DISTRICT HEATING

October-November 1973

District Heating in Finland

Solid Waste Recycle Energy System in Akron, Ohio

District Heating in Sweden

Energy Conservation in Eugene Oregon

IDHA Board Addressed by OEC's Assistant Director

1974 Annual Meeting Committees

AN OFFICIAL PUBLICATION OF THE INTERNATIONAL DISTRICT HEATING ASSOCIATION
PUBLISHED QUARTERLY SINCE 1915

District Heating In Finland

by **U. Halme**
PARAISTEN KALKKI OY
Pargas, Finland

PARAISTEN KALKKI OY is a member of IDHA.

Because Finland is located in the northern part of Europe between the 60 and 70 degree parallels of latitude, many persons who have not visited our country, believe that we have an arctic climate similar to that in the northern part of Canada within the same latitudes. The Gulf Stream, however, warms our climate considerably, so that even in the wintertime the weather is quite bearable, and in the summer the climate is relatively warm.

The heating period, however, is rather long. If the number of days when the average temperature registers below 12 C (53 F) is considered as the length of the heating period: Fig. 1 shows the average number of heating days from 1901-1930, and the importance of district heating. However, as the population of Finland is only about 4.8 million, or a density of about 16 people per square kilometer (km) or eight per square mile, there are definite borders for the extent of district heating. Almost all the fuel required for generating thermal energy is imported, because there are no coal, oil, or natural gas supplies in the country. In a few district heating plants, peat or wood chips are used as fuel because there are abundant peat deposits in Finland.

District heating began in a suburb area of Helsinki in 1953, although there existed some minor local heat distribution networks before that time. In Helsinki, steam district heating started in 1952, and 8.4 km (5.2 mi) of distribution mains were constructed. District heating by means of hot water began in 1957. During the 1950's, there was a limited growth of district heating, but in the 1960's a real advancement took place. As residential building increased, district heating also increased. Now, more than 600,000 people (about 12.5 per cent of the population) are supplied with district heating.

The major heat distribution plants have combined to form the Finnish Heating Plants Association. Its purpose is to promote and develop all phases of district heating, and to distribute information among the present 20 members of the Association. The heat capacity of the members' district heating plants is about 2,650 megawatts (Mw), and the total length of the district heating network 544 km (33.8 mi). The heat content of the fuels used during the year 1971 was 9,513 gigawatt-hours (GWh). The distribution of different fuels was as follows: coal 4,074.5 GWh, heavy combustible oil 5,012 GWh, light combustible oil 125.5 GWh and other fuels 301 GWh (statistics December 31, 1971).

When hot water district heating is to be used in some new locality, the thermal heat generation is usually arranged by a heat supply station; if there is no station in the area, portable plants are used. The portable heating centers have proven to be convenient, especially at the initial building phase while the required quantity of heat is still small. The capacity of the portable heating centers varies from 0.3 to 6.3 gigawatt calories per hour (Gcal/h). When a district heating network has grown large enough to warrant it, a heat-and-power plant or plants are then built to produce the required heat supply.

In Finland, the district heating systems are generally constructed as two-pipe hot water lines; in just one smaller area a three-pipe line has been built. The maximum temperature is generally 120 C (248 F), and the temperature of the return pipe is 70 C

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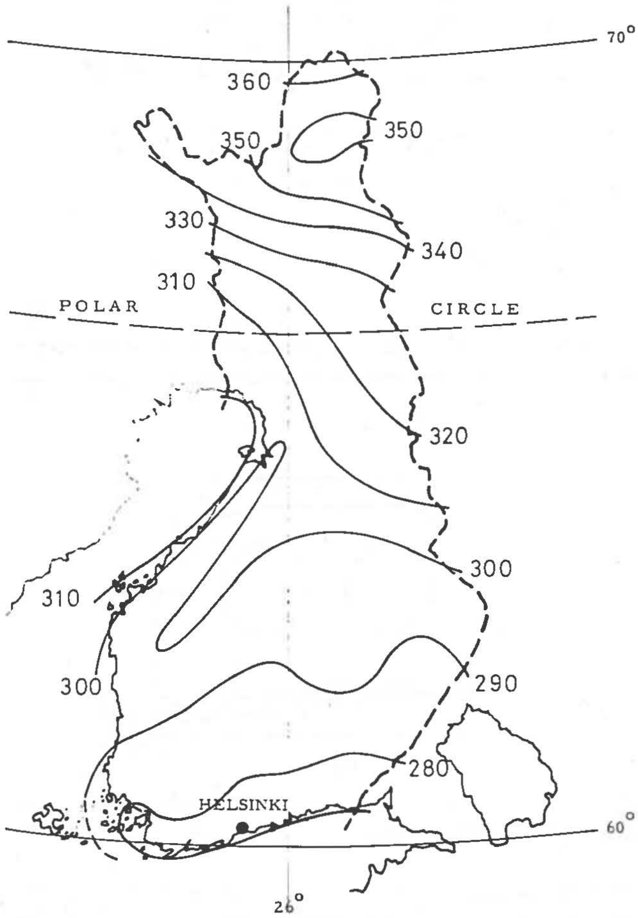

Fig. 1

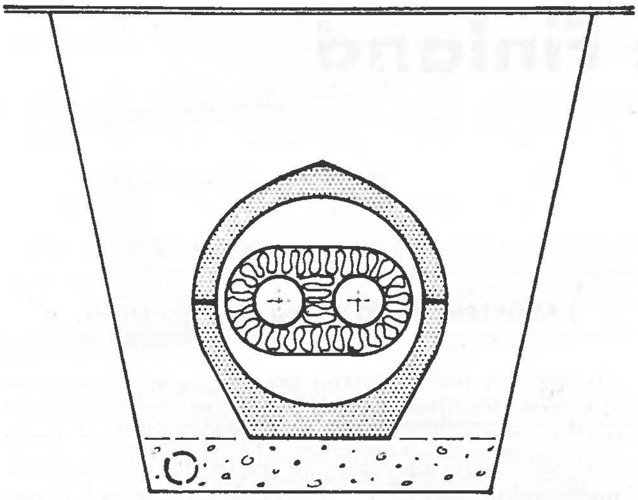

Fig. 2

(158 F). In the warm seasons, lower temperatures are used; a minimum of 70 C (158 F) for the flow water, and 45 C (113 F) for the return water. The constructional pressure of the pipes is generally 10 kilograms per square centimeter (11 barometers), or

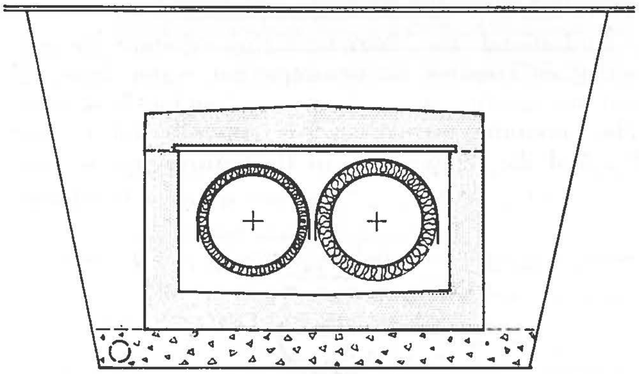

Fig. 3

in some cases 16 kilograms per square centimeter (17 bars).

The district heating lines are generally built in street areas and preferably away from the traffic — under the sidewalk, or alongside it. The pipelines

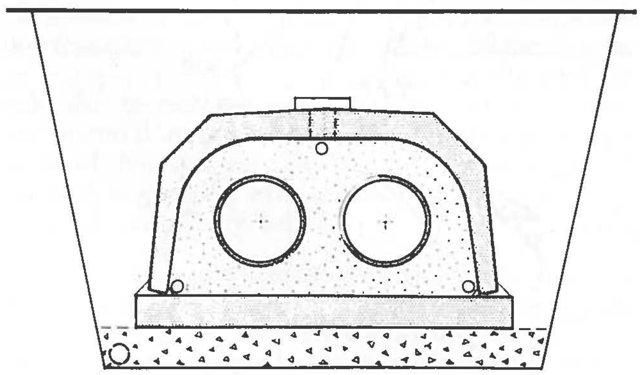

Fig. 4

are, in most cases, laid so that they are sloped; this makes it possible to drain out any water which might get into the insulation as a result of damage to the pipeline. Sufficient air space must be left between the heat insulation and the outer protective shell of the duct, so that airing of the duct is possible. In certain

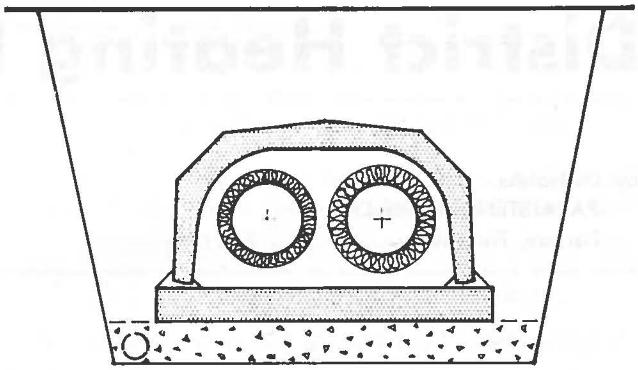

Fig. 5

factory-made elements, the airing space is in the space between the steel pipe and the inner protective thermal insulation pipe. Chambers are built into the pipeline, in which the fixed points, leading points

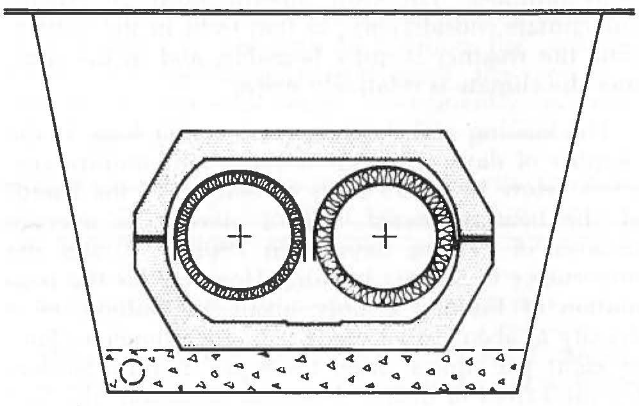

Fig. 6

and the axial bellows expansion joints are placed. In most cases, the pipeline branchings are constructed of watertight concrete.

The thickness of the chamber walls is generally 15-18 cm (5.9-7.1 in.). At the bottom of the cham-

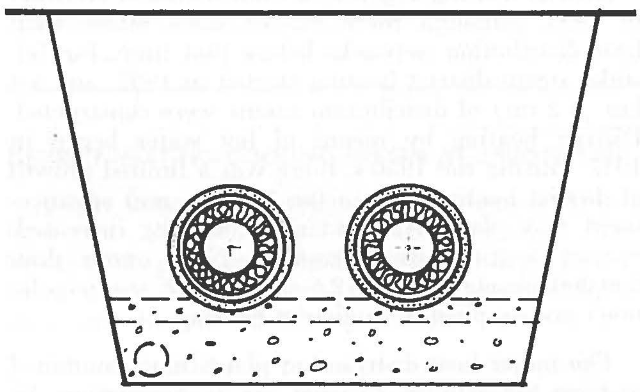

Fig. 7

bers, large enough openings must be provided so that if water leaks occur, the water will not flow out of the chambers and damage the next pipeline. The covers to be mounted in the concrete laid upon the chambers should, as a rule, be of watertight construction; at least in areas where water might possibly flow above the chambers, as in the case of thawing snow. The chambers are usually also equipped with airing pipes. The building of district heating lines, in most cases, is done by firms specializing in this kind of work. Some heating plants have construction departments of their own, which are responsible for structural engineering work.

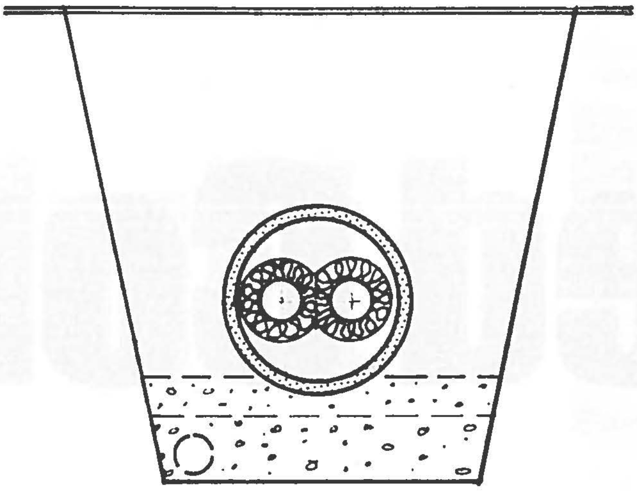

Fig. 8

In the beginning, in building heating lines, concrete ducts were mainly used (Figs. 2 and 3). The concrete ducts were later developed into semi-prefabricated ducts (Figs. 4 and 5). The fully prefabricated duct (Fig. 6) is now used in most installations. Duct made of split concrete pipes (Fig. 2) is not used much anymore, because it is very difficult to make a duct of this kind watertight.

In the beginning, light concrete was used as heat insulation in concrete ducts, but now mineral wool is almost exclusively used.

Factory-made district heating pipe elements have been produced in our country since 1962, when Paraisten Kalkki Oy took up producing Himanit-elements. In these, an AC pipe is used as an outer shell, with mineral wool insulation and steel pipes being fitted ready in the elements. The elements are fixed into each other by means of joints (Figs. 7 and 8). Fig. 9 shows a factory-made angle fixed point element, and Fig 10, a factory-made straight fixed point element.

Later, the factory started production also of polyurethane-insulated Himanit-elements, the use of which has continuously become more general. Now, more than 200 km (124 mi) of Himanit-elements have been installed in Finland. Various ready constructional components for the Himanit-system have

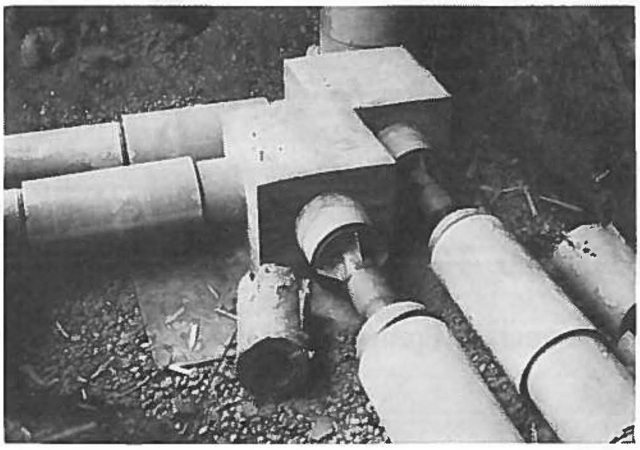

Fig. 9 — Factory-made angle fixed point element.

Fig. 10 — Factory-made straight fixed point element.

been developed, such as fixed points, an angle, and T-elements.

There is also an element on the market with an outer shell of HD-polyethylene, with polyurethane insulation and an inner protection pipe of polyester strengthened with fiber glass (Fig. 11). This element is used chiefly for service pipelines. Various prefabricated district heating elements on the market elsewhere in Europe have not won any acclaim in Finland, nor have the different water-repellant powders achieved any success.

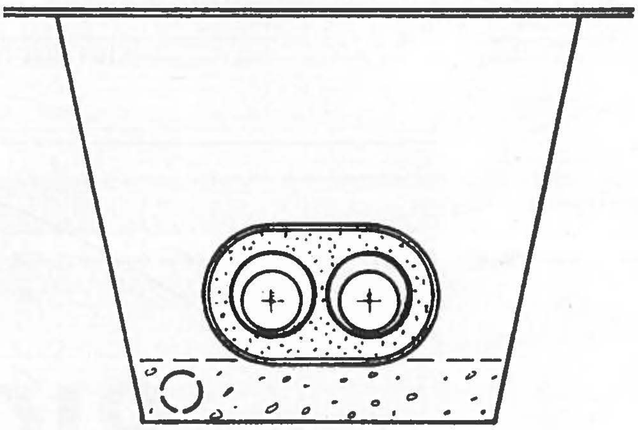

Fig. 11

When constructing heating pipelines, great attention is paid to the quality of work. A standardization of constructional parts for district heating ducts is desirable, and prefabricated parts are used as often as possible so that field work is kept to a minimum.

The future prospect for district heating in Finland is very good, and according to present prognosis it is expected to double in the next five years. It is expected that in the Helsinki area, heat will be supplied by nuclear power plants, during the 1980's. At present, a natural gas pipeline is being built from the USSR to South Finland, so eventually gas also will be used for district heating. Δ