



四节伸缩臂 Four section telescopic arm

四段式伸缩臂由四个臂段（一节臂、二节臂、三节臂、四节臂）、一个末端执行器（如贝壳斗、梅花抓斗）组成，每段臂之间通过液压油缸、钢丝绳和滑轮组等部件进行连接和驱动。其原理主要基于以下几点：

滑轮组合：通过多个滑轮（包括动滑轮和定滑轮）的组合，利用动滑轮省力、定滑轮改变力的方向的特性，实现力的倍增。

钢丝绳张力分散：当钢丝绳绕过滑轮时，其张力被分散并传递到多个滑轮上，从而减少了单个滑轮所承受的力，并增加了整体的提升能力。

倍率调整：通过改变滑轮组的倍率（四节伸缩臂通常设计为12倍率），可以灵活地调整起升力，实现翻倍的效果。倍率增加时，钢丝绳每个分支拉力减小，但整体提升能力增强。

综上所述，四节伸缩臂利用滑轮组合、钢丝绳张力分散以及倍率调整等技术手段，实现力的倍增和整体提升能力的增强。

四段式伸缩臂按其应用场景可分为低净空伸缩臂和超长伸缩臂两种。低净空伸缩臂通常应用在施工高度低、狭小立体的空间中，三段式伸缩臂和四段式伸缩臂在最大挖掘深度相同的情况下，三段式伸缩臂需占用更高、更大的空间，而低净空四节伸缩臂占用空间较小。超长伸缩臂是以作业范围更深、更广大为特点，极致发挥挖掘机的可拓展性，挖掘深度可达45米，在超深基坑、桥梁建设等工程中起着重要作用。

The four-stage telescopic arm is composed of four arm segments (one arm, two arms, three arms, four arms) and an end actuator (such as shell bucket, plum grab), and each arm is connected and driven by hydraulic cylinder, steel wire rope, pulley block and other components. Its principle is mainly based on the following points:

Pulley combination: Through the combination of multiple pulleys (including dynamic pulleys and fixed pulleys), using the characteristics of dynamic pulleys to save effort and fixed pulleys to change the direction of the force, to achieve force multiplication.

Wire rope tension dispersion: As the wire rope goes around the pulley, its tension is dispersed and transmitted to multiple pulleys, thereby reducing the force on a single pulley and increasing the overall lifting capacity.

Magnification adjustment: By changing the magnification of the pulley block (the four-section telescopic arm is usually designed to be 12 magnification), the lifting force can be flexibly adjusted to achieve a doubling effect. When the magnification increases, the tension of each branch of the wire rope decreases, but the overall lifting ability increases.

In summary, the four-section telescopic arm uses technical means such as pulley combination, wire rope tension dispersion and rate adjustment to achieve force multiplication and overall lifting ability enhancement.

According to its application scenario, the four-stage telescopic arm can be divided into low headroom telescopic arm and ultra-long telescopic arm. Low headroom telescopic arm is usually used in low construction height, narrow three-dimensional space, three-stage telescopic arm and four-stage telescopic arm in the case of the same maximum digging depth, the three-stage telescopic arm needs to occupy a higher and larger space, while the low-headroom four-section telescopic arm occupies a smaller space. The ultra-long telescopic arm is characterized by a deeper and more widespread operation range, which gives full play to the extensibility of the excavator, and the digging depth can reach 45 meters, which plays an important role in ultra-deep foundation pits, bridge construction and other projects.