Diesel oil begins to solidify at 30 below - Mercury thermometers freeze at 38 below - storage batteries lose more than half their power at low temperatures. A man literally can freeze his lungs by gulping too much air at minus forty. Rubber tires freeze solid and crack. Engines won't start. Drinking water freezes in a few moments. Instruments with delicate moving parts often "freeze" because of the different contraction properties of different metals. Steel becomes brittle and snaps or shatters. Food rations freeze so solid that almost everything must be heated in the field. Much of the food must be thawed out and then cooked or heated as two operations. The frozen ground lacks conducting properties for the grounding of signal corps, radio, telephone and telegraph equipment. Radio waves are freakish and often black out completely. To keep warm a man must wear such heavy mittens and boots that he cannot easily operate instruments and knobs, nor depress the clutch of his vehicle without also applying the brake. If he touches any metal with his bare hands his skin tears away when he tries to let go. Medicines freeze and burst their bottles.

We are trying to find ways of making this business of keeping alive easier so that more time can be left for other activities. As you can imagine, this involves a tremendously wide field of experimentation and trial.

If a soldier can overcome the problem of living and thinks himself ready to fight he finds: Exhaust pipes issue vapour clouds which would betray a unit's presence miles away; camouflage is virtually impossible because of tell-tale tracks in the snow and the prominence of any shadow against the whiteness; a wounded man would freeze to death rapidly if help were not forthcoming; even after he is picked up it is extremely difficult to keep him warm.

Clothing, of course, is a first consideration. There are two approaches to the problem. The first is the "layer principle" which consists of bundling a man up with all the layers of insulating and windproof clothing he can carry. This method has been found to have serious drawbacks, one of which is that when the men exert themselves even in the coldest weather they perspire. The perspiration freezes and destroys the insulation of the clothing and threatens the man himself with exposure. In opposition to this the "vapour barrier" principle has been developed. Here, as in many other instances we have learned a great deal from the Eskimo, and vapour barrier clothing is patterned as closely as possible after the Eskimo trousers and overshirt. They should be made of caribou skins, but there are not enough of them. While it is not so good, we are getting a very fair substitute in rubberized nylon. On top of a string shirt and ordinary cotton shorts, service men wear a parka lined with non-absorbent material, which prevents absorption of perspiration. As the clothing is loose, permitting the air to enter up the pants' leg, under the bottoms of the parkas and down the necks, perspiration is allowed to evaporate and the body is kept at a normal temperature. Men who have worn them said it felt like entering an air-conditioned theatre on a hot day, so cold that they hesitated to leave camp in them at first. After a hard trek they could pat themselves on the chest and puff out clouds of white steam created by body heat and evaporating sweat. Extensive tests showed that what we now have worked well at temperatures below 40 below zero. One doctor found he could sleep in a snowbank for several hours in a "vapour barrier" suit before the cold would awaken him, although it was 38 below zero with a wind of 10 miles per hour.