



Design & development of human energized oil expeller machine

Mohammad Ali Sheikh¹ and Zakiuddin Syed Kazi²

¹Department of Mechanical Engineering, G.H.Raisoni Academy of Engineering & Technology, Nagpur, India.

²Department of Mechanical Engineering, Priyadarshini College of Engineering, Nagpur, India.

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ABSTRACT

The human energized flywheel motor has been adopted for many designs of rural applications in the last two decades. In the recent past a human powered process machine has been developed for brick making, chaff cutter, water pump, blender, wood turning, clothes washing and drying and earthen pot making etc [1]. The machine consist of human powered flywheel motor using a bicycle drive mechanism with speed increasing gearing and a flywheel, which drive the process unit through a spiral jaw clutch and torque increasing gearing [2]. The operator puts energy is stored, pedaling is stopped and the energy in the flywheel is made available to the process unit. Pedal power is the transfer of energy from a human source through the use of a foot pedal and crank system. This technology is most commonly used for transportation and has been used to propel bicycles. Less commonly pedal power is used to power agricultural and hand tools and even to generate electricity. The paper discuss about the application for pedal power technology. The machine is economically viable, can be used by unskilled workers, save time otherwise spent in traditional mixing and can be adopted for human powered process units which could have intermittent operation without affecting the end product.

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Introduction

India is one of the largest producers of oil seeds in the world and Maharashtra is one of the major oil seed producing and edible oil producing state in India [3]. Over the last two decades, world production and consumption of oil fruits and oil seeds and their products has almost doubled. Power ghanis are faster than manual or animal types but are more expensive and their higher capital and operating costs. Now a day, Oil Expellers play a very vital role in the oil extraction process. Oil seeds are extracted in two Primary ways. Mechanical pressing is the most popular method worldwide for separating oil from vegetable oilseeds. This method ensures extraction of a non-contaminated, protein –rich low fat cake at a relatively low cost [4]. However, mechanical presses do not have high extraction efficiencies of available oil in the cake are left un-extracted [5]. Second method is the chemical method or solvent method, done by either continuous solvent extraction or aqueous extraction. This extraction is a complex operation, which is not suitable for small-scale processing because of high capital and operating costs, the risk of fire and explosions from solvents, and the complexity of the operation [6]. Once the oil is removed from the seeds, either mechanically or chemically, the oil and its by-products can serve various purposes some of which are liquid fuel, gas, electricity, fertilizer and soap [7]. Mechanical screw pressing is the most popular method in the world to separate oil from vegetable oilseeds on small to medium scale. Reasons for its popularity in for example India are that the machines require low initial and operation investments, can easily be operated, maintained and adopted by semi-skilled personnel [8].

Need for Manually Energized Oil Expeller

There are many factors affecting agricultural productivity in developing countries and it would be simplistic to assume that the solution to problems of low productivity is purely one of applying the right technology. The existing oil expellers in the market are too big and too expensive for these small medium

size businesses to invest on. Other limitations are its maintenances aspect as well as its operations. The main objective to design and develop a machine, which uses the human powered flywheel motor as an energy source consisting of a bicycle mechanism, use of non-conventional energy a source [9]. Oil expeller can be done by manually operated machine and electric operated. Traditional technologies usually have the advantage of requiring low investment but are labour intensive and time consuming. Some oil expellers is also operated by hand that causes strain to the body parts due to incorrect ergonomic posture, which will be eliminated by using this machine. Developing countries of third world like India are facing problems of Power storage due to rapid industrialization, non-availability of power in rural areas and workers. In the context of the present condition in India and third world countries the Power shortage and exhaustion of coal reserves and unemployment, it is felt that “Human powered energized oil expeller machine” for oil extraction is very necessary. This machine is environment friendly i.e. non-pollutant. It will bring Innovation & Mechanization in agricultural engineering. Unskilled workers may also get employment. Development of such an energy source which has tremendous utility in energizing many rural based process machines in places where reliability of availability of electric energy is much low. The need for new designs of oil expeller is base on the cost and efficiency of the machine especially for the usage in small and medium size industries.

Concept of Manually Energized Oil Expeller Machine

The means of powering IT machinery commonly used are human and animal power electric motors (DC or AC mains) and internal combustion engines using oil based fuels. Other methods, which have been, used either directly or via an energy storage medium are wind powers, water power, solar energy transducers, or bio-gas engines. The suitability of a particular method in a given situation will be determined by local

environmental, economic, and technical conditions but there are generally applicable considerations, which can be used as a basis for comparison. Such a comparison will not indicate a single method for universal application but can be used to establish the relative usefulness of human muscle power methods. The power outputs obtainable from hand cranking are between 30-50% lower than methods using the leg muscles and fall further with operating times above 20 minutes [10]. It is, however, the simplest method of operating machinery requiring little power to operate. For heavier machinery and higher powers it is necessary to use the leg muscles which are more powerful than those of the arms [11]. Both treadle and pedal actions are used to drive machinery. The treadle action is commonly operated by one leg, only using half the available power, but enabling the operator to support himself on the other leg and load the machine. Treadle mechanisms are commonly inefficient and much higher power outputs are obtained from the pedal crank arrangement [12]. The power output available from pedal crank systems in static applications will be about 75 watts. The technology involved in these methods using muscle power is relatively simple and can be simpler in most cases than 'bicycle technology'. The "fuel" used is food calories and the relative costs of power derived from food in this way can be comparable with other methods [13]. It is obviously of paramount importance that methods used should be efficient because of the psychological effect on the operator. For this reason, the use of pedal drive is likely to be of the best alternative where high outputs are expected. This development will increase the productivity as well as efficient of the small medium business providing by self-employment jobs.

The average work rate of a man working continuously is equivalent to 0.13hp [14]. Therefore, only continuous manufacturing process requiring less than 0.13 hp can be man powered. Any manufacturing process requiring more than 0.13 hp and which can be operated intermittently without affecting end product can also be human powered. Such human powered manufacturing process can be based on the following concept. In this processes a flywheel is used as a source of power. Manpower is used to energize the flywheel at an energy input rate, which is convenient for a man. After maximum possible energy is stored in flywheel it is supplied through suitable clutch and gearing system to a shaft, which operates process unit [15] the flywheel will decelerate at a rate depends on load torque. Larger the resisting torque larger will be the deceleration. Thus theoretical a load torque of even infinite magnitude could be overturn by this man –flywheel system. Oil Expeller Powered by Human Powered Flywheel Motor operates on the basic of following principal.

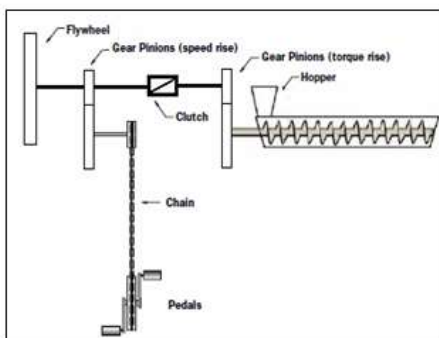


Figure No.1 shows concept of human powered Oil Expeller machine

Working

The energy unit consists of a bicycle mechanism, a pair of speed-increasing gears G1 and a flywheel. The transmission consists of a spiral jaw clutch and the torque amplification gear pair G2. The suggested machine system uses human energy achieved by pedaling and stores this energy in a flywheel at an energy-input rate convenient to the peddler. After storing the maximum possible energy in the flywheel (pedaling time could be 1-2 minutes) the same can be made available for the actuation of any process unit (Extruder Unit) by making available the energy stored in the flywheel through a suitable clutch and torque-amplification if needed. Thus the flywheel will decelerate depending on the actual resisting torque offered by the process. It implies that the peddler does not pedal while the flywheel is supplying energy to the process-unit. Upon engagement of the clutch there is a rapid transfer of momentum and kinetic energy between the energy unit and the process unit. The process unit input shaft is thus instantaneously accelerated and, after reaching the maximum speed, is subjected to deceleration. This deceleration is induced by the resistance offered on account of oil expellers. The process unit consists of the gear pair G2 which is connected to the convener. The process unit consists of the gear pair G2 which is connected to Auger (*i.e. screw shape tool used for crushing and squeezing of citrus*). Because of which the auger rotate in the drum and provide crushing and squeezing action.

Result and Discussions

The pedal energized oil expeller machine was developed. The development of the Oil Expeller we can say that the design must be efficient and low in cost. The efficient use of human muscle power through pedal drive systems constitutes a useful alternative to other power sources for oil extrusion process. Future consideration of the 'human-scale' technology involved in these applications could be of great benefit to developing countries. In designing the pedal-powered oil expeller, the focus was on cheap, readily-available materials and we proposed a simplistic design that can deliver productive, efficient. This development will increase the productivity as well as efficient of the small medium business providing by self-employment jobs.

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