

Rhodes: I think Mr. Paget has two or three pictures of this Snow-Bug that were sent in, and they will probably be available for anyone who wants to look at them.

Paget: We also have some slides and will show them a little later.

Clyde: I think you have all read about the "Weasel" in the Saturday Evening Post. I am going to ask Mr. Nolan, of the Corps of Engineers at Portland, read us Mr. John M. Allison's paper about the Weasel.

THE ARMY WEASEL  
ON  
SNOW SURVEY WORK  
BY  
JOHN M. ALLISON

The Army Weasel was born of the necessity of war. In the spring of 1942, allied strategy demanded a surprise invasion of Norway. For such an invasion, an entirely new vehicle was desperately needed. The vehicle had to be small enough to be transported by a plane, light enough to be dropped by parachute, strong enough to carry 1200 pounds, must have a speed of at least 25 miles per hour, and must be able to cross bare ground, soft snow, forests, swamps, and to climb steep slopes.

The story of the development of the Weasel is long and awesome. Many of the Nation's outstanding technicians, including engineers, meteorologists, physicists, explorers and sportsmen collaborated in the project which had a priority equal to that of radar and the atomic bomb. The job of production was one demanding American production methods. Hence the technical problems were assigned to American specialists for solution. However, Canadian technicians worked simultaneously and independently upon the same problem. It has been noted that the final specifications developed by the Canadians were almost exactly identical to those developed by our own technicians.

After many weeks of well-nigh unprecedented working pressure, many tests and revisions and much personal hardships our technicians announced that they were ready for a real production schedule, only to then learn that the invasion of Norway had been called off. However, the Weasel proved invaluable in the sands of North Africa, as well as in the muck and swamps of the South Pacific. The caterpillar tracks have a way of finding ample traction where more conventional vehicles are helpless.

The "M-29 Weasel" which is in use for snow survey work in the Portland District of the Corps of Engineers has a gross weight of 4,900 pounds. It is powered with a Studebaker Champion engine and has a top speed over dry level surface of about 35 miles per hour. Six forward speeds give the "Weasel" an advantage not commonly found in other similar vehicles.

The caterpillar tracks are 20 inches wide and on level dry ground the bearing surface is 80 inches in length. Roughly, this gives a weight load of one and one-half pounds per square inch of contact surface. However, in snow, the total contact surface increases to a length of 104 inches, thus changing the weight

load to approximately one and two-tenths pounds per square inch of contact surface.

In new fallen snow the "Weasel" sinks to a maximum depth of about 18 inches, compacting the snow in such a manner that a man can walk along the tracks without skis or snow shoes. As would be expected, the depth to which the weasel sinks in snow cover decreases with increasing snow density.

Carrying four men and a full load of snow survey and miscellaneous equipment, the weasel will travel over steep and snow-covered terrain at speeds up to ten or twelve miles per hour. The driver's seat is situated directly in front of the machine and beside the motor. Three additional bucket seats are provided in the rear. A canvas top and side curtains provide very ample protection from the weather.

The machine does have a tendency which for some uses might well constitute a serious weakness. That tendency is to slip rather badly on steep side slopes, the rear end being prone to swing down hill. It is this side slipping motion which more than any other feature tends to throw the weasel's tracks.

The "M-29" has a reputation, which in the opinion of this writer is wholly undeserved, as a temperamental creation which throws tracks with or without provocation. This is probably a result of worn or poorly repaired equipment and should not constitute reason for blanket condemnation of this versatile machine.

In this season's use to date our Willamette Basin snow survey party has partially thrown one track. This was replaced without serious difficulty by the party.

An excellent job of engineering has been done in the distribution of the weight of this vehicle. When in motion in a deep snow cover, the front end raises slightly, but not in amount sufficient to interfere with visibility through the windshield. When forward motion over deep snow is halted, the front end sinks sharply but this does not offer any difficulty in again resuming forward motion.

The snow courses surveyed by personnel of the Portland District of the Corps of Engineers are situated off the mountain highways and are accessible from such highways by skis. Thus far, therefore, our chief use of the weasel has been for travel along unplowed mountain roads. Unlike some other types of snowmobiles the weasel does not have to be trucked off the dry highways to the snow fields, but without any adaptation or conversion of running gear can go directly from pavement to snow, sand or mud. It is easy to handle and is sufficiently compact to be placed upon a trailer, if such procedure is desired, for long trips to or from the snow fields. For the uses to which we have put the machine, it has been most satisfactory.

Nolan: The Weasel has a gasoline capacity of 30 gallons; it gives an overall average of about 7 miles to the gallon; cruising range about 200 miles. Any questions?

Work: Mr. Nolan, assuming one was to buy a Weasel, an individual lacking army connections, how much difficulty would he have in securing repair parts for that machine, this year, next year, and thereafter?

Nolan: I imagine he would have a little difficulty. Studebaker, as I understand, has stopped their production. We have had trouble with the machine, but were able to get it readily repaired by Studebaker. So we are not having

trouble, but as far as buying new parts is concerned, I imagine an individual would have difficulty, because the company has stopped production.

Work: Have you determined the hill climbing ability?

Nolan: No, we really haven't. We have taken it up slopes of a 35% grade; that is all.

Work: Soft snow or hard? What type and how deep?

Nolan: It was soft, new snow, about five feet deep.

Work: And a 35% grade?

Nolan: Yes.

Clyde: Ever get stuck on high centers?

Nolan: Never been stuck yet.

Kraebel: I have never seen one go half a mile without losing track. Nor one out of three, I might say, off a paved road.

Farrow: I had occasion to use it in Germany. On the whole its performance was good. It lost some track under extremely bad conditions.

Nolan: I believe any tracks under good conditions won't give too much trouble throwing. It is when they get old and stretch. That rubber track is bound to stretch when it gets old. Any other questions?

Clyde: I would like Mr. Murphy to tell us about his experience with the Weasel.

Mr. Murphy: The weasel seems to have two or three strikes against it already but I will try and present you information that shows it has some points in its favor. I have a couple of pictures I will pass around to give you a better idea of what it looks like. The Seattle Engineer District was able to obtain an Army type M-29 snow weasel out of surplus Army supplies at the Mt. Rainier Ordnance Depot last November. The weasel is used in the snow reconnaissance in the Puyallup River Basin of Washington in which basin Mud Mountain Dam is located. It is part of the snow research program carried on jointly by the Weather Bureau and Corp of Engineers.

We do not claim it to be the best vehicle for all types of snow travel but believe it to be better suited for our specific use than any other available transportation at present. To appreciate its adaptability one has to know its use. Weekly or semi-monthly snow reconnaissance surveys have been made on two routes in the Puyallup basin this season starting from the snow line which may be as low as 1,000 or 2,000 feet, and reading courses at each 500 feet difference in elevation up to 5,000 feet elevation.

The basin is located on the west side of the Cascades near the slopes of Mount Rainier. The weasel is carried on a  $1\frac{1}{2}$  ton flat bed truck over the plowed roads to about elevation 2500 feet. The weasel is then used up to elevation 5,000 feet which is the upper limit of our survey.

One route is Corral Pass road which is a typical forest service access road being a narrow winding mountain road with a 12.5% average grade.

The other route is up Mowich Road to Lake Mowich which is within Mount Rainier National Park. The road is a graveled Park Service road through heavy timber on a flat 5-8% grade. Any means of snow transportation would be satisfactory here except for one bothersome condition. In numerous places, springs on and adjacent to the road run across it in little rivulets which melt and erode a channel down to the road thereby leaving washouts in the snow which may be 4 to 10 feet deep and 8 to 20 feet wide with very steep banks (indicated). The weasel has to climb down into some of these holes and chew its way out the other side.

In general there has been 8 to 14 inches of new wet snow on top of the old pack when the surveys have been made but this has varied from 40 inches of new light snow to the last survey which there was no new snow and the old snow was consolidated to a density of 20 - 25 percent.

No trouble has been encountered in climbing or descending hills in both new and old snow; hills of 45% slope could be negotiated without trouble. In deep new snow the tracks usually sink down 14 inches and the adjacent snow falls down on top of the lower track. This doesn't interfere unless the weasel is slipping sideways which occurs when traversing a side hill. The snow balls up behind the drive sprocket and causes jumping of the drive sprocket; if this were allowed to continue the weasel would no doubt stall or may throw a track. In this new snow the weasel is limited to slopes of only 10%. In consolidated snow no trouble has been encountered in traversing slopes up to 30%.

In 11 trips to the basin four mechanical failures have occurred. These were due to inexperienced operation of the weasel and faulty repair. As near as can be ascertained all the trouble began when the front right idler wheel was sprung and the axle bent when the weasel landed too hard on the roadway of one of the washouts on Mowich road previously described. After that, the right track was thrown 3 times before the trouble was ascertained. These breakdowns occurred while turning around or traveling on side slopes in new snow of 3 to 3½ feet. In straightening the axle the U-bolt hangers for the front right spring were overheated and on the next trip out they broke so we had to return riding on the track. With this fixed, no trouble has been encountered in the last 3 trips.

It seemed that trouble was only met when the tension on the tracks was loosened which occurs on side slopes and backing. We planned to re-inforce the boogie wheels to keep tension on both the upper and lower track at all times.

Outside of ironing out the original difficulties encountered in any piece of equipment foreign to a person, the weasel is operating fairly well. The speeds average 5 to 10 miles per hour when breaking trail and 24 miles per hour on traveling the original trail down hill or on level in shallow snow. It is able to carry all the equipment and personnel inside the weasel and under cover out of the weather. The equipment does not have to be packed as it would have to be if kept on a sled, which is a considerable saving of time figuring on the frequent stops of the weasel. It is also short enough to maneuver into heavy timber for taking a measurement there.

The history and use of the weasel was written up very nicely in the last edition of the Saturday Evening Post. Reading that article, you would think here

was the solution of all our problems. It was the solution of the Army's problem, and it could be the solution for snow survey work if the time was spent to alter it, having in view that particular purpose.

If there are any questions, I will try to answer them.

Clyde: Thank you, Mr. Murphy. Any questions?

Work: Do I understand the machine will climb a 45 degree slope, or a 45% slope?

Murphy: Maybe I said it wrong. It is a 45% slope.

Parsons: No trouble with the machine freezing if left out overnight?

Murphy: No, we don't leave it out overnight. We take the machine from Seattle to Enumclaw, about 50 miles away, on a 1-1/2 ton flatbed truck, get back to town, and leave it in the garage, and go up the other side of Mt. Rainier the next day, so we have never left it out overnight.

Rhodes: May I add to that? The one we have in Montana has never been in the garage since we have had it; it sits outside all the time. But the Weasel is equipped with a preheater underneath the engine; and if the equipment has been sitting out in slush, cold weather, etc., the instructions are that the preheater is to be used before the unit is moved. Its gasoline heater has a switch to pull to turn the preheater on. It is similar in principle to the Stewart-Warner heater for automobiles, it not only heats the engine up but also the unit inside, and circulates the heat around so it melts the ice in the tracks. It takes ten to fifteen minutes to heat and burn itself out; then just push the button and it is ready to go.

If I may continue with one or two other things. I possibly have at times condemned the Weasel. I am not condemning the Weasel in itself. It was the first thing designed for a multiple purpose; the machine was not designed for just snow alone. I condemned it for the use we have to put it to over there, on very soft, very dry snow. The machine, literally, when you try to use it under such conditions will wallow like a cow in a mud hole. However, we have used the machine where it is flat and good going, and we have pulled trucks and cars out of the snow on the highway, and it does a swell job. I have an excellent mechanic working for me; he knows the Weasel. I also have a man who used the Weasel overseas. He concedes this man who used the Weasel overseas, that when they get into soft snow on side slopes you have to be careful; she will not navigate it.

My mechanic will not give up trying to do a good job. He knows it is a good machine, and our trails are narrow. There may be very thick snow on the trails. Where you are close to trees, the first thing you know the unit slips against a tree. If we get out of that hole without the track coming off, we breathe a sigh of relief. When we take it anywhere, we have a jack and wooden spokes put in the back, so when it throws track we can jack her up and jiggle the tracks on again.

On side hills, with so much weight on the side, it does not level itself like the Tucker Sno-Cat will. Sticking one wheel, and spinning the other. The Tucker Sno-Cat levels itself. The Weasel doesn't do that. The tracks are tight; we haven't had any trouble with ice or snow building up on the drive sprocket, forcing the track off, which we understood would happen. Our trouble has all

been caused by the shifting of the weight in dropping into side holes or side slopes.

The machine has performed fine <sup>at</sup> speeds up to 25 or 27 miles an hour, a couple of times. It does a swell job of supplementing our transportation over there; we can use it to get back and forth from our "lab" so the Weasel isn't to be condemned for the purpose for which it was built.

I might add one other remark. We were going up through the timber and the snow was perfectly level, on a fairly good slope. Suddenly the rear of the machine practically stood on end. There was a stream under there, and we had broken through the snow. That machine stood on end; we were in the back of the machine with our feet up in the air. We got out of that without shoveling one scoop of snow. We eased it slowly, getting the front end down, worked it back and forth until she righted, took her out and away we went. So the machine has a lot of good points. I condemn it only for the conditions we have had to use it under.

Clyde: Summing up this discussion on the Weasel, Fred Paget has just passed me a note which says, when the Weasel gets on a side slope, it is "Pop goes the Weasel." I am wondering if these photographs of the Tucker Sno-Cat could be turned back to the table here, so we might show these other machines.

Some of you are familiar with the M-7, which has two runners in front, on the engine. This machine, for certain conditions, is very satisfactory. I understand, Mr. Codd you have one.

Codd: It just came today. We are looking forward with anticipation, however, to the T-27, which is the motorcycle of this type of equipment. Only thirteen of those machines were built by the Allis-Chalmers Company. It consists of a half track with a couple of runners under the engine. It weighs only 650 pounds; is 36 inches wide, and seven feet long. It is driven by means of rubber belts with tracks on them, by means of friction against the rear drive wheel. This machine will carry two men and tow two additional men. We have had 1200 pounds on one, and operated it at 5,000 to 11,000 feet elevation in all kinds of snow. This machine may get into a hole, as most other machines do, but you can get out rather easily. It is transported by means of a panel body truck--just open the back doors and drive it in. It is a garage in transit. We used that for about 400 miles this last spring, and then returned it to the Allis Chalmers Co. The \_\_\_\_\_ Company have taken it over and are remodeling it now, on the basis of certain things they found out about it. It does offer a lot of promise. I have tried several, and it is my choice, as far as our type of country goes. We have fairly hard snow.

Clyde: Now at this time we are going to have a recess; and after the recess I want to call everyone together for our business meeting. First, however, just a few slides showing the Snow-bug. Mr. Paget had an explanation of the Snow-bug from Menson. In writing about it, he said, "We took all the bugs out of the other machines and put them in this one, to make it go. So we called it the Snow-bug."

WHEREUPON, the meeting recessed briefly, at 10:10 P.M.

Editors Note: A letter dealing with the M-7 snow tractor of the army written by Ashton Codd to George Clyde subsequent to the Sacramento meeting describes another snow traveling machine and is reproduced here:-