

under the control of the division engineer. The plan worked on the whole remarkably well, largely on account of the personal ability and experience of the two divisional chiefs, H. T. Morrison and J. F. Rose.

The parties worked winter and summer, enough supplies being brought in during the late summer by the water routes to convenient points, at which caches were made, and from these they were distributed as required by dog teams to the various camps. These caches were placed as far as possible ahead of the work, rather than behind. The moral effect upon the spirits of the men, owing to the feeling of security thus engendered, was of marked value. As a matter of fact, there was no real privation at any time through shortage of food, practically no sickness, and very little accident. Some men mutinied at one point, tried to find their way out alone and got frostbitten and half starved; two others were drowned, but in neither case was anyone but themselves to blame. One died from the effects of alcoholic poisoning on his way in. One engineer came out of the woods to die of a disease contracted years before. These represent all the casualties.

On the other hand, the standard of comfort was maintained to practically the same level as on similar work nearer home. The tents were roomy and well heated, and the food was the best which could be obtained. A special mail carrier was attached to each division and made regular trips (by canoe in summer and on snowshoes in winter) over the 75 to 150 mile gap which separated the parties from the C.P.R. Fresh meat was often obtainable and fish almost always, except in midwinter.

One remarkable exception to the general standard of comfort was on an expedition organized by the western divisional engineer through an exceptionally inaccessible belt of country, which it was urgently desired to finish before the spring breakup. Mr. Rose discarded all his white staff except those absolutely necessary for the instrumental work and retained 17 Indians of the country. Tents were abandoned in favor of enough canvas to cover the wigwam. Heating and cooking were done on an open fire in the centre. All the camp impedimenta and provisions were carried on the backs of the men at one trip. It is sufficient to say that in spite of temperatures lower than 50° below zero, the party emerged from the woods three months later in the best of health and spirits and with the work satisfactorily finished.

In one respect the survey parties in this north land had a great advantage over the Antarctic explorers about which so much has been heard lately. Fuel and shelter from the wind were always within reach. On the other hand the light fleecy snow of the north land is incomparably more difficult to travel on than the wind swept wastes of the South Pole. And one is led to wonder whether the British sailor is after all the right man to carry through successfully such expeditions as that of Capt. Scott, and whether the north country Indian or Esquimaux, under competent leadership, is not the proper person.

The half breed runner has been known to make 100 miles in 24 hours on snowshoes. The writer had made 70 miles, and 40 to 50 miles was an ordinary day's work a generation ago. But these men were brought up to it from childhood. No man, however strong, could hope to keep pace with them unless after years of practice. They travelled with the

simplest and lightest of outfit; a rabbit skin blanket, a sheet of cotton to keep off the wind at night, a copper teakettle, a tomahawk and a frying pan. This was the outfit, and it was such men as these who accompanied Dr. Rae to the Arctic and men of a kindred race who went north with Peary to the Pole. Nansen made one of the most remarkable journeys in history, in comparative comfort, because he had studied their methods and modes of life during years of residence among them. There are still waste places on the earth to be explored and mapped, and the explorers will do well to attempt merely to improve the methods which have enabled the natives to live and thrive under the local conditions, not to revolutionize them.

#### Equipment and Camp Outfit.

The outfit of these survey parties was an interesting study in itself. The principal consideration, of course, was transportation. The northern wilderness is for the most part a hopeless jungle of growing and fallen timber, with precipitous rocks, swamps or muskegs, and lakes and rivers intersecting it in every direction. Continuous travel on foot is difficult and exhausting, and the use of pack animals impracticable. But the numerous lakes, ponds and streams afford good (though broken) navigation, and the universal means of travel in summer is the canoe. At first this was the birch bark canoe of the native Indian, a wonderful construction built entirely of the products of the local forest, but extremely delicate and unfit for use by any but practised white men.

Next came the basswood or cedar canoe, built roughly on the Indian models. It was much stronger and more speedy, but also heavier, and weight is a very serious matter on the portages. A still later arrival, and one coming into general use, is the canvas canoe. I believe this came originally from Maine, and it is now brought to considerable perfection. The construction, except for the canvas skin, is very like that of the Indian; but the white man's tools and metal fastenings give him a great advantage over the native, and wonderful as the Indian's work is, considering his facilities, the civilized product is better. The canoes for the C.N.R. surveys were built by the Chestnut Co., in Fredericton, N.B., but its models were rejected in favor of that of the aboriginal craft, and both models and construction were a decided advance on anything previously used.

Tents were also experimented with, and a number of different styles were tried. Here again lightness was essential. The final evolution was a roof of best 8 oz. duck, with back, front and walls of light drill. Shelter being almost always available and windage unimportant, the walls were made unusually high (5 to 6 ft.), adding much to available room inside.

Bedding for summer consisted of the inevitable woolen blankets, but in winter the extremely low temperatures render these insufficient for the ordinary man, even when made into a sleeping bag. The rabbit skin blanket is the most perfect substitute which the red man or anyone else had evolved up to a few years ago, but latterly the eiderdown quilt has superseded everything else. This, made into a sleeping bag, with a protective covering of duck, has been a very satisfactory solution of the bedding question. A well fed man can sleep comfortably in a snowbank in one of these bags with the thermometer at 30° below zero.

Transport in winter is accomplished over practically the same routes as in summer, the ice on the lakes and rivers forming the road. The toboggan takes the place of the canoe. Experiments have been tried with broad runner sleighs similar to the kometric of the Esquimaux, and under certain circumstances they are admirable. But they need a broad, open road and a fairly hard one, and this they only get on the larger lakes. The portages are too narrow and generally too soft, and the flat narrow flexible toboggan is the only thing which is universal in its adaptation. It is generally made of the native birch, and is another Indian creation which has been little improved on by the white man, although steel screws, tire bolts, and even steel wire ropes have of late entered into its construction to replace the lashings of rawhide.

The hard wood gives a minimum of friction in cold weather, but towards the breakup of winter the wet snow not only makes them difficult to haul but roughens and rags up the wood. Low wooden runners, shod with steel, are then sometimes used as an adjunct, but they are awkward things to carry about during the long winter and the period of wet snow is so short that they are often omitted. Dogs are used for long distance work and rapid travelling.

The most important part of the winter outfit is probably the snowshoe, and it has been one of the hardest to get of serviceable make. The snowshoe the Indian makes for himself is good, but those he makes to sell are the reverse, and those sold by the dealers in civilization are almost useless. The Fredericton firm has taken up this branch of manufacture of late, and is supplying a very good article.

Cooking outfits have also been the subject of much study and experiment. For light flying expeditions, the open fire is all sufficient, but for a large party requiring a variety of food it is difficult in these days to find a cook who is willing to operate on one. In stormy weather his job is not an enviable one, the baking of bread especially being very difficult. Further, the open fire necessitates a very large quantity of dry wood, which is only obtainable anywhere by virtue of much chopping and hauling and sometimes not at all. In any case it takes a helper's whole time to keep the cook supplied. Sheet steel cook stoves have been brought to a fair state of efficiency, but they are still cumbersome and heavy.

#### Instruments.

The surveying instruments would seem to be the most important of all, but as a matter of fact they caused little worry and few accidents occurred. American patterns were used almost exclusively, and the simplest and lightest were preferred. One of the worst faults with the smaller instruments was the small diameter of the milled head of the leveling and clamp screws, necessitating the removal of the mitten for every adjustment. Stadia wires or a gradiometer attachment for the measurement of distances were essential, in fact much of the exploratory work was carried on by micrometer work. A vertical arc on the other hand was worse than useless, merely so much more weight to be carried.

The dumpy level was the favorite on account of the greater need for ample light than for great magnifying power. For one reason or another long sights in thick woods are seldom possible in any case, and in midwinter in these latitudes the day is only eight hours long