11th International Research/Expert Conference
"Trends in the Development of Machinery and Associated Technology"
TMT 2007, Hammamet, Tunisia, 05-09 September, 2007.

THE SUPLEMENT TO THE TRANSPORT AND WAREHOSING DEVELOPMENT OF EDIBLE OIL

D. Sc. Dragisa Tolmac,
University of Novi Sad, Technical faculty ''Mihajlo Pupin'', Zrenjanin
Djure Djakovic bb, 23000 Zrenjanin, Serbia

D. Sc. Slavica Prvulovic,
University of Belgrade, Technical faculty, Bor.

M. Sc Ljiljana Z. Radovanovic,
University of Novi Sad, Technical faculty ''Mihajlo Pupin'', Zrenjanin
Djure Djakovic bb, 23000 Zrenjanin, Serbia

ABSTRACT
In the paper is presented the technological project solution for the transport and warning up of edible oil, during the preparation for pouring into packing. The project is done for the company AD (The Oil Industry - Diamant), Zrenjanin in Srebian. The paper includes the technology process description, the technology process schema, the characteristics of the machine technological equipment, as well as the warming up solution, i.e. oil temperature adjusting at the constant temperature.
Keywords: transport, warming up, oil, warehousing.

1. INTRODUCTION
In the framework of the main project is done the technological machine project of the production plant for "PET" bottles of "PET" granulate (polietilen teraftalat), as well as the project of the plant for pourino oil into "PET" bottles with their packing onto the pallets. So was replaced the out-of-date and work-done line for PVC bottles.

The new projected lines in the plant are provided by very modern technical solution for edible oil packing, tacking into consideration the experinces and attainments applied in food processing industry.

In the framework of the project are selected the oil transport pumps for oil transport from warehouse into warehousing reservoirs, also is given the technological technical solution of warming up - adjusting oil temperature at $+22^{o}C$, as well as feeding the pouring machines for bottles with olready adjusted oil.

The projects also includes the installations for the conducting of water, vapour and compressing air, for machines and devices in the pouring plant.

2. THE TECHNOLOGICAL TECHNICAL SOLUTION
Taking into consideration that the plant reconstruction is done with the aim to improve quality and increase the oil pouring plant (hall) (the sunflower oil), the machines and equipment are dimensioned to the capacity of 20000 l/h. The technological scheme for the warehousing, transport and warming up of oil, is given on the fig.1.

The oil transport is done by pump and pipeline from the warehouse (1 on the figure). The oil warehousing is done is done in the reservoirs (2 on the figure), each with the volume of about 35m^3. Oil is arranged into the reservoirs with the help of ball valves with the electro-pneumatic driving, i.e. every valve is equipped by rotating cylinder, which, by command puts the valve in the position "on" (open) and "of) (closed).

With the help of the pipeline (3 on the figure), and the pump (4 on the figure) is carried oil transport up to the pouring machines. There are three lines for packing filling, as follows:

- the plastics line -PET bottles with 1(l) volume,
- the canister line,
- the glass line (glass packing).

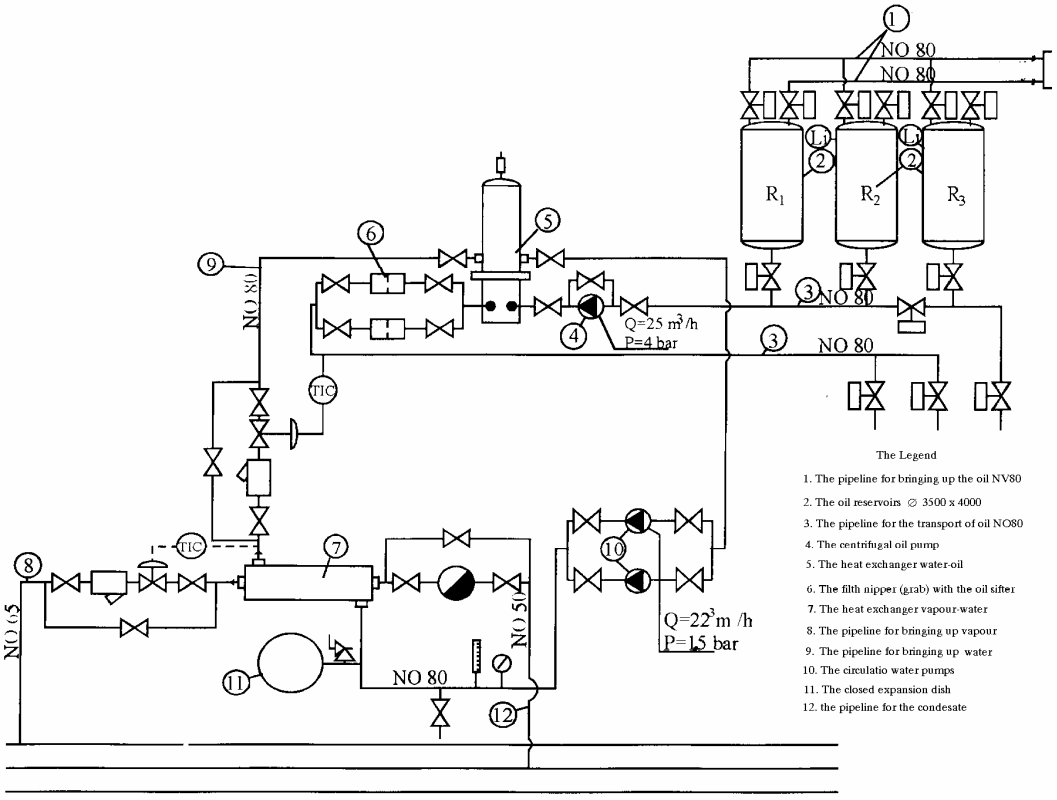

Figure 1. The Technological scheme for transport, warehousing and warming up of oil

Warming up oil at the constant temperature of +22^{o}C is done with the help of heat-exchanger (5 on the figure). The pipeline (3 on the figure) for oil transport is provided with the necessery armature for oil handling (manipulating) as the flat closing valves, the filth nippers with oil sifter (6 on the figure) and ball valves with the electro-pneumatic driving. These ball valves are in front of every filling-machine.

In the winter period oil temperature can fall onto +5^{o}C. The warming up, up to the temperature +22^{o}C, in the heat-exchanger (5 on the figure), is performed by warm water at the temperature of 90^{o}C. The warm water preparing is done in the heat-exchanger (7 on the figure), and the heating fluid is vapour: p=3bar, t=134^{o}C.

The warm water flow regulation is done by the regulating valve, attached on the exit from the heat exchanger-secundar. For vapor flow regulation is used a particular regulation valve, as in the fig.1. These two "regulations circles" enable the oil warming up at the temperature +22^{o}C. The warm water circulation in the closed warming system is done by the pump (10).

At the pump-strain estimate (4 on the figure), is used the known relation:

$$\Delta p = (\lambda \frac{L}{d} + \Sigma\xi)\frac{1}{2}\rho v^2 + \rho g H + \Delta p_M + \Delta p_i + \Delta p \left[\frac{N}{m^2}\right] \quad (1)$$

where there are:

Δp_M - the overpressure at the filling machine connecting,

Δp_i - the fall of the pressure in pipe heat exchanger (5 on the figure),

Δp - the fall of the pressure on the sifter.

On the basis of the estimate according to (1 on the figure), the characteristics of the centrifugal pump are:

$Q=25 m^3/h$, p=4bar, N=7.5kW.

The heat exchanger heat power (5 on the figure):

$$Q_1 = c_p \cdot \rho \cdot V \cdot (t_2 - t_1) \left[\frac{kJ}{h}\right] \quad (2)$$

The heat exchanger heat power (7 on the figure):

$$Q_2 = 1.1 \cdot Q_1 \left[\frac{kJ}{h}\right] \quad (3)$$

Vapor consumption:

$$m_p = \frac{Q_2}{r} \left[\frac{kg}{h}\right] \quad (4)$$

The circulation pump capacity (10 on the figure):

$$V_v = \frac{Q_2}{c_p \cdot \Delta t} \left[\frac{m^3}{h}\right] \quad (5)$$

On the basis of the results according to (1 on the figure) follows:

Exchanger heat power: Q_1=228 kW, Q_2=250 kW; Vapor consumption m_p=425 kg/h; The circulation pump capacity V_v=22 m^3/h.

The oil pouring plant project is done and realized and it successfully realizes the projected capacities.

3. CONCLUSION

The goal of completion of this project where the capacity increase of edible oil from 6.000 l/h. to 20.000 l/h. and quality improvement of oil. After completion of investment project is proved technical capacity from 20.000 l/h. The quality of edible oil become better and therefore that sugar can be used in nutritional and pharmaceutical industry.

4. REFERENCES

[1] Tolmac, D., Turinski, J., Vujovic, S. (1996), The main Technological Machine Project of the Pouring plant, "SM" Engineering, Zrenjanin, (in Srebian).

[2] Bogner, M., Isailovic, M. (1986), The Collection of Regulations in Engineering, The Science Book, Belgrade, (in Srebian).

[3] Tolmac, D., Bulik, D. (1997), The Machine Technological Project of Transport and Storage of PET granulates, "SM" Engineering, Zrenjanin, (in Srebian).

[4] Incropera. F. P., Dewitt. D. P. (1996), Fundamentals of Heat and Mass Transfer, 4th edition, John Wiley and Sons, New York.

[5] Holman, J.P. (1981), Heat Transfer, fifth edition, McGraw Hill Book Company, New York.

[6] Lambic, M. (1998), Thermo Technique with Energetics, University in Novi Sad, Technical faculty "Mihajlo Pupin'', Zrenjanin, (in Serbian).