

“USE OF EXHAUST GAS HEAT TO KEEP FOOD DELIVERY ITEM WARM”

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ABSTRACT

In this era, the rate of online food delivery item is increased rapidly. The food item which is to be delivered to customer requires at least 15 to 20 minutes from the time of making. Meanwhile the food item gets cooled and so as it loses its quality.

The present innovation tackles this problem by providing an arrangement which will keep the food item warm up to the time of delivery. The basic principle of working for this arrangement is transferring heat energy of waste exhaust gas, which is any ways going waste to the food chamber which will maintain the food temperature and also reduces the heat from exhaust.

This innovation will be useful mainly for the online food delivery and also the fast food items delivery. This can be also use to transfer food from one place to another without losing its quality.

1. Introduction

1.1 Need

In recent year, the online food delivery items like Pizza, Burger etc has been increasing rapidly. But to deliver the ordered food item requires time of about 20-25 minutes. Meanwhile the food items get cooled and lose its taste. So either customer needs to heat it or to eat as it is. To avoid this loss of food quality, some arrangement should be made which will solve this problem. If the delivered food is warm then customer gets more satisfaction and this will attract more customers to order online food which will ultimately increases the business.

Keeping this need in mind a device which will solve this problem is to be made. We have two main options either make more effective insulated box which will restrict the heat transfer or some device which will maintain the temperature of that box at desired temperature.

1.2 Aim

To make an arrangement which will keep ordered food warm till it reaches the customer.

Now the aim is to design an arrangement which will keep the temperature of box to required value. All the available boxes are only acts as an insulation box. There no as such device which will maintain the temperature of food item till the time of delivery.

With two-wheeler, we are available with considerably large amount of exhaust gas heat which anyways gets waste. We can utilize this heat from Exhaust Gas to keep food delivery items warm. So the exhaust gas should be circulated around the box and thus temperature can be maintained.

2. History of project

2.1 Initial phase of food delivery system

2.1.1 Dabbawala, Bombay (1890)

In 1890 Bombay, Mahadeo Bhavaji Bachche started a lunch delivery service with about a hundred men. In 1930, he informally attempted to unionize the Dabbawalls.

2.1.2 United Kingdom (1943)

Meals on Wheels originated in the United Kingdom during the Blitz, when many people lost their homes and therefore the ability to cook their own food. Many early services used old prams to transport the meals, using straw bales, and even old felt hats, to keep the meals warm on delivery.

2.1.3 United States (1954)

The first home-delivered meal program in the United States began in Philadelphia, Pennsylvania, in January 1954. At the request of the Philadelphia Health & Welfare Council, and funded by a grant from the Henrietta Tower Wurtz Foundation.

2.2 Delivery technology

As the time passed, the customer requirements increased and hence it was necessary to develop a system for delivering the food which satisfies the customer requirements. Some of such systems are described below.

2.2.1 Domino's Pizza Box (1960)

Since the 1940s pizza take-out was done with the pizza sitting on a round cardboard base and covered with a paper bag. It is believed Domino's developed the modern corrugated flat square pizza box in the early 1960s, but they never patented it. Patent designs for pizza boxes date to at least 1968. Innovations since have included various venting configurations; built-in holders for extra sauces; designs for easier recycling; perforated tops so wedge-shaped pieces of cardboard can be used as plates. The lid of the box is often supported by a disposable plastic tripod on top of the pizza.



Figure 2.1 Delivery Box

2.2.2 Ingrid Kosar, Delivery Bag (1984)

Bags used to keep pizza hot while being transported are commonly referred as hot bags. Hot bags are thermal bags, typically made of vinyl, nylon that passively retains heat. Heated bags supply added heat through insertion of externally heated disks, electrical heating elements, or pellets heated by induction from electrically generated magnetic waves. Innovations in delivery bag designs have allowed without the usage of a fixed box for bike delivery, such as a hard frame, back straps, and waterproofing. These systems proved to be cheaper, more efficient and faster to use.



Figure 2.2 Delivery Bag

2.2.3 Jose A. Rial (1994)

Jose A. Rial has patented food-warming arrangement for maintaining the food at a desired temperature for consuming, in a food-delivery motorized vehicle having a box for carrying the food and an engine cooling system, the arrangement comprising an isolating case with a heat exchanger therein, the hot coolant coming from the engine is circulated through the heat exchanger by a food-heating circuit and at least one fan is provided to remove heat from the heat exchanger and spread it within the case so as to be capable of keeping a desired temperature within the case, the food-heating circuit being connected to the engine cooling system.

3. Design and modeling

3.1 Working Principle

The project setup works on the basic concepts of heat transfer, where the heat from the exhaust gas of delivery vehicle is carried through the pipe to heating chamber and then it is convected to the food chamber and so the inside box temperature is maintained.

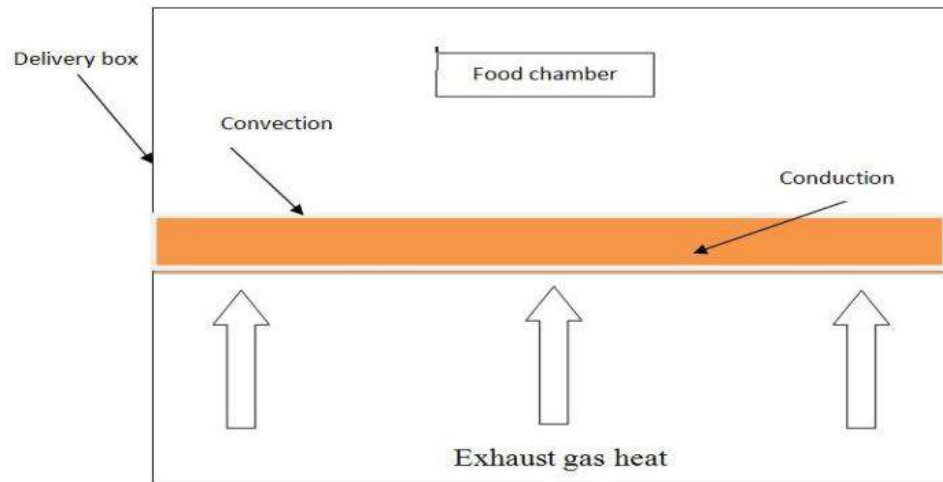


Figure 3.1 Conduction, convection heat transfer

3.2 Construction and working

The setup consists of following parts-

- Delivery Box
- Connecting pipe
- Copper sheet
- Baffles
- Insulation material
- Pipe clamps

The conventional delivery box is modified by adding copper sheet and baffles at bottom side. There are two chambers, one is heating chamber and another is food chamber. The chamber is separated by using copper plate. Copper plate is fixed to the delivery box wall with help of adhesive material and it is made air tight so that there should not be any leakage of exhaust gas from bottom chamber.

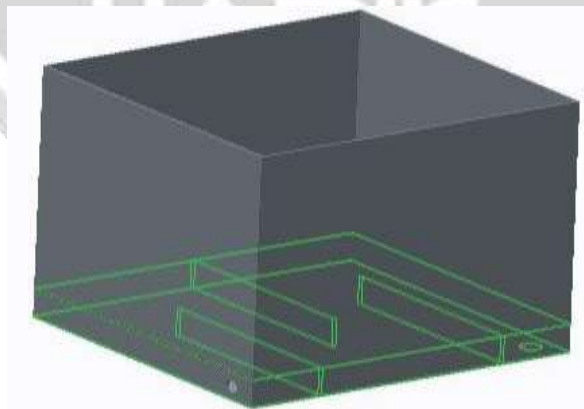


Figure 3.2 Model of Delivery box

The bottom chamber consists of baffles which are provided to guide the flow of exhaust gas in zigzag fashion. The baffles are spaced equidistance from the centre of the box. It is placed perpendicular to bottom surface. The inlet and outlet port is provided on the bottom side. Pipe connector is fixed at inlet so that pipe should fix on it properly. Outlet port is having bend pipe connector so that the exhaust gas should be released into the atmosphere.

The connecting pipe is insulated from with the help of insulated foam and also the delivery box is insulated from with. An insulation sheet is provided at bottom surface of box to reduce the heat transfer from bottom chamber. The exhaust gas from the muffler is carried to the heating chamber with help of connecting pipe. The pipe is connected to the inlet connector. The exhaust has entered into the heating chamber then is allowed to pass in zigzag manner with the help of baffles. While moving through the baffles the heat from the exhaust gas is conducted to the copper plate and then it is convected to the food chamber.

Conclusion

The set up performance is well when the vehicle is running continuously. But when the vehicle stops and again started after some time, it takes about 15 minutes to reach the desired temperature. There is variation of temperature on copper sheet from inlet to outlet; this affects the heat transfer coefficient. Thus the plate thickness has more importance as it is required to have optimization of strength of plate and heat transfer coefficient.

The pressure drop due to set up results in drop in engine efficiency which is considerable. Adding the set up increases the fuel consumption but this gives the customer quality food which will increase the customer satisfaction.

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