the purposes of official test:

Military, Artillery Wheeled Tractor	251
Standardized Class B Machine Shop	414319
" " " Spare Parts Truck	414683
" " " " " "	414668
" " " Cargo Truck	47971
P. W. D. " "	415768



Careful examination of all parts of these trucks where Dixon's was used indicated that lubrication had been entirely satisfactory, and the gears and bearings were apparently in much better condition than those on which other lubricants had been used. In addition to the six trucks listed above, the drivers and mechanics on the other vehicles were constantly requesting Dixon's Graphite Greases for use in grease cups and elsewhere, showing the popularity which this lubricant has gained among the men who really know what gives the best results.

The maintenance work was considerably hampered because of the necessity of carrying spare parts for so many different makes of trucks, and the additional fact that the stock carried had not been intelligently selected. Large stocks of such parts as axles and drive shafts, among which there were no breakages, were carried, while no spares whatever were taken of many other parts, including radiators, on which there were frequent failures. In few instances, it was possible to replace a broken or worn part in one truck with a spare part for another make of truck, when careful calibration showed the dimensions to be practically the same. Another difficulty was due to the poor quality of the hand tools supplied, and better tools should be furnished to the mechanics, as well as such special tools as are necessary to make certain adjustments properly.

It should be remembered that the Convoy was not operated solely for the purpose of securing engineering data, with the result that the reports from drivers and mechanics were frequently only approximations, and the money value of the part that was worn, damaged, lost, or had failed entirely, was never definitely established; nor, was the time spent in making repairs, and the time the vehicle was not in operation, due to the repairs being made, taken into consideration.

9. GENERAL CONCLUSIONS: In general, very few serious automotive troubles developed, but the experience gained on the trip and the information secured from an examination of each vehicle after arrival at San Francisco would seem to warrant the following statements.

(a) Cooling Systems. The vertical tubular type of radiator, with bolted-on upper and lower tanks is the most satisfactory on military vehicles, because of the facility with which it may be cleaned and repaired. The addition of a temperature regulator in the water line, which would restrict the flow of water until the motor had warmed up, and such as is now standard equipment on many commercial trucks, would be most desirable. Such a device would be simpler and less expensive to install than radiator shutters, less liable to damage, and is automatic in its operation.

An endless flat fan belt, of leather or rubberized fabric, is most desirable for military motor vehicles, and an effort should be made to standardize the width and length of these belts. An extra endless belt should be carried in each vehicle at all times. The "V" fan belts are not desirable, but on the Riker trucks now in service, some form of a dust pan should be placed in front of the lower fan belt pulley to protect the "V" belt.

(b) Motors. Because of the high percentage of failures experienced with the valve tappet rollers and guides and the valve springs of the Class B motors, prompt attention should be paid to the development of a more durable valve lifter assembly, which will be interchangeable with that now in use. It is suggested that steel be used in the construction of the guide, instead of cast iron as at present, and that the valve springs be heat treated more carefully.

The governors of all trucks in the Convoy were rendered useless during the first few days of the trip, resulting later in many burned-out connecting rod bearings, due to speeding the vehicles. Some means should be provided to protect the governors against tampering on the part of drivers and mechanics.

A simplified carburetor would be advantageous on the Cadillac motor cars used by the Army, as the present sensitive automatic throttle and auxiliary air valve are not thoroughly understood by the average mechanic. Stewart, Rayfield and Ball & Ball carburetors appear to be unsuitable for military purposes.

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Only the very best grades of oils should be used in motor s, and a simple and positive means of determining the oil level should be provided on every truck. This is especially needed on the Garford trucks.

A study should be made of the conditions which are responsible for the blowing out of cylinder head gaskets in the motor of the Standard Class B truck, and such changes made as may be necessary to eliminate this trouble.

The mufflers of the G.M.C. and White motors clog up easily, and the construction should be changed.

(c) Ignition and Electrical Systems: The Bosch Magneto used on the Standard Class B truck should be corrected to have a greater air gap between the pencil and the distributor block.

The present acetylene headlights used on all trucks are entirely inadequate, and the carbide generators are unsatisfactory and poorly constructed. It is believed an efficient system of electrical lighting should be adopted for all military trucks. Such a system was developed for the Ordnance Department during the war, by Mr. R. M. Newbold, thoroughly tested, and pronounced satisfactory.

The use of mechanical or electrical self-starters on military vehicles is undesirable, as they merely add complications to the operation and maintenance of the trucks.

All service cars should be equipped with four electric spot lights for night repair work.

(d) Fuel Systems: Except for a few broken gasoline lines the fuel systems now in use are generally satisfactory, although larger drain cocks in all gasoline tanks would be desirable.

(e) Transmission Systems: A driving worm of 24 pitch instead of 33 1/3 pitch is recommended for all Class B trucks. Of the three Class B tankers, the one with the 33 1/3 pitch worm was the one which was so frequently stalled.

It is recommended that steps be taken to have all future military motorcycles equipped with a complete protective guard around the drive chain system. Some steps should also be taken to provide for a unit power plant, eliminating the short drive chain. In future developments steps should be taken to eliminate the chain drive entirely and to substitute shaft drive. There are no insurmountable difficulties to the inclusion of this type of drive in a motorcycle, but it cannot, however, be applied when the "V" type, two cylinder motorcycle motor is used.

Chain driven trucks cannot be operated satisfactorily where soft sandy or muddy roads are encountered. They are essentially good roads trucks.

As an automotive principle the four wheel drive was surely vindicated by the Militor and the F.W.D. trucks. It is believed that the Militor is the most powerful wheeled motor vehicle constructed up to the present time.

(f) Vehicle Controls: The steering gears gave very little trouble, but better lubricating facilities are desirable, to secure the ease of steering which is so necessary on a motor truck, especially when operating on heavy roads, as some types are very hard to operate on rough roads, especially the F.W.D.

On the White trucks the brake rods are placed too close to the springs and there is frequently wear between these parts.

(g) Front Axles: There were no front axle troubles due to any inherent mechanical faults.

(h) Rear Axles: No serious rear axle trouble developed on the road, other than stripping some teeth out of two Dodge ring gears. All worm gears operated without any signs of overheating under the heaviest pulls. Increased ground clearance under most rear axles would be very desirable. The rear spring shackles on the Garford show interference with the frame.

(i) Wheels and Tires: All trucks for military use should have cast steel wheels; and passenger automobiles for the army, wheels of the pressed steel disc type.

Solid tires for trucks should be of the Giant type instead of the Dual type, as the Giant type gives better traction and apparently stands wear better than the Dual type. This was especially noticeable in the deserts where a ridge of sand was pressed in between the two halves of the Dual tires, virtually eliminating the ground pressure of the tread, and thus reducing the tractive effort. Furthermore, the manufacturers have practically ceased production of Dual tires and are centering all their energies upon the construction of Giant tires.

(j) Chasses: The frames of all vehicles completed the journey with no apparent damage. All frames were in alignment, and only one case of deflection was observed. Rear bumpers should be placed on all trucks, and a stronger bumper, possibly with steel facing should be used on military vehicles. Many towing hooks straightened out under pull, and a much stronger hook should be developed.

(k) Bodies: 1½-ton White and Packard trucks had to have the body sills cut out for wheel clearance, and the necessary change in body design should be made.

Tankers are overloaded and the center of gravity is too high. Slush was responsible for one overturning. Bumper should be in rear of faucets, to protect them.

A White Reconnaissance Car should be used as a service car by every Service Park Unit, with a sliding bench under the body. It would carry 12 men where the G.M.C. carries only 10 men.

Whenever a train is started out for other than experimental purposes, the trucks should be of the same type and tonnage, thereby eliminating the number of spare parts necessary to be carried.

For the mobile army light trucks not to exceed 2-ton capacity should be the practice. The heavier trucks should be used in the rear areas only.

With reference to shop trucks, no fixed tops should be used. The general scheme of using bows and paulins should be followed, because the fixed top is unnecessary, as it adds to the weight of the truck and often is an encumbrance in the passage of low bridges and low hanging branches.

The equipment on the machine shop trucks should be rearranged to provide greater accessibility, placing the motor-generator set where the lathe now is, and locating the lathe transversely at the rear of the body. A double bench could then be placed across the body at the center with the drill press on one end and the grinder on the other, and four vises of various sizes and types could be attached as convenient.

Some provision should be made on all trucks to permit both sides of the hood to be folded up and securely retained in that position. This would enable two men to work on opposite sides of the motor at the same time, and would make it possible to increase the circulation of air around the motor in very warm weather. A more sturdy form of hood clip should be developed.

The rope cleats and stake pockets all worked loose and a better means of fastening them should be used.

Floor boards are too weak, and should be made of heavier gage stock. Laminated floor boards did not prove to be satisfactory.

(1) Equipment: The non-skid chain devices furnished by the Challoner Co. were very satisfactory and could be adjusted more quickly than other makes.

Horns loosened up from vibration, and should be more securely attached to the body.

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Tool boxes should be of heavier construction in order to withstand the very hard usage to which they are subjected in the field.

10. RESULTS:

It is the opinion of the Ordnance Observer that the First Transcontinental Motor Convoy, as the pioneer undertaking of its kind, was a successful operation, and that the experience gained during this trip will prove invaluable, not only to the Army, but to all users of motor trucks in general.

All along the route, great interest in the Good Roads Movement was aroused by the passage of the Convoy, and it was reported that several states had voted favorably on large issues of road bonds. However, the officers of the Convoy were thoroughly convinced that all transcontinental highways should be constructed and maintained by the Federal Government, because the sparsely settled states of vast area in the Rocky Mountain region are absolutely unable to finance their own sections of such a project. The Townsend Bill, now before Congress, provides for just such an undertaking under a Federal Highway Commission, and it is earnestly hoped that this measure may be favorably acted upon at an early date, in order that the nation may be ready for the commercial "Ship by Truck" movement.

Although the number of enlistments actually secured by the Recruiting Officer was not large, great interest in the various activities of the Army was stimulated throughout the regions covered by the Convoy, and reports from Recruiting Stations indicate that several hundred recruits were obtained as a direct result of the Convoy.

The interest of the general public in the Convoy was evidenced by a whole-hearted hospitality which never failed from beginning to end of the trip, and which was quite as spontaneous in the small towns as in the larger cities. Everybody was glad to see the trucks and the men, who were showered with every variety of refreshments all along the route. In the larger towns and cities, luncheons and dinners were served, entertainments and dances given, and the clubs and many homes opened to the entire personnel. Great credit should be given to the Red Cross Canteen Service, the War Camp Community Service, the Knights of Columbus, the Y.M.C.A., the Chambers of Commerce, the Commercial Clubs, the Elks, and many similar organizations who served the Convoy with distinction all the way "from Coast to Coast."

In the operation and maintenance of a motor truck train many valuable lessons were learned, which warrant the following recommendations:

That extended use of triangular signs, bearing the designation of the unit using them, as road markers is invaluable.

That there should always be a very careful inspection of all vehicles for the proper amount of gasoline, oil, and water before departure on any run, no matter how short.

That a light touring car or light delivery car replace the present motorcycle with side-car, which cannot negotiate soft, sandy or muddy roads successfully, and is a single purpose vehicle.

That Class B trucks are too heavy for use in the field, except in the rear areas on good roads and over strong bridges.

That only trucks of the four-wheel-drive type be used with artillery, because of the ease with which they negotiate any sort of rough terrain, sand or mud, in any kind of weather.

That two Class A trucks be used instead of one Class B truck wherever there are unimproved roads or doubtful bridges.

That every Service Park Unit and Repair Base should have a Militor with winch for wrecking.

That the Militor should have a longer and stronger sprag, of the artillery type, similar to the spade of a gun carriage trail; or perhaps two such sprags, one on each rear corner of the frame; that the cable reel should be placed on a squared shaft to facilitate rewinding, and should be located ahead of the winch and guide sheaves which should have universal support.

That spare parts trucks should have a stock record card system, and that the arrangement for packing the parts be improved so that such articles as bearings may be protected with individual boxes or cartons.

That the Harley-Davidson Motorcycle is the most desirable for military use.

That every effort be made to cooperate with carburetor manufacturers toward the production of a carburetor of the jet type suitable for use on motorcycles.

11. APPENDICES:

The following appendices are submitted with this report and form a part thereof: