
MOBILE AND STATIONARY EQUIPMENT FOR MELTING SNOW FROM THE URBAN PUBLIC SPACE

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Abstract: *The article presents a new category of technological equipments used to remove the fallen snow on the public urban spaces such as parking, airport runways, public roads and private spaces. It shows the principle of operation, structure and performance of such equipments, currently called snow melters, which actually are an alternative to the classic snow removal solution by transporting it to predestined locations, usually at long distances, which offers certain advantages, especially in terms of speed of decongestion of traffic, but also the interface with the environment, the removal of snow being an ecological process.*

Keywords: *Snow melters, mobile snow melters, stationary snow melters, urban snow melters, self-propelled snow melters, trailed snow melters*

1. Introduction

Snow melters are machines equipped with either electric heating systems or diesel, or gas burners that melt snow for the purpose of removing it from crowded urban areas, airports, parking malls and hypermarkets, parking facilities for hospitals, public institutions, business or exhibition centers, private spaces etc.

They represent an alternative to the classic snow removal solution by the transport with trucks outside of the localities and have a number of advantages such as: quick unlocking of the carriageway and the parking spaces, decongesting car traffic and deploying it safely, ecological snow removal by controlled discharge water. The water from snow melting is coarsely filtered and then discharged into the public sewer /rainwater collection system and from there to the treatment plant where it is decanted and then filtered.

Snow melting equipments may be self-propelled or semi-mobile. The semi-mobiles can be transported to various work points by fitting them on a trailed platform, and these are the usually of large capacity (18 ... 300 t /hour); are used to decongest large areas of urban agglomerations (roads, car parks etc.) or to airport runways when rapid release of functional spaces is required. The self-propelled ones are truck type and have lower capacities (3 ... 15 t /hour); are used in specific objectives of local units (parking of public institutions, hospitals, etc.).

The most famous manufacturing companies come from the USA and Canada: Snow Removal Systems [1], Snow Dragon [2], Trecan Combustion Limited [3], [4], Michigan Melters [5], and Aero Snow Removal Corp [6] and they have numerous models with snow melting capacities ranging from a few tons and up to 300 t /h and even more.

2. Technical solutions applied by construction companies

Generally, snow melting requires a heat source and a hot water tank and, of course, the other components for operating control.

Although all companies follow this general conception, the concrete technical solutions differ from manufacturer to manufacturer, solutions that differ according to the performance.

In principle, depending on the mobility of the equipments, there are two basic categories:

2.1 Stationary snow melting equipments

Figure 1 shows an example of stationary snow melting equipment, made by **Trecan Combustion Limited** [3], type **Trecan 20-SG**, 20-Ton stationary snow melter, with a capacity of 20 tons per hour, its burner 4.5 million BTU /hr can melt 50 to 100 cubic meters of snow with an average snow

density of 15 to 30 lb./ft. /hour, ie 200 to 500 kg /m³. The machine from Figure 2 is also a stationary snowmelter, type **Trecan 40-SG**, 40-Ton stationary snow melter, manufactured by the same company [3] with a capacity of 40 tonnes per hour, its 9 million BTU /hour can melt 100 to 200 cubic meters of snow with the same density.



Fig. 1. Trecan 20-SG, stationary snow melter [3]



Fig. 2. Trecan 40-SG, stationary snow melter [3]

2.2 Mobile snow melting equipments

Mobile snow melting machines are brought to the place where snow removal is needed, when is needed, and they are also of two kinds, namely:

- mobile self-propelled snow melting equipments, which have a towing vehicle dedicated to the machine, thus enabling it to move independently where it is needed.

An example of such equipment is given in Figure 3, which shows a self-propelled mobile equipment achieved by **Snow Removal Systems** [1], type **SRS M150**, which melts 150 tons of snow per hour with a BTU 35,000,000 burner.

Other self-propelled snow melting equipment is shown in Figure 4 and is produced by canadian company **Trecan Combustion Limited** [3]. The **500-PD** has a melting capacity of 500 tons of snow per hour, the six burners each of 14 million BTUs, with 84 million BTU / hr and is capable of melting 1.234 to 2.469 cubic meters of snow. The model 500-PD is a dual side loading snow melter and is designed for use at large airports and large city snow dumps.



Fig. 3. Self-propelled snow melter SRS M150 [1]



Fig. 4. Self-propelled snow melting type 500-PD [3]

Aero Snow Removal Corp. [6] achieves direct removal and collection snow equipments, Figure 5, but especially self-propelled snow melting equipments, both small size and large size, Figure 6, for large airports.



Fig. 5. Direct snow removal equipment [6]



Fig. 6. Self-propelled snow melting equipment for airports [6]

Aero Snow Removal Corp. has been clearing snow in airports, cities, municipalities, shopping malls, sports complexes, seaports and at commercial sites for more than 30 years. We are innovators in the snow removal and snow melting industry. Aero provides numerous snow removal services at major airports throughout the United States [6].

- trailed mobile equipment that can be driven by another vehicle. These in turn, depending on size and performance, can be with an axis, figure 7, two axes, figure 8, three axes, figure 9 and even four axes, figure 10.



Fig. 7. Model Michigan Melters with one axis [5]



Fig. 8. Two-Axis Trecon Model [4]



Fig. 9. Snow Dragon Three-Axis Model [2]



Fig. 10. Model Michigan 4-Axis Melters [5]

Snow Removal Systems [1] also has outstanding achievements in snow traction equipment. Thus, in Figure 11, there is shown a snow melting equipment type **SRS-P70** which, due to a burner of $17 \cdot 10^6$ BTU, has a melting capacity of 70 t / hour, and in figure 12, is shown a device snow melting type **SRS-P100**, which, having a $30 \cdot 10^6$ BTU burner, has a melting capacity of 100 tons per hour.



Fig. 11. Snow Removal Systems typ SRS-P70 [1]



Fig. 12. Snow Removal Systems typ SRS-P100 [1]

Deltamed Company, in collaboration with **Energo-Term**, achieved un prototype of snow melting equipment, presented in Figure 13.



Fig. 13. Snow melting equipment Energo-Term [7]

The equipment currently in the testing phase is called "**Urban Snow Melter**" and effectively melts the snow, and the resulting water is sent directly to the city's sewerage system, after a rough filtering, the equipment being thus environment-friendly [7].

3. Structure and functioning of snow melting equipments

To present structure and functioning of snow melting equipments, is used the data presented in [1], referring to the **SRS-P70** models shown in Figure 11 and the **SRS-P100** model shown in Figure 12. The components of the snow melting plant are mounted on the platform of a triple axle trailer, which has all the necessary accessories for public roads (electric brakes, signaling, towing hook etc.).

The melting plant is made up of three large subassemblies, shown in Figure 14: generator module and heat exchanger; the technical module; the snow melting tank.

The generator module and heat exchanger (1) is also composed of:

- the tank of heat exchanger that contains water for melting snow;
- the ignitubular heat exchanger that transfers heat from the hot gases to the hot water bath for snow melting;
- standard fuel burner (diesel) that produces the heat needed to melt the snow.

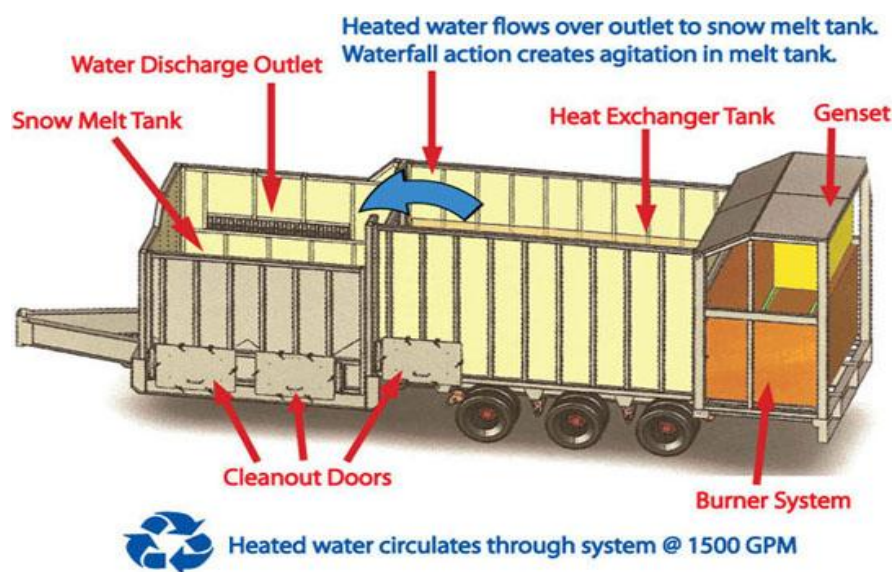


Fig. 14. The composition and flow circulation of water at the snow melting equipment SRS-P100 [1]

The technical module of the equipments (2) comprises:

- an electric generator with a thermal motor for producing the electric current needed for the plant equipment: burner, combustion fan, electric pump, electric panel etc.;
- a combustion fan that ensures forced circulation of hot gases inside the heat exchanger pipes;
- a water circulation pump that sends hot water from the heat exchanger to the snow melting unit;
- an electric control panel, control and automation;
- a fuel tank that provides a minimum operating time of 4 hours.

The snow melting tank contains water in which snow is downloaded and melting. The melting tank is supplied with hot water from the tank of heat exchanger.

The equipment is mounted on a three-axle trailer. It has two distinct tanks, a tank for heating water and a tank for snow melting. The snow is loaded into the melting tank through the back or the side of it using a milling cutter or excavator. Here the warm water from tank transfers the heat to the snow or the ice blocks. Additionally, some melters are equipped with a snow-mixing /shaking system and a spray system located at the top of the tank that throws hot water over the snow in the tank, Figure 15. The thermal energy needed to melt the snow is provided by a burner with liquid fuel (diesel fuel) and has an operating autonomy that depends on the capacity of the fuel tank. The burner together with a fan provides the hot air flow to transfer its heat through an ignitubular heat exchanger to the water in the tank. An electro-pump delivers warm water from the changer tank into the melting tank and into the spraying system. The volume of snow introduced into the tank

coupled with snow melting leads to increased levels and the discharge of the melted water through the holes too. From the melting tank, the water is discharged either through the overflow or through the drainage connections to the sewer after a preliminary rough filtration. The tank has on the bottom some slurry outlet doors. A hydraulic system, shown in Figure 16, inclines the melting tank so that deposits on its bottom (sand, anti-slip material, etc.) can be removed and washed gently.



Fig. 15. Hot water spraying system in the melting tank [2]



Fig. 16. Melting tank inclining system [1]

The location of the component subassemblies and the principle of operation of the snow melting plant is shown in Figure 17, below.

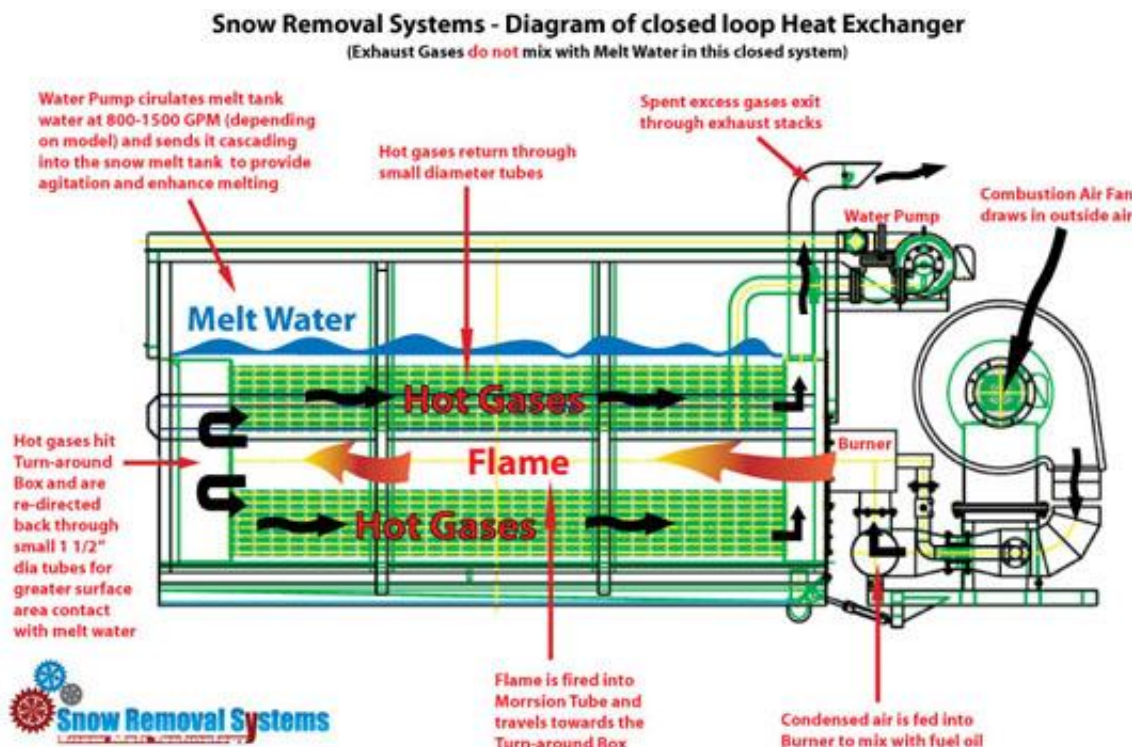


Fig. 17. Layout diagram of components and heat transfer system [1]

Based on the data presented above, as well as on their detailed analysis, it can be concluded that on the market there is a very wide range of technical solutions for the production of snow melting equipments, solutions that can meet all the requirements of potential customers.

As for the principle of achievement, the equipments are generally like, but differs from the concrete technical solutions. It can be said that such equipments can be designed and built in the country, with both design potential and companies /companies for effective physical realization, as well as potential clients, both private companies as well as companies and public institutions.

4. Conclusions

The article presents a new category of technology equipment made by foreign firms and used to remove snow fallen on the urban public spaces such as public roads, parking, airport runways, private spaces etc.

It also presents the working principle, the structure and the performance of such machines, currently called snow melters, which, through the technology and through performances, perform the ecological removal of snow.

From the analysis of the melters presented above, results that there is a wide range of snow melter equipments that can satisfy all customer requirements.

From the analysis of the principle of realization and of the technical solutions in detail, it can be said that such equipments can be designed and realized also in ROMANIA, having the potential for physical design and realization (firms /companies), but also potential users (private companies, companies and public institutions in the local government etc.).

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References

- [1] *** Snow Removal Systems, Inc. Products. In: <http://www.snowremovalsystems.com/>, 2017;
- [2] *** Snow Dragon. Products. In: <http://www.snowdragonmelters.com/default.asp?ID=3>, 2017;
- [3] *** Trecan Combustion Limited. Canadian designer and built snowmelter used in worldwidw. In: www.trecan.com, 2017;
- [4] *** Snowmelters.Presented by comercial boiler systems inc. In: <http://www.snowmelters.com/>, 2017;
- [5] *** Michigan Melters. Snow Melting Machines and Equipment: Commercial Snow Melters. In: <http://www.michiganmelters.com/>, 2017;
- [6] *** Aero Snow Removal Corp. In: <https://www.linkedin.com/company/aero-snow-removal-corp>, 2017;
- [7] *** Deltamed. Urban Snow Melter - Prototip de echipament de topire a zăpezii. In: <http://www.deltamed.ro/product/urban-snow-melter/>, 2017.