

## Roots o'Reels XVII: *Leonardo da Vinci's Reel Failure*

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(This article is part of a series about inventions that were adapted for use in fishing reels.)

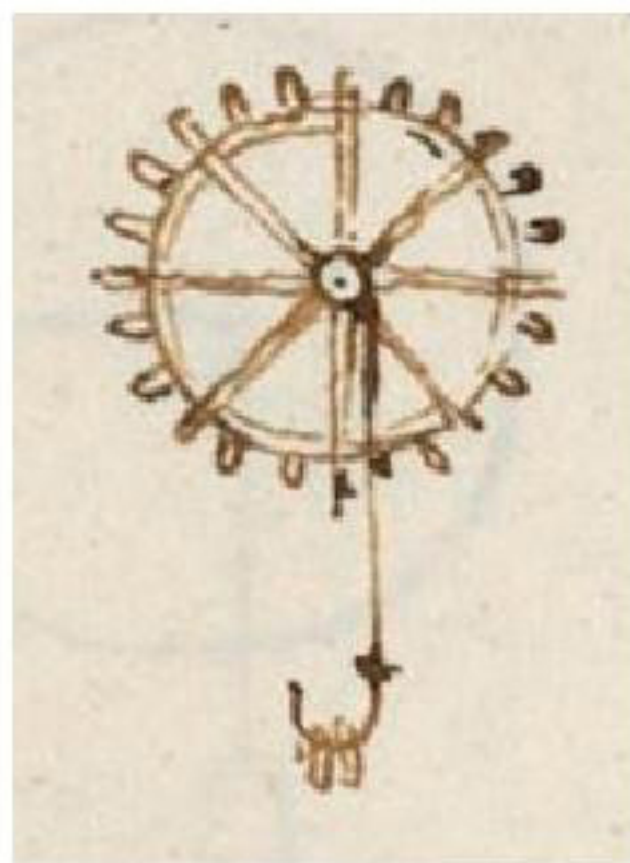


Fig. 1. A winch  
drawn by Leonardo

If only Leonardo da Vinci had focused on the needs of contemporary fishermen! Instead, he wasted years in heated arguments with the Duke of Milan over which of the apostles had a dimple and so never finished painting *The Last Supper*. He would waste later years in heated arguments over whether or not to retouch the gap-toothed smile in his portrait of Francesco del Giocondo's wife, Lisa. Alas...Leonardo blew his chance to become history's consummate fishing reel engineer, simply because he couldn't get his priorities straight.

Did Leonardo give any thought to fishing reels? He drew a hook dangling from a winch (Fig. 1) in his *Codex Madrid I*, a notebook that remained undiscovered for centuries until 1967. Although the winch was designed for measuring waterfall force, and the hook carried weights, a polymath like Leonardo almost certainly would have recognized its potential use as a fish-catching device. Could he have designed a reel that could be attached to a rod? Of course! What is a reel, after all, but a spool, usually mounted within a frame, with a crank to turn it and wind up line? But Leonardo could have gone far beyond making a single-action reel. His notes indicate that he easily could have invented a conventional multiplying reel equipped with an anti-reverse, a freespool clutch, a friction brake, and even a level wind. He could have invented a spinning reel, as well. As shown in Fig. 2, 15th-century anglers could have used some help.

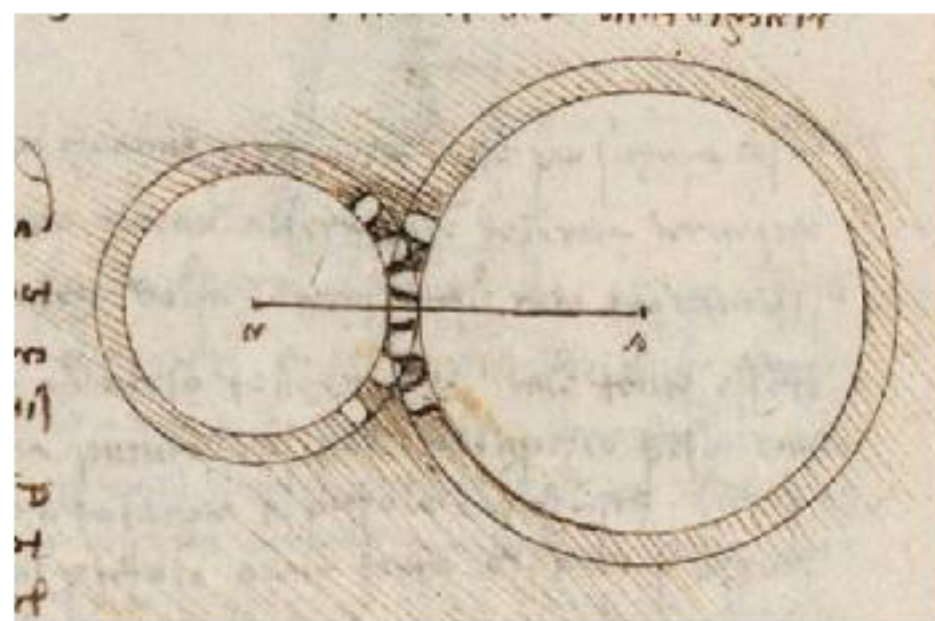


Fig. 3. A pair of multiplying spur gears

### Conventional reels

The ancients used geared winches for centuries. Greek engineers were advanced enough to create what was essentially a bronze-gearred analog computer, known to us as the Antikythera Mechanism, capable of making myriad astronomical predictions. Leonardo, well-versed in subjects like classical engineering, would not have had to settle for inventing a simple single-action reel; the idea of using multiplying gears would have been a no-brainer (Fig. 3). He might even have used planetary gears, with which he was quite familiar (Fig. 4). If he had decided to make a

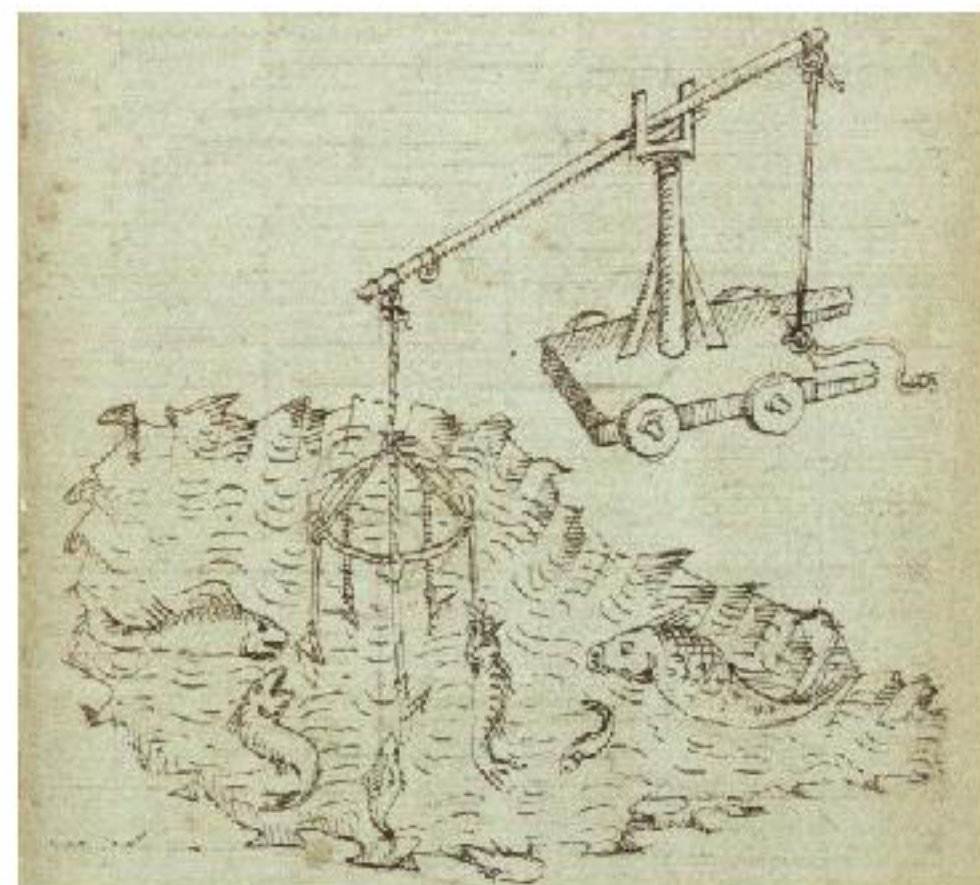


Fig. 2. Fishing crane, Mariano Taccola,  
ca. 1425

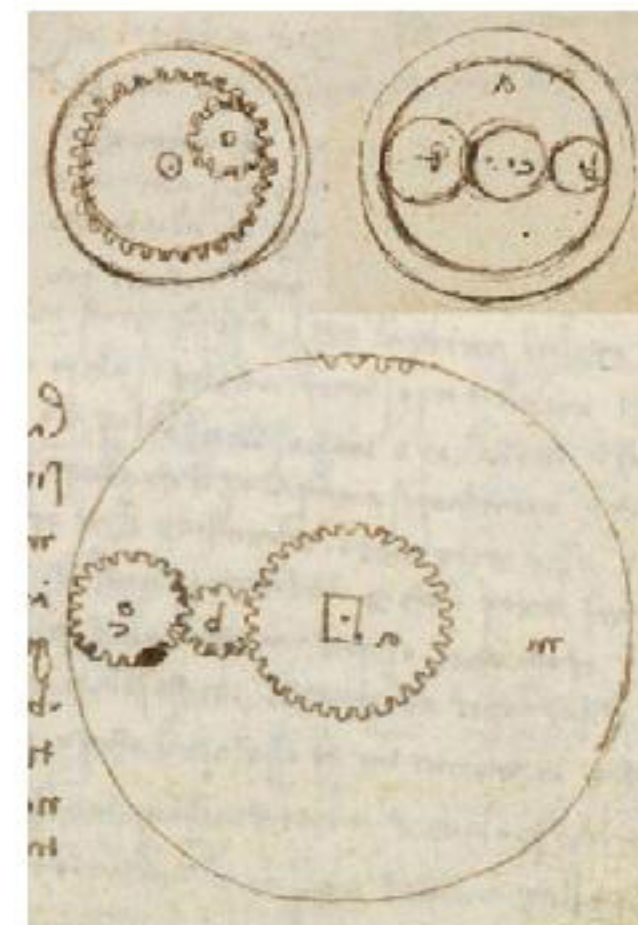


Fig. 4. Planetary gear trains drawn by  
Leonardo

multi-speed reel, he could have adapted one of several transmissions he described (Fig. 5).

The spool itself would not have been a challenge. Thread spools similar to those we still use were in use in Leonardo's day, and he was capable of making spools with larger-diameter flanges attached to arbors (Fig. 6). He probably would have elected to support the spool on ball, conical, or even roller bearings (Fig. 7).



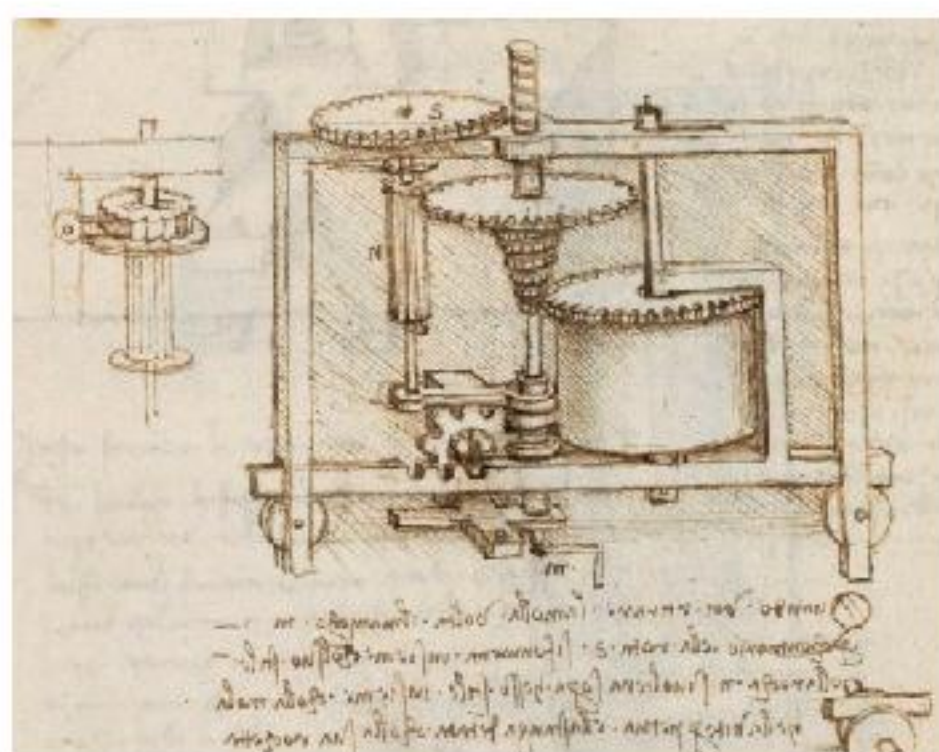


Fig. 5. A transmission designed by Leonardo

For Leonardo, adding a friction brake of some kind to his reel would have been a relatively simple task, compared with supplying one for his self-propelled, spring-driven cart. Of the various possible means of actuating the brake, he might have used a cam (Fig. 8). His designs of flywheels could have inspired the invention of a centrifugal brake, as well.

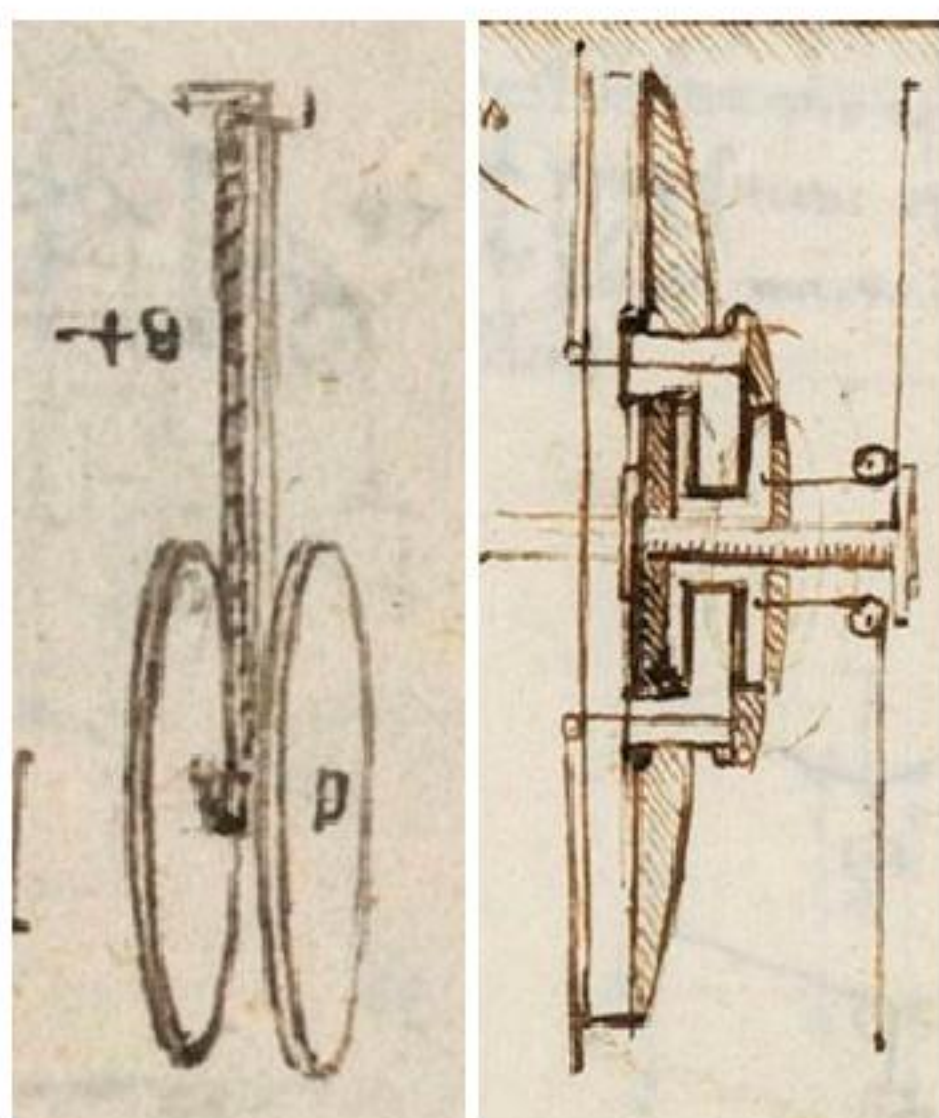


Fig. 6. A spool and a method of attaching a spool flange to an arbor

The addition of such niceties as anti-reverse and freespool clutches would have added a level of complexity for Leonardo. Nevertheless, he clearly had the wherewithal to design them. Mounting gears

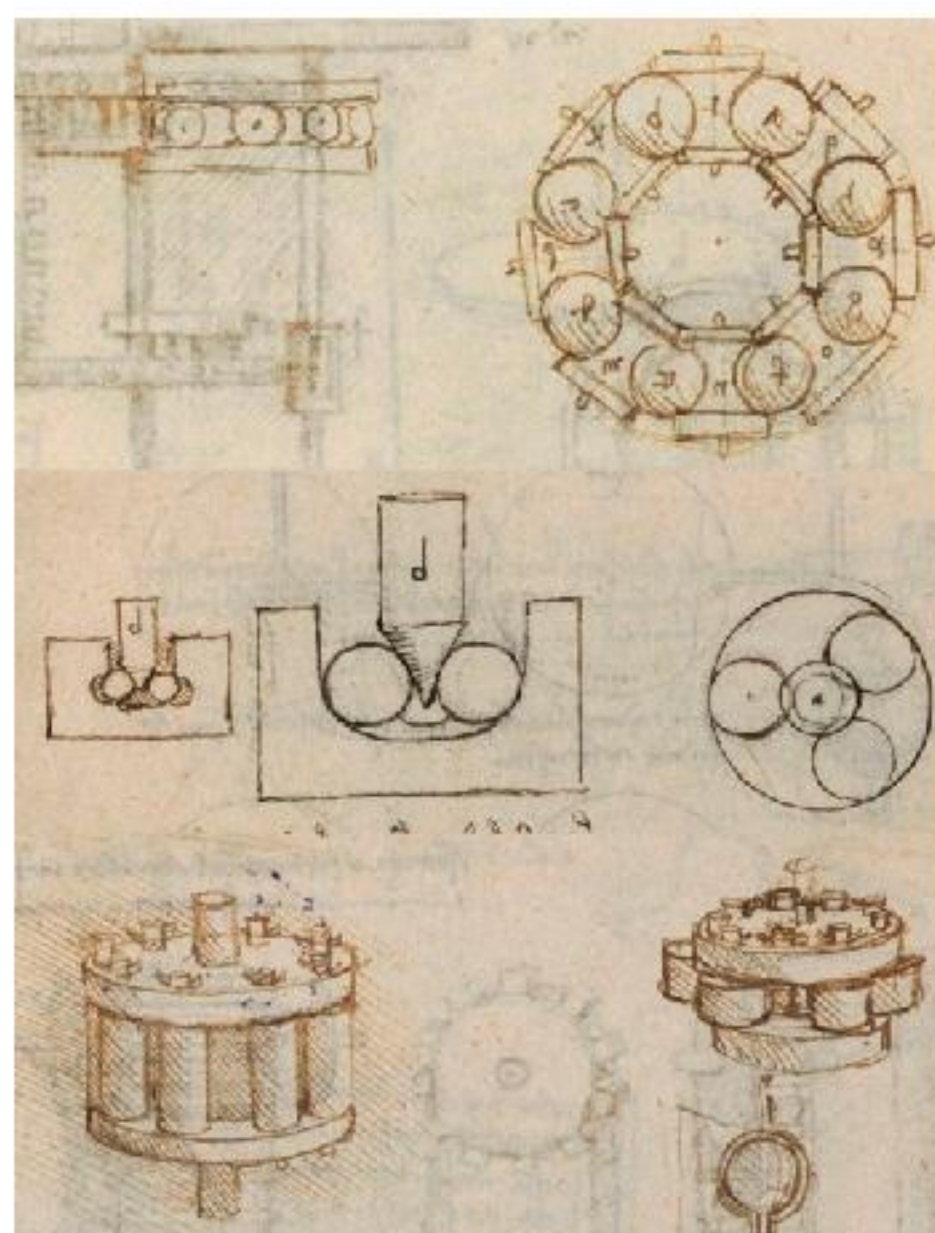


Fig. 7. Ball, conical, and roller bearings (top to bottom). The design of the conical bearings is probably superior to that patented by Julius Vom Hofe in 1882.

coaxially was not a novelty during the Renaissance, and Leonardo described a ratchet wheel that rotated independently of a coaxially mounted gear. Use of a pawl with such a ratchet can be used to operate a clutch. And he even described what could have been used for an overrunning clutch, using a pawl within an internal ratchet (Fig. 9). If you preferred a clutch that required separation of two shaft members, such as the spool axle or the crankshaft, Leonardo could have provided it (Fig. 10).

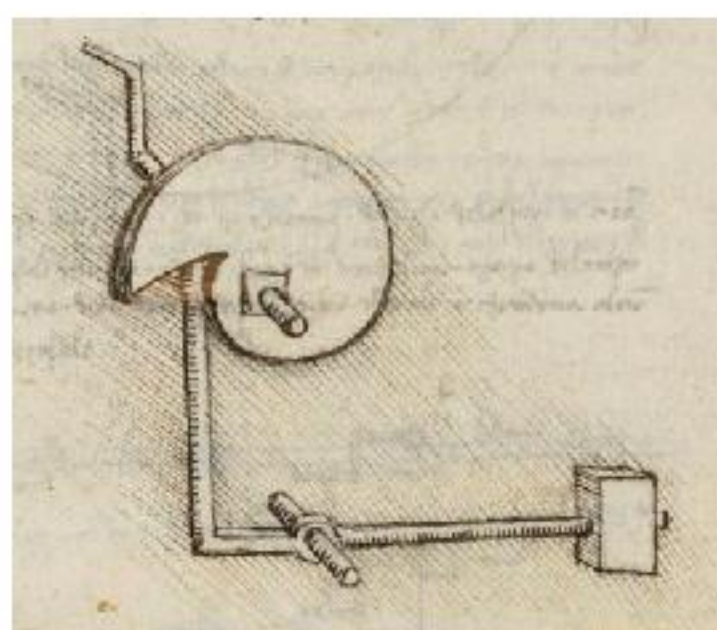


Fig. 8. A cam used to shift a rod, similar to the Shakespeare/Marhoff adjustable brake of 1903



Fig. 9. Independently rotating ratchet wheel and spur gear (left) and a pawl in an internal ratchet wheel, a potential overrunning clutch (à la Rockwell, Meisselbach)

Reel designers and collectors have devoted much time over the years to studying level winds on casting reels. Our Renaissance Man could have designed at least three that would be used in 20th-century reels. He invented a mechanism for a pendulum clock that could have been adapted for a “windshield wiper” level wind (Fig. 11). Another mechanism, employing two threaded cylinders with a pawl between them, anticipated the famous Shakespeare level wind of 1897 (Fig. 12). One writer naively suggested that the Shakespeare invention was based on a mechanism in a loom invented in the 1880s (*The Reel News*, May, 2004, pg. 15), but Leonardo drew the mechanism almost 400 years before that.

Perhaps the most astonishing idea regarding level winds was Leonardo’s design of a rotating cylinder cut with a continuous hel-

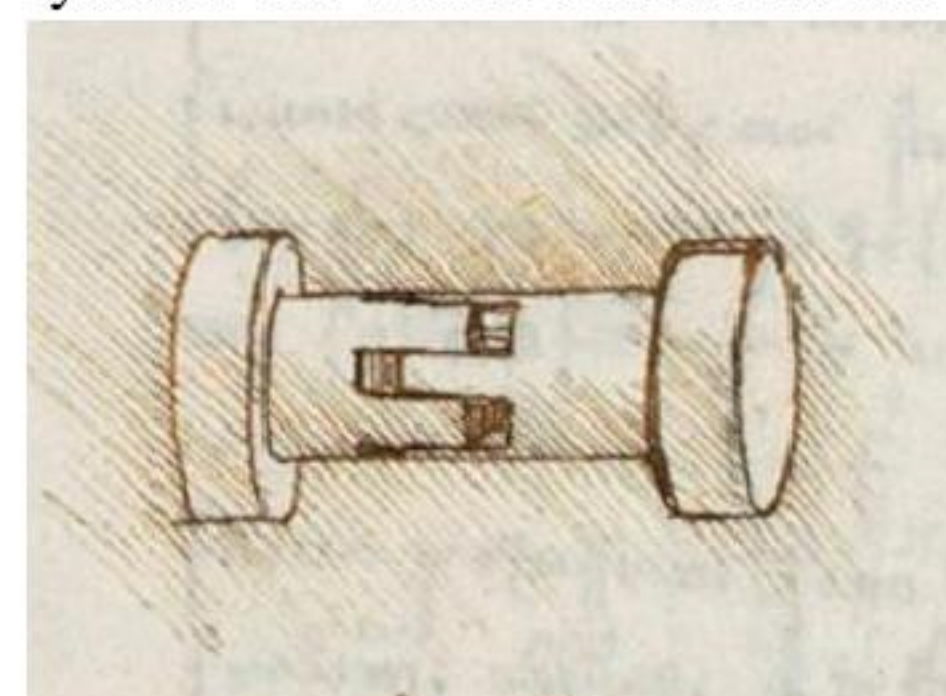


Fig. 10. Design for a shaft-associated clutch (à la Hunter, Atwood)



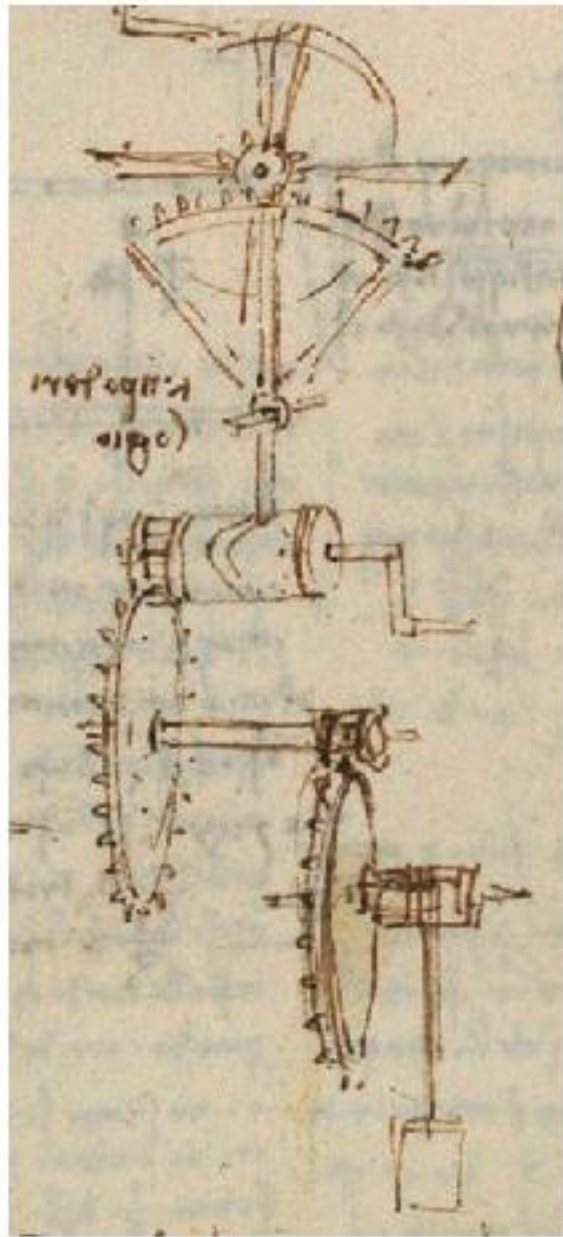


Fig. 11. A pivot mechanism (à la Welch)

ical groove that changed handedness at each end of the cylinder. This “multiple return cylinder” has been the basis of most reel level winds since 1860; a pivoting pawl

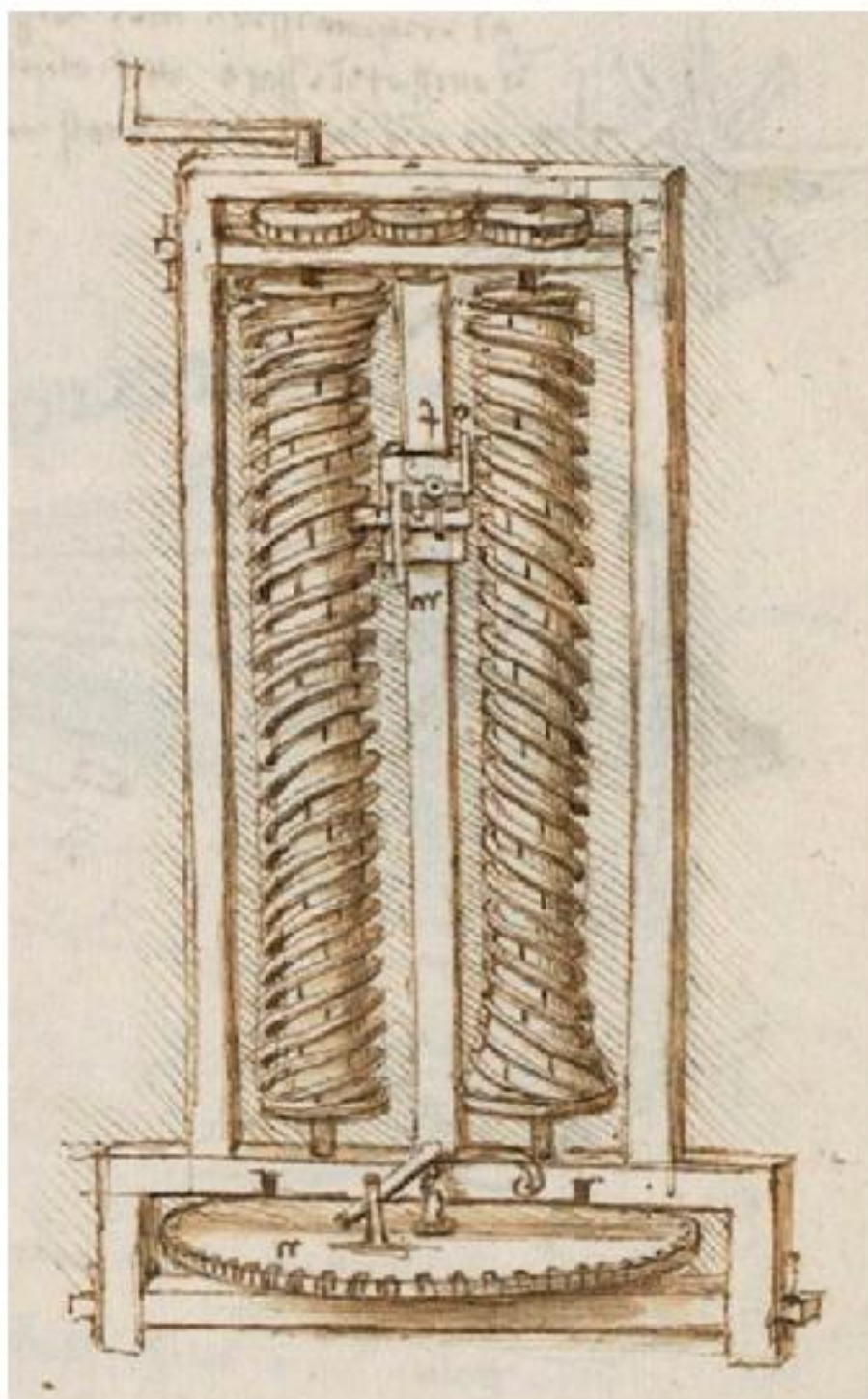


Fig. 12. A dual-cylinder return mechanism (à la Shakespeare). Whether or not the cylinders use the same handedness is determined by the gear trains that turn them. The flared ends of the cylinders shift the rectangular pawl between them.

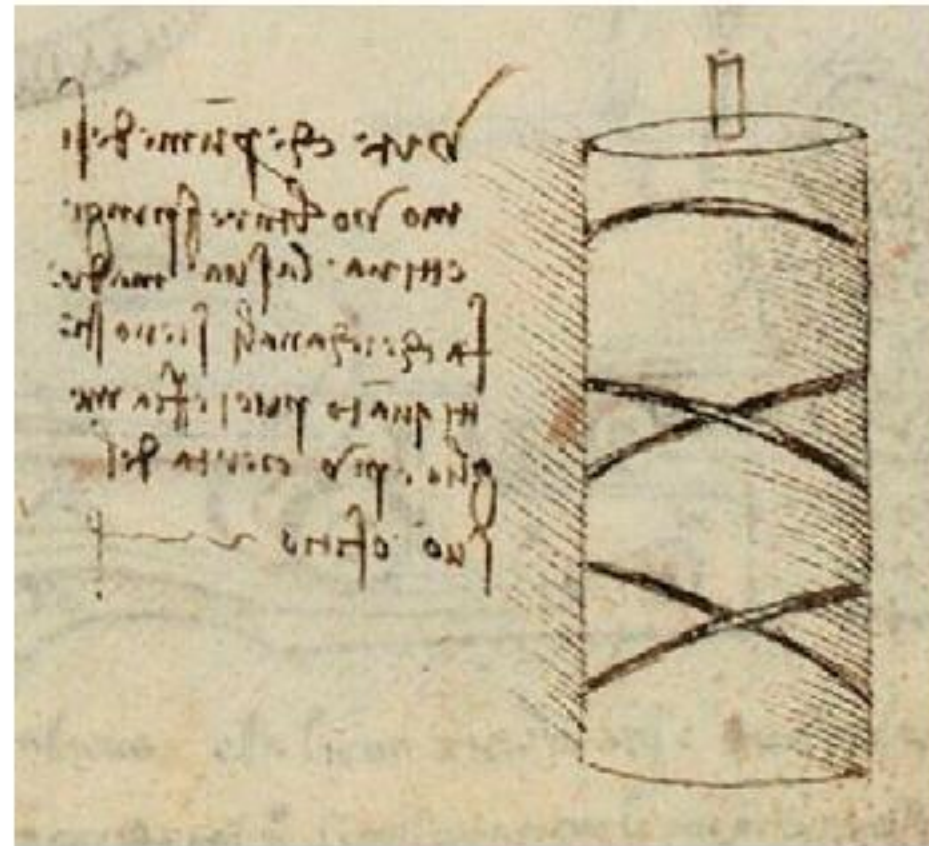


Fig. 13. A “Double Screw of Napier” drawn centuries before Napier’s birth

attached to a line guide travels back and forth along the cylinder (Fig. 13, 14). The invention of this cylinder has been attributed to Robert Napier, a Scottish marine engineer. His cylinder, called the “Double Screw of Napier,” was probably invented during the 1830s. However, Leonardo designed such a cylinder, probably before 1495.

Thus, the mechanical technology required to create the equivalent of



Fig. 14. One of Leonardo’s versions of how his multiple return cylinder might have looked. A pivoting pawl is included.

a modern casting reel was available to Leonardo, even if he had to develop much of it himself. Obviously, he lacked the materials—the plastics and alloys—we have today. Furthermore, he lacked the precision machinery to make some parts, such as the 3-56 screws that no self-respecting modern reel can live without. But I wonder if some primitive casting reel of his lies hidden in some Italian or French castle.

### Spinning reels

The textile industry spawned the invention and development of the spinning reel over a century ago. Centuries earlier, Leonardo designed a number of looms and bobbin winders. Some of the bobbin winders could have been adapted for use as fishing reels with minimal change. They were driven by gearing similar to that used in many reels in today’s collections (Fig. 15-17). I have no doubt that, given the use of such devices for fishing, the idea of casting from a fixed spool would have occurred to him.

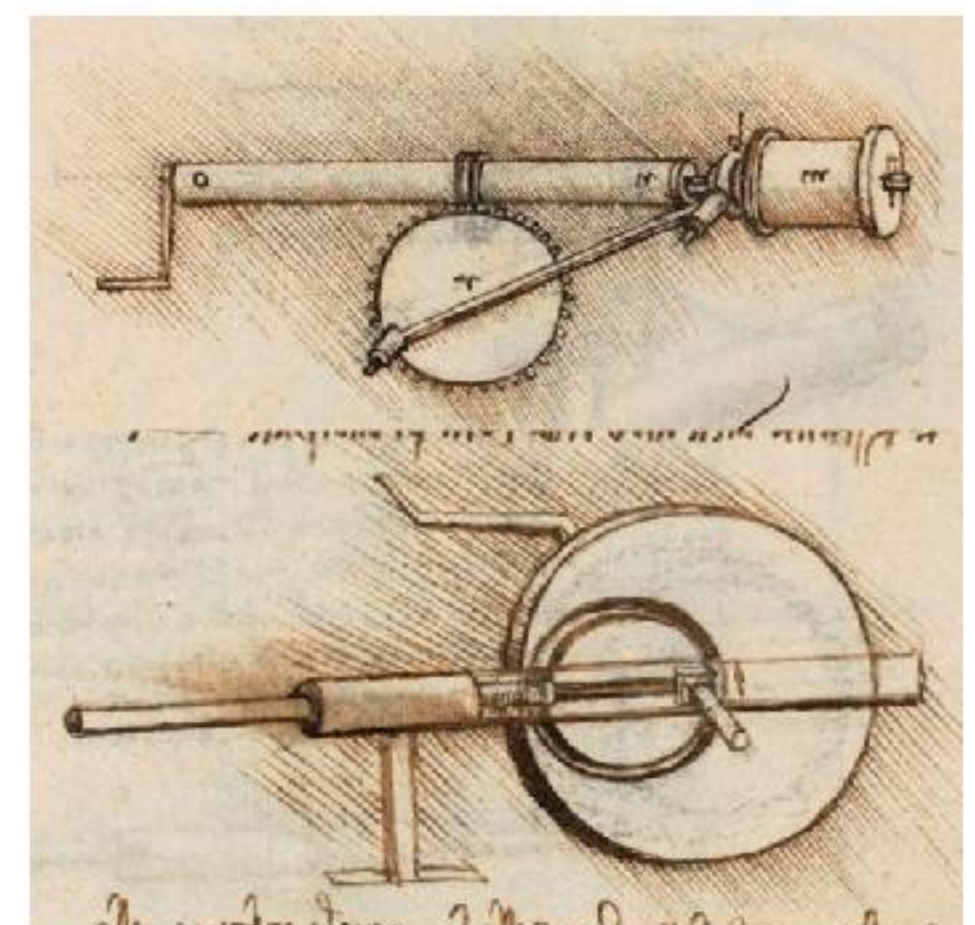


Fig. 15. Two means of using rotary motion to slide a rod back and forth (à la Stanley). The upper drawing is a bobbin winder, and the spool turns as the rod slides.



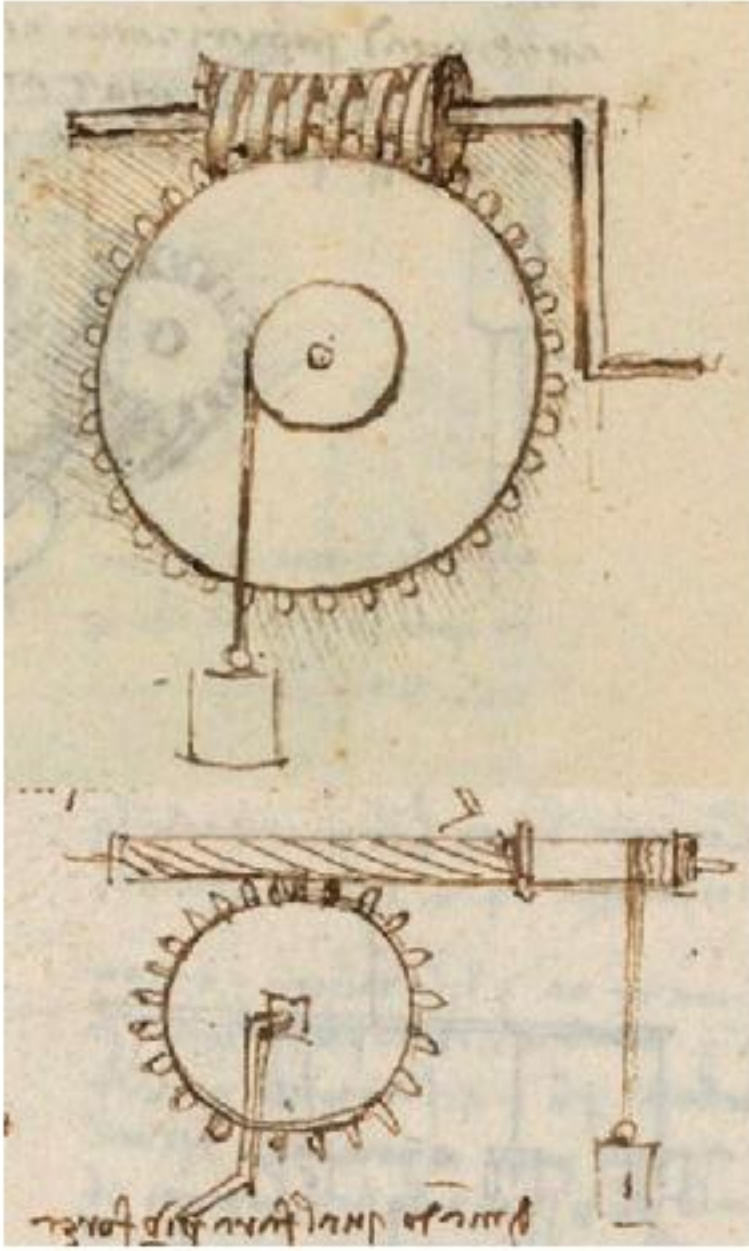


Fig. 16. Two worm drives, also usable for converting rotary to linear motion

Leonardo probably would have added a wire bail for line pickup eventually, as he already had devised flyers for a couple of his bobbin winders (Fig. 18).

We shouldn't blame Leonardo for his failure to create fishing reels that might have been suitable for use even today. He apparently had other things on his mind. But in

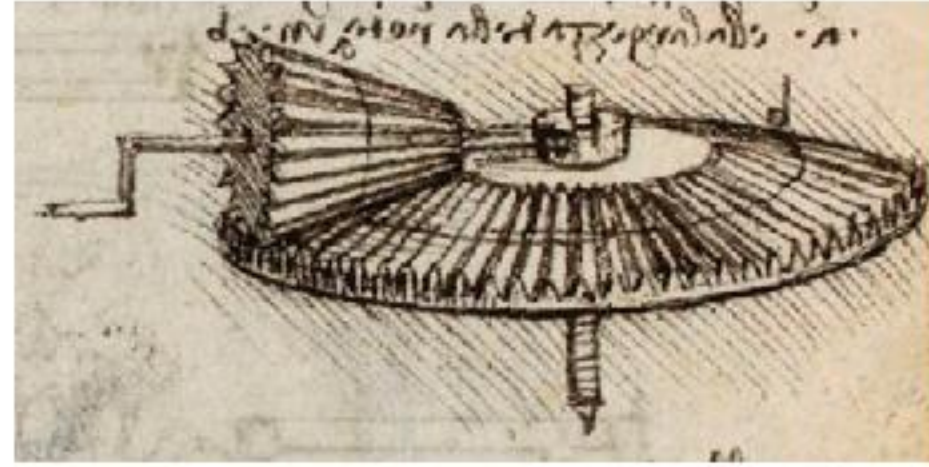


Fig. 17. Bevel gears, used to transfer power perpendicularly

light of the mechanical technology already developed by the end of the 15th century, we can surely ask why it took centuries more for tackle makers essentially to reinvent the reel.

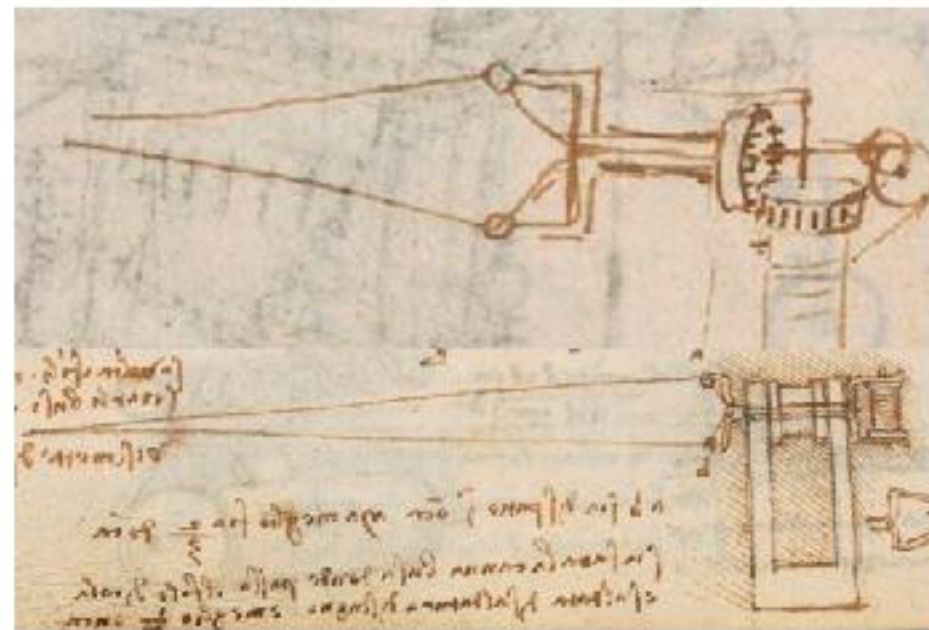


Fig. 18. Flyers used for winding thread (à la Illingworth)

*I am very grateful to Jutta Seibert for providing translations of some of Leonardo's notes.*