Understanding Starter Drives—Part Two
Barrel Drives

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The Bendix screw-type starter drive served the auto industry well for several decades, but an inherent flaw in the design begged for improvement. That flaw was, that if one cylinder fired but the engine did not start, the pinion would be thrown back out of the ring gear with the starter motor still spinning at full speed. This was a common occurrence. When that happened, the operator would have to release the start switch and wait for the starter to come to a full stop before making another attempt.

Failing to wait for the "full stop" could prevent the pinion from re-entering the ring gear cleanly, because the motor shaft and pinion would already be turning too fast, causing the pinion to strike the ring gear with insufficient force to become engaged. Remember that it is the sudden turning of the screw shaft that forces the pinion out the screw threads. You can easily see this the next time you test a starter with a screw-type drive on your bench, if you re-energize the starter you are testing while it is still turning. Anyone who has ever owned a car or tractor with a screw-type drive, knows the distinct sounds associated with both the failed start (spinning out) and a second start-attempt initiated before the starter comes to a full stop (grinding). Those second start-attempts will take a heavy toll on pinions and ring gears.

Facet Enterprises Inc. invented the "Folo-Thru" drive to solve the problem, by utilizing a locking mechanism to prevent the drive from retracting until the engine actually started. Most rebuilders know the Folo-Thru as a "barrel drive", nicknamed after the bell-shaped housing that holds the pinion gear. Early versions (see Figure 1) appeared before the locking mechanism was developed, but most barrel drives you encounter are supposed to lock in the engaged position . Once locked, they cannot be retracted until they are spun past a specified RPM, as they would by the ring gear of a running engine.

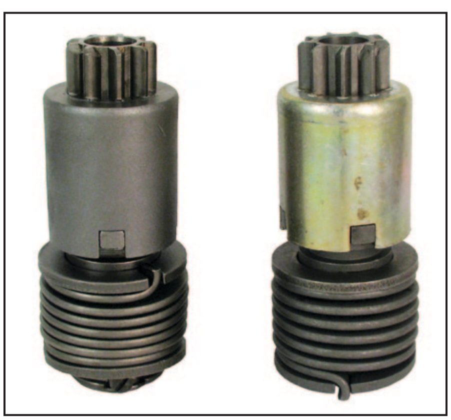

Figure 1—Early non-locking barrel drives

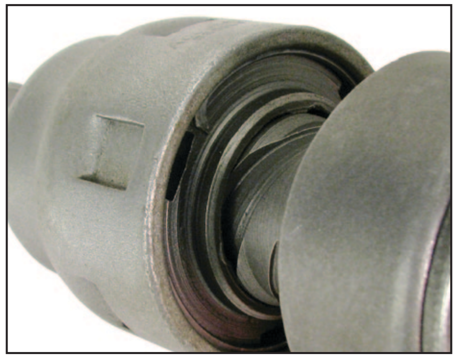

Figure 2—Retainer ring must be removed to disassemble barrel.

The "locking" is made possible by the use of a shallow notch in the threads of the screw shaft (see Figure 4) and a matching blind hole in the control nut, to which the pinion and barrel are securely attached. The holes line up when the nut is in the engaged position on the shaft. A detent pin is housed in the cavity in the control nut with a small spring behind it (see Figure 5). When this drive is engaged, the pin, under pressure from the spring, locks into the shallow notch in the screw shaft. This essentially secures the nut and pinion to the screw shaft. If the start-attempt fails for any reason, the drive will stay engaged, because the detent pins hold it there. There is a one-way ratchet clutch on a barrel drive that allows the pinion and barrel assembly to over-run freely once the engine starts. The drive will stay engaged until a specified engine speed is reached. That release speed is generally just below idle for any given application.

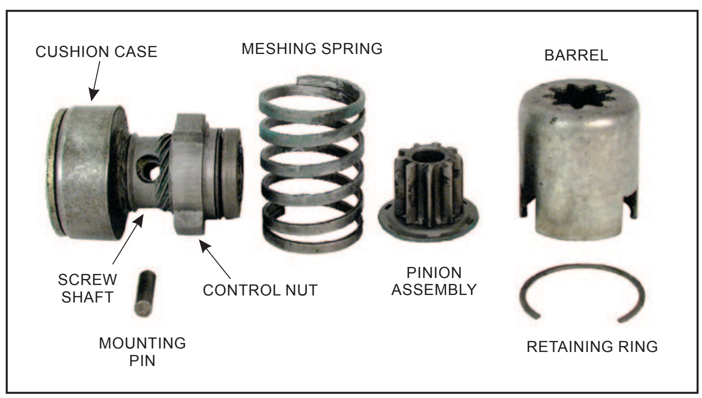

Figure 3—Small barrel drive partially disassembled.

As the pinion and barrel reach release speed, the weight of the detent pin compresses the spring until the pin moves out of the cavity in the screw shaft. With the pin no longer in the way, the spinning motion of the control nut and pinion can now turn it back down the threads on the screw shaft. The force that is acting on the detent pin is often called centrifugal force—that is the apparent outward force that draws a rotating body away from the center of rotation. It is caused

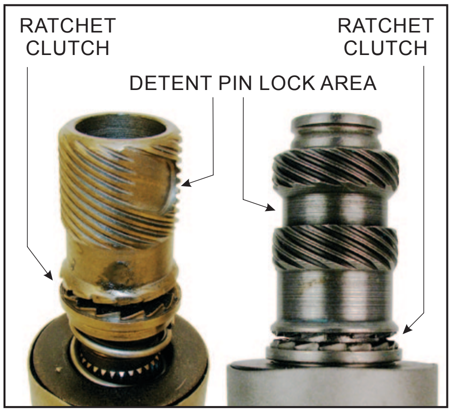

Figure 4 —Different styles of detent-pin locks.

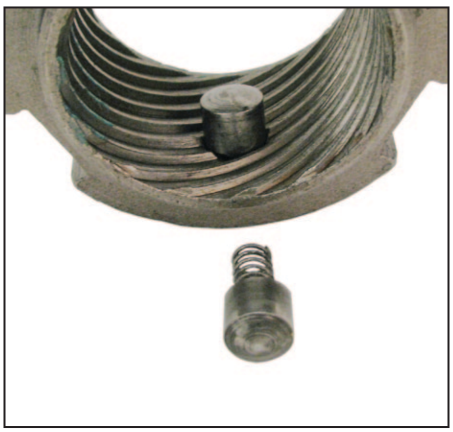

Figure 5 —Control nut showing detent pin and spring.

by the inertia of a body in motion being constantly redirected or prevented from moving off in a straight line. The detent pin is continually redirected because it is confined inside the cavity of the control nut.

The strength of this force is determined by two things, the speed of the rotation and the mass of the pin. For this reason, the weight of the detent pin and especially the strength of the spring are critical in determining the release speed of any particular barrel drive. If you are rebuilding one of these drives yourself, do not swap detent springs or pins between different drives. This can produce a different release speed that is too high for the application. This would be a big problem if the application is an old model farm tractor that rarely moves past idle. Obviously, if the pin does not release as it should, the armature will be over-spun to the point of catastrophic failure. Some imported aftermarket barrel drives are known to have springs that do not release at the speed which they should.

As mentioned earlier, the first barrel drives appeared before the locking mechanism was developed, and the transfer of power came through a driving spring. The purpose of the driving spring was to dampen the blow of the moving pinion meeting a stationary ring gear. The driving springs were eventually replaced by the rubber cushion, another innovation by Facet Enterprises (see Figure 7). All of these were sold with the Folo-Thru brand name. When a rubber cushion drive is engaged, the rubber is compressed to soften the impact of the pinion meeting the ring gear. It serves the same purpose as the spring, but it does so at a reduced cost and with greater reliability.

Facet produced rubber-cushioned barrel drives to replace many part numbers of early application screw-type drives (see Figure 8). Most of these did not have a locking mechanism. They were simply referred to as rubber compression barrel drives. They are still available today for some of the more popular screw-type drive part numbers.

Like the screw-type drive, a barrel drive may be mounted inboard or outboard. It may also be CW or CCW rotation. Until 1962, Ford Motor Company used starters with outboard-mounted rubber-cushioned barrel drives on their cars, trucks and tractors.

Barrel drives may be fixed to the motor shafts by way of a pin or a set screw (see Figures 10 and 11). Those utilizing a set screw will most likely also have a woodruff key, to prevent slippage on the shaft. If you are mounting a barrel drive with a pin, be sure that the pin is centered and tight. If the pin were to move during use, it could jam the screw shaft to the driving head and prevent the ring gear from spinning the barrel fast enough to release—again with catastrophic results.

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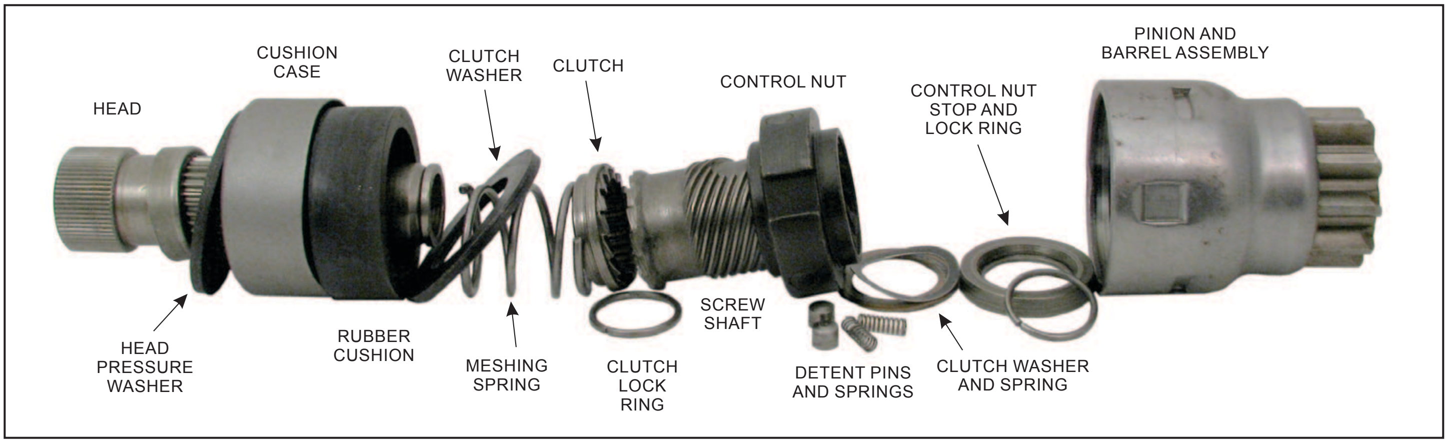

Figure 6—Disassembled large-body rubber-cushioned Folo-Thru drive.

Figure 7—The spring-type drive (left) and the rubber-cushion-type drive (right) will interchange.

Figure 8—The screw-type drive (left) can be replaced by the rubber-cushion-type drive (right).

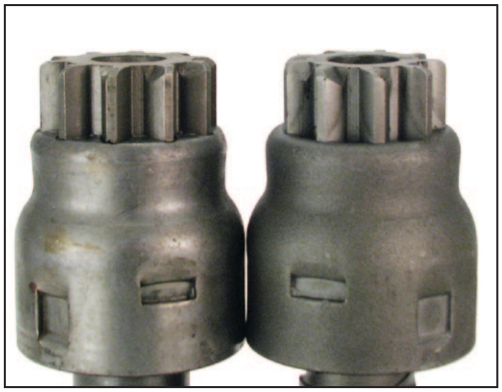

Figure 9—CCW (left) and CW (right) drives

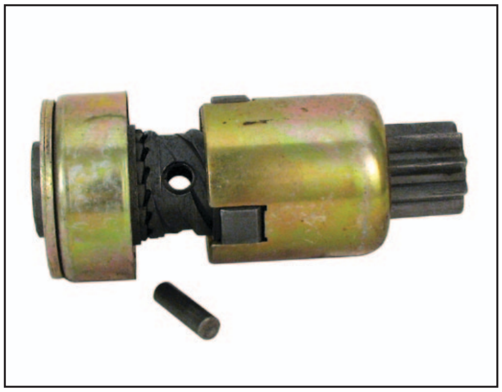

Figure 10—Pin-secured drive

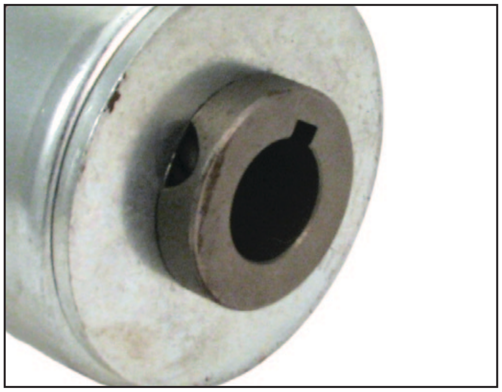

Figure 11—Set screw and keyway-secured drive