

## Licensing and Technology Transfer Opportunity: Manipal University

### **Title of Technology Available: Slip mechanism for PTO shaft**

**Brief Description of Invention:** A Power Take off (PTO) shaft is a way of transmitting power from a power source to attached implement. Slip mechanism for PTO shaft is installed between PTO gearbox output shaft and PTO input shaft to regulate power transmission. The output shaft of gearbox connected with slip mechanism to transmit power through spring loaded followers to the cam mounted on the input shaft of PTO. Followers are installed in the housing which in between loaded with springs which exerts force on followers to make contact cam. If the resistance from attached implement is more compared to the maximum Power output of PTO gearbox, the followers compress the springs to rotate housing freely without transmitting any power. When the resistance becomes less, the spring-loaded followers come back to its initial position and cam starts moving with the housing hub i.e. the power is transfer to the attached implement from cam shaft output shaft.

**Brief Background of Invention:** PTO shaft can be monitored and controlled electronically with the help of sensors. Inductive Sensors are installed on the input and output shaft of PTO gearbox. The inductive sensor gives signals which measure different frequencies. A control unit is used to display the PTO data, which helps in controlling PTO clutch's engagement and disengagement. Inductive sensors need proper calibration to get accurate results and need proper maintenance due to use in off-road. If one sensor fails, the entire system fails or make other components fail. In another system PTO clutch is controlled hydraulically. Sensor is installed on both sides of the clutch to measure rotational speed. Clutch slip is determined with the help of speed on both sides of the clutch assembly. A control unit is provided to measure actual slip data, pressure in the clutch is maintained to get desired slip to avoid the conditions of overloading (when resistance becomes more)

In the hydraulic system at a fixed interval, the hydraulic fluid needs to be change. If there is any leakage in the hydraulic pipeline the hydraulic pressure does not maintain, and entire system fails. If the torsional force increases in output shaft the oil seals break and systems fail. In hydraulic systems, the extra hydraulic motor is needed.

In another system, the PTO shaft is controlled by a slip clutch, consist of a clutch plate surrounded by two friction plates. These plates are enclosed in a flange. Input from the power source is given to coupling. The output shaft is connected to the clutch plate. Due to instant jerk or overloading conditions, clutch engages i.e. friction plates squeezes and clutch plate starts slipping.

This mechanism freezes because of moisture in the friction plates, so friction plates need to burn four to five times before operation. Another limitation is that nuts on bolts need to be tight after three or four jerks i.e. need regular maintenance. Slip clutch doesn't give satisfactory results if not adjusted according to necessities.

**Describe the final product:** Coupling hub 1 is connected with the output shaft of PTO gearbox i.e. the input power source 9 of slip mechanism. Coupling hub is used for holding the various

components in it. The guideways 2 are provided to guide the motion of followers 5. The guideways 2 rotate with coupling hub with the same speed. The guideways also hold springs 4 in it.

Followers are installed in the housing which in between loaded with springs which exerts force on followers 5 to contact the cam 7. The groove 6 on followers is made such that in compression of springs, the groove 6 on follower slides in the inner shaft 3 and guides the follower.

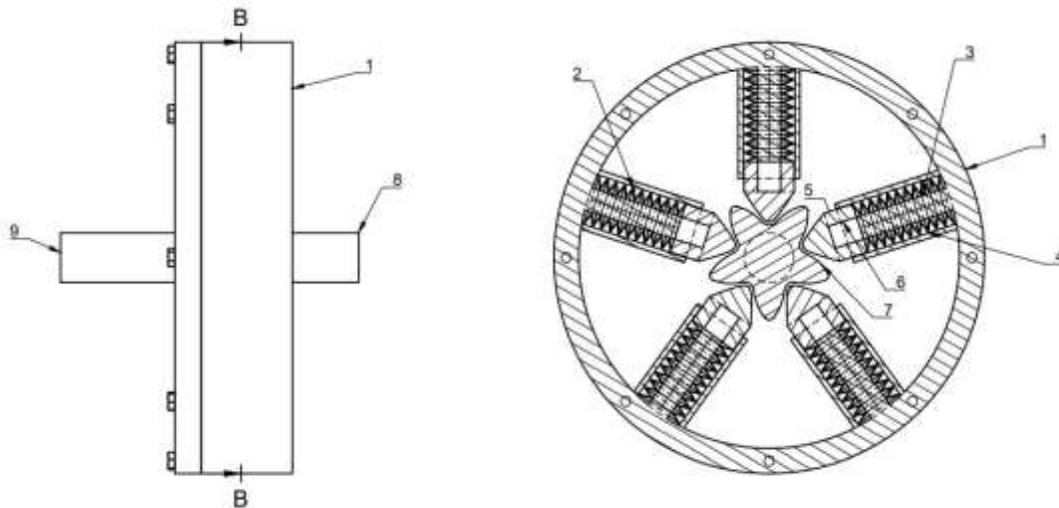
Springs ensure positive contact between the follower and cam. Cam is used for transferring the power from housing hub 1 to PTO input shaft through spring loaded followers 5.

When resistance is less on PTO shaft, the power from the output shaft of PTO gearbox is transferred to coupling hub and helps to rotate it with the same speed as of the PTO output shaft.

Due to the rigid connection, the guideways rotate with coupling hub. Guideways 2 rotate the followers 5 with them which in turn rotate the cam. The cam 7 starts rotating with the followers 5 and transfer power to PTO input shaft

In more resistance on PTO, the PTO gearbox output shaft transmits power to the coupling hub which transmits power to guideways 2. Due to extra force on springs, spring-loaded followers compress the springs and followers start moving over the cam i.e. followers compress the springs to rotate housing freely without transmitting any power. The groove on followers slide in the inner shaft and guides the follower.

When the resistance became less, springs retain its initial position and spring-loaded followers stop compressing the springs and again helps the cam to rotate with spring loaded followers.



**Technological Domain (Keywords):** PTO Slip mechanism, Slip Mechanism for Power Take-off shaft, PTO shaft guard, PTO Shaft control mechanism, PTO shaft control unit using slip function, PTO overloading control

**Proof of Concept:** PTO shaft is a way of transmitting power, from a power source to attached implement. While operating, there may be instant jerk or heavy load conditions in external implement that may cause damage to the transmission system, sometimes may even lead to undesired failure of PTO shaft. To prevent undesired failures, PTO slip mechanism can be used.

This mechanism can be installed between the PTO gearbox output shaft and PTO input shaft. If the resistance from attached implement is more compared to the power unit, the followers compress the springs to rotate housing freely without transmitting any power.

This mechanism has various advantage over existing technologies-

- An extra power source such as electric motor or hydraulic pump is not required
- There is no need of sensor in slip mechanism (like electrical systems)
- Calibration before the operation is not necessary every time. (like
- Hydraulic fluid is not required
- No effect of moisture on Slip mechanism (unlike slip clutch)
- No need of maintenance and adjustment required in a small interval of time (unlike slip clutch)
- Slip mechanism is adaptable to all machines which have PTO shaft.

**Stage of Development:**

Ideation/Prototype/Advanced Prototype/Ready to Market technology: **Ideation**

Provide Information on Competitors who manufacture and/or sell similar products: NA

**What are the unique advantages your innovation has compared to the competition:**

A few potential companies who might be interested in this technology: In the field of earth moving machinery;

JCB India Ltd.

Tata Hitachi Construction Machinery.

Komatsu India Pvt Ltd.

Action construction Equipment Ltd (ACE)

Mahindra Construction Equipment.

Hyundai Construction Equipment India Pvt Ltd.

Escorts Construction Equipment Ltd.

Caterpillar India Pvt Ltd.

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