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Use of Gear Shaft in Single Wheel Driven Spray Pump

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A B S T R A C T

Both rain feed and irrigated farms in Maharashtra have major pot and weed problems in crop output.Farmers are required to use manually operated machinery to spray insecticides, pesticides, and herbicides on a regular basis.This becomes a time-consuming, arduous, expensive, and manually wheel-operated sprayer with poor application uniformity. The goal of this study was to create and assess a wheel-operated sprayer. The sprayer was tested for uniformity of application, discharge rate, field capacity, and field efficiency in the lab and in the field, and it achieved an application rate of 63.09l/ha, a coefficient of variation (CV percent) of 2.50 among the nozzles discharge rate, and an effective field capacity of 0.075ha/hr. Currently, labor shortage is posing a difficulty during agricultural operations, as more labor is required in agriculture. and a 56 percent field efficiency According to the results, the newly developed sprayer can cover 1 hectare of land in around an hour with a superior spray uniformity and a potential field capacity of 0.126 hectares per hour.

Keywords: Boom sprayer, Wheel barrow, Wheel driven, Design, Performance evolution, Effectiveness, Efficiency.

1. INTRODUCTION

This mark is exactly 1/2 degree distant from the scale's current position, implying that it was made two years before to the setting. Such arithmetical schemes are separate from the astronomical geometrical theory of circles and epicycles, which appears to be primarily Greek. Consequently, while the evidence is far from solid, we are led to believe that the instrument was built around 82 B.C., utilized for two years (just long enough for repairs to be required), and then transferred to the ship within the next 30 years. The inscriptions on the original instrument were found outside the front door, inside the back door, on the plate between the two back dials, and on the parapegma plates near the front dial, according to the pieces. These dials displayed a variety of cosmic data, including lunar phases, dates of lunar and solar eclipses, and constellation locations over a period of several years. Alternative dates are doubtful based on archaeological evidence: Claudius Ptolemy's efforts in 200 B.C. signified the victory of a new mathematical attitude toward geometrical models that still characterizes physics today.

A coral-encrusted metal mechanism was among the items recovered from the shipwreck and taken to the Greek National Archaeological Museum. In the second century A.D., the two types of theory were merged and brought to their pinnacle. Similar cycles were known for planetary occurrences; in fact, this form of arithmetical theory is at the heart of Seleucid Babylonian astronomy, which was passed down to the Hellenistic world in the last several centuries B.C. It's amazing that such inscriptions can even be read. Considering the evidence so far, it appears logical to assume that the Antikythera apparatus was designed to automate exactly this type of cyclical relationship, which was a common element of ancient astronomy. Using the described cycles, it would be simple to create gearing that would function from a single dial with an annual wheel that would turn a number of other wheels that would move pointers marking the sidereal, synodic, and draconitic months. In fact, until the Eighteenth Century, some two thousand years later, it was more advanced than anything comparable. The gadget contained a system of fine brass gears that, when rotated, moved dials. It was originally covered in a wooden box and looked like an old fashioned table clock. It was ultimately deduced that this ship was a Roman galley filled with Greek statues and other spoils being sent back to the imperial capital. Decades later, in 1958, a young British historian of science named Derek Price investigated the gadget and came to some unexpected conclusions: the Antikythera device, as it came to be known, was an astronomical computer, far more advanced than anything else of the time. It is far too late. As I previously mentioned, there are inscriptions around all of the dials, and each part and hole appears to have been labeled with identifying letters so that the pieces could be assembled in the proper sequence and position. 40 A.D. is far too early. We can also learn more if we are correct in assuming that a fiducial mark near the month scale was initially placed there to provide a means of resetting the scale in the event of

unintentional relocation. To give you an indication of how bad they are, in some cases a plate has totally vanished, leaving just an impression of its letters standing up in a mirror image in relief on the soft corrosion products on the plate beneath. As a result, the slip ring was fixed in if it had not shifted from its previous position. 80 B.C. They discovered the wreckage of a classical shipwreck in 200 feet of water there. The principal inscriptions are in bad shape, with just snatches of them legible. A group of Greek sponge divers were stranded off the coast of Antikythera after being blown away from their usual working area by a storm.

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1.1 Function of Gearshaft

• The gears can change the power's rotational speed. The gears of a motor engine are an example. The power is regulated by the gears, which provide specific gear ratios. Installing a gear with a ratio of 1: 2 for an electric motor with 1400 rpm might increase or reduce the motor rpm.

• The second purpose of gears for transmitting power is that they can transmit power with interconnected gears without slipping. This function can be found on a lathe machine.

•An engine produces torque, which is a rotational force (it is for acceleration). Providing a gear can be used to modify the torque.

• Gears for reversing the power flow Gears can change the direction of power as well as the speed with which they change torque. It's common on dam gates and reservoirs. When we use gears to turn the door handle up and down, we can raise and lower the door.

• The gear shaft is essentially the gear's axle, delivering the rotation that allows one gear to engage and turn another. The procedure, known as gear reduction, is critical for transferring horsepower from the engine to the driving mechanism. The driving force that powers, for example, the wheels of an automobile comes from the conversion of engine speed into torque. The engine can operate at a steady speed through the gears and shafts in an automotive transmission, but the car wheels can be driven faster or slower, or even in reverse, utilizing the same engine rotational direction and speed.

Fig 1.1 Stainless Steel Gearshaft

Fig 1.2 Alloy Steel Gearshaft

2. GEAR SHAFT IN SINGLE WHEEL DRIVEN SPRAY PUMP

Chemical pest management has proven to be quite effective, but it must be handled carefully, used in rationed doses, and sprayed correctly. Chemical application is the only fully mechanized farming process, hence specialized equipment is required. Knapsack sprayers, ultra-low volume sprayers, and

tractor boom sprayers are examples of earlier chemical application machines.

The wheel is connected to the sprocket, which is connected to the gear, and the sprocket and gear are connected by chain. The assembly is secured to the frame. By pressing the cycle, rotating wheels provide pushing pressure. Then the sprocket attached to the wheel will rotate. The assembly of attaching the chain will rotate the gear as well. Because the gear is coupled to the wheel, the user can rotate the wheel by pushing it. This machine uses a four-bar mechanism to convert the rotary motion of the chain sprocket into reciprocating action for the piston to develop pressure inside the air pump used in the spray tank, which is then released as water vapor through the sprayer boom. This sprayer has three nozzles and a boom frame to adjust the height and width of the nozzle according to crop requirements.

I suggest a wheel-driven sprayer, which is a portable gadget that does not require any fuel to work, is easy to transport, and sprays pesticide by moving the wheel.

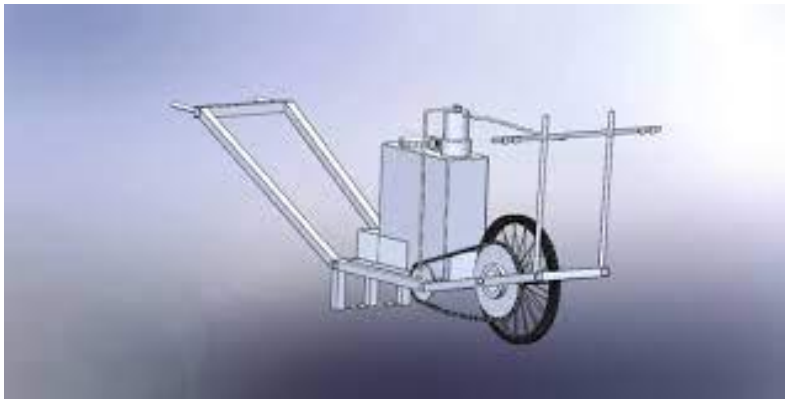

Fig 2.1 Agricultural sprayer

2.1 Gearshaft Mechanism

Because each gear or toothed component is connected to a machine shaft or base component, when the driving gear (i.e., the gear that provides the initial rotational input) rotates or translates its shaft component, the driven gear (i.e., the gear or toothed component that is impacted by the driving gear and exhibits the final output) rotates or translates its shaft component. The transmission of motion between the driving shaft and the driven shaft might result in a change of rotation or movement direction, depending on the design and construction of the gear pair. Furthermore, if the gears aren't the same size, the machine or system gains a mechanical advantage, allowing for changes in output speed and torque (i.e., the force which causes an object to rotate).

The shafts that gears connect must be close together, but they can be in virtually any spatial relationship with one another: parallel or nonparallel, intersecting or nonintersecting. Gears with adequate capabilities can be produced for each of these shaft combinations.

Fig 2.2 Pinion Gearshaft

Shafts must be built so that deflections are kept to a minimum. For example, excessive deflection can reduce gear performance and produce noise and vibration. Limits on critical speed, minimum deflections required for gear function, and bearing requirements are commonly used to establish the maximum permitted deflection of a shaft. The shafts that gears connect must be close together, but they can be in virtually any spatial relationship with one another: parallel or nonparallel, intersecting or nonintersecting. Gears with adequate capabilities can be produced for each of these shaft combinations.

Fig 2.3 Input Output shaft

3. CLASSIFICATION OF GEARS

The following are the several types of gears or toothed wheels:

• According to the position of the shaft axes. The axes of the two shafts that will transfer motion can be (a) parallel, (b) intersecting, or (c) non-intersecting and non-parallel. The gears are used to connect two parallel and co-planar shafts. Spur gears are the name for these gears, and spur gearing is the name for the arrangement. These gears contain teeth that are parallel to the wheel's axis, as depicted. The spur gearing is also known as helical gearing because the teeth are inclined to the axis. A single helical gear and a double helical gear connecting parallel shafts are depicted. Herringbone gears are double helical gears with two helical axes. A pair of spur gears is kinematically equal to a pair of cylindrical discs with a line contact and keyed to parallel shafts. The two non-parallel or intersecting, but coplanar shafts are depicted, and they are joined by gears. The arrangement is known as bevel gearing, and the gears are known as bevel gears. The teeth of bevel gears, like spur gears, can be inclined to the face of the bevel, in which case they are referred to as helical bevel gears. Two non-intersecting and non-parallel, i.e. non-coplanar shafts are depicted, which are joined by gears. Skew bevel gears or spiral gears are the gears used in this arrangement, which is known as skew bevel gearing or spiral gearing. This form of gearing also contains a line contact, which generates the two pitch surfaces known as hyperboloids by rotating around the axes. Notes: (a) Mitres are bevel gears that connect two shafts whose axes are perpendicular to one other and have the same number of teeth. (b) A hyperboloid is a solid that is generated by rotating a straight line around an axis (not in the same plane) so that every point on the line remains at the same distance from the axis. (c) Worm gearing is a type of spiral gearing in which the shafts are normally at right angles to each other.

• In accordance with the gears' peripheral velocity. The gears can be categorized into three categories based on their peripheral velocity: (a) low velocity, (b) medium velocity, and (c) high velocity. Low velocity gears are those with a velocity of less than 3 m/s, while medium velocity gears are those with a velocity of 3 to 15 m/s. High-speed gears are defined as those with a velocity of more than 15 m/s.

• Depending on the gearing type. The gears are classed as (a) external gearing, (b) internal gearing, and (c) rack and pinion, depending on the kind of gearing. The gears of the two shafts mesh externally with each other in external gearing, as shown in Fig. 12.3. (a). The larger of these two wheels is known as the spur wheel, while the smaller wheel is known as the pinion wheel. The motion of the two wheels in an external gearing is always opposite, depending on the position of teeth on the gear surface. On the gear surface, the teeth can be (a) straight, (b) inclined, or (c) curved.

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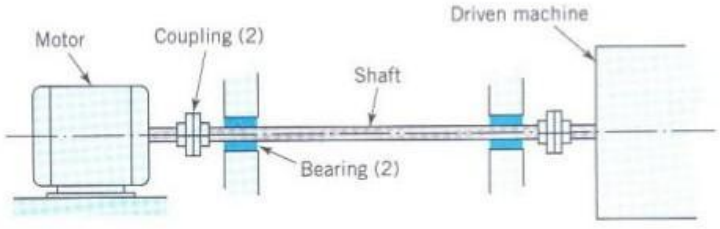
3.1 Design of Shaft

A shaft is a spinning part (solid or hollow) with a circular cross-section that transmits power and rotational motion. Gears, pulleys (sheaves), flywheels, clutches, and sprockets are machine parts mounted on shafts that carry power from the driving device (motor or engine) through the machine. These machine elements are attached to the shaft via press fit, keys, dowel, pins, and splines. The shaft rotates on bush bearings or rolling contact bearings. To take up axial loads and place the spinning elements, several types of retention rings, thrust bearing grooves, and steps in the shaft are used. Couplings transfer power from the drive shaft (e.g., a motor) to the driven shaft (e.g., gearbox, wheels).



(*a*) Connecting shaft

Fig 3.6 Connecting Shaft

Both the Distortion Energy method of combining stresses and the fatigue failure locus nomenclature are used to refer to equations. For instance, DE-Goodman, DE-Gerber, and so on. In an analysis setting, these bespoke equations for factor of safety can be used, or a conventional approach can be used. Customized equations for d are far more useful in design situations. Because a stress element on the surface cycles from equal tension to compression throughout each rotation, the bending stress on a rotating shaft with steady, alternating bending and torsion is totally reversed (alternating). The torsional stress is continuous (constant or static). Mm and Ta equal to 0 simplify previous equations.

4. Conclusion

The equipment's performance will improve when it is used on a smooth or less uneven surface, and it will also be more effective when it is used on crops. The usage of a traditional sprayer has drawbacks as compared to this one. The goal of this research is to improve the gear shaft used in agricultural spray pumps. The use of a wheel spray pump instead of a traditional sprayer for spraying has boosted the design advantages due to its load bearing capacity, strength, and simplicity of handling. In addition, the sprayer's usage of a gear shaft mechanism will be convenient. The weight of a traditional sprayer is greater than that of a spray pump that is operated manually.

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