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超级装备

第1集 独立装备

Super equipment / Episode 1 – Independent Equipment

装备 (zhuāng bèi) equipment; to equip; to outfit.

This is Shanghai,

Night falls,

At the beginning of Hua Deng,

Another unique night of the
magic city begins.

A palace that continues to be
abundant,

Make this city bright as day.

If you look down from the sky,

Shanghai is one of the brightest
cities on the east coast of the
entire Eurasian continent.

And just in Harwusu, Inner
Mongolia, 1400 kilometers
away from Shanghai,

On the vast mine,

这里是上海,

夜幕降临,

华灯初上,

又一个别具风情的魔都之夜开
始。

持续充沛的宫殿,

使这个城市亮如白昼。

如果从空中俯瞰,

上海是整个亚欧大陆东海岸最明
亮的城市之一,

而就在距离上海1400公里外的内
蒙古哈尔乌素,

广袤的矿山上,

夜幕降临 (yè mù jiàng lín) nightfall.

华灯初上 (huá dēng chū shàng) early evening when
lanterns are first lit.

风情 (fēng qíng) mien; bearing; grace; amorous
feelings; flirtatious expressions; local conditions and
customs; wind force, direction etc. 魔都 (mó dū) Modu,
nickname for Shanghai.

充沛 (chōng pèi) abundant; plentiful; vigorous. 宫
殿 (gōng diàn) palace.

白昼 (bái zhòu) daytime.

空中 (kōng zhōng) in the sky; in the air. 俯瞰 (fǔ kàn) to
overlook; to look down from a height.

亚欧大陆 (yà ōu dà lù) Eurasian continent. 东海
岸 (dōng hǎi àn) East Coast. 明亮 (míng liàng) bright;
shining; glittering; to become clear. 之一 (zhī yī) one of
(sth); one out of a multitude; one (third, quarter,
percent etc).

内蒙古 (nèi měng gǔ) Inner Mongolia; abbr. for 内蒙
古自治区 (nèi měng gǔ zì zhì qū), Inner Mongolia
autonomous region. 乌 (wū) crow; black. 素 (sù) raw
silk; white; plain, unadorned; vegetarian (food);
essence; nature; element; constituent; usually; always;
ever.

广袤 (guǎng mào) vast. 山上 (shān shàng) Shanshang
township in Tainan county 台南县 (tái nán xiàn),
Taiwan.

A steel giant is neighing with his head up.

一头钢铁巨无霸正在昂首嘶鸣。

一头 (yī tóu) one head; a head full of sth; one end (of a stick); one side; headlong; directly; rapidly; simultaneously. 巨无霸 (jù wú bà) Big Mac (McDonald's hamburger). 昂首 (áng shǒu) head high; in high spirits; to raise one's head (e.g. of neighing horse). 嘶鸣 (sī míng) to whinny (of a horse); to neigh.

The bucket capacity is 75 cubic meters,

铲斗容量75立方米,

铲 (chǎn) to shovel; to remove; spade; shovel. 斗 (dòu) to fight; to struggle; to condemn; to censure; to contend; to put together; coming together. 容量 (róng liàng) capacity; volume; quantitative (science). 立方米 (lì fāng mǐ) cubic meter (unit of volume).

The excavated materials can fill two train boxes.

挖掘的物料可以装满两节火车箱。

挖掘 (wā jué) to excavate; to dig; to unearth. 物料 (wù liào) material. 装满 (zhuāng mǎn) to fill up. 火车 (huǒ chē) train.

It contributes 30 million tons of coal to China every year,

它每年为中国贡献3000万吨煤炭量,

每年 (měi nián) every year; each year; yearly.

These coals can generate 90 billion tons of electricity,

这些煤可发电900亿吨,

发电 (fā diàn) to generate electricity; to send a telegram.

It is equivalent to the electricity consumption of a whole year in Beijing city.

相当于北京城区一整年的用电量。

相当于 (xiāng dāng yú) equivalent to. 城区 (chéng qū) city district; urban area. 电量 (diàn liàng) quantity of electric charge or current.

It is the mining equipment with the largest bucket capacity in the world today.

它就是当今世界上铲斗容量最大的矿用挖掘装备,

当今 (dāng jīn) current; present; now; nowadays. 装备 (zhuāng bèi) equipment; to equip; to outfit.

75 cubic meter excavator.

75立方米挖掘机。

挖掘机 (wā jué jī) excavator.

When the steel giant works tirelessly under the night,

当钢铁巨无霸在夜幕下不知疲倦的工作之际,

夜幕 (yè mù) curtain of night; gathering darkness. 不知疲倦 (bù zhī pí juàn) untiring; not recognizing tiredness. 之际 (zhī jì) during; at the time of.

Changsha, Hunan, thousands of miles away, is another scene.

远隔千里的湖南长沙则是另外一番景象。

远隔千里 (yuǎn gé qiān lǐ) thousands of miles away; far away. 湖南 (hú nán) Hunan province in south central China, abbr. 湘, capital Changsha 长沙 (cháng shā). 长沙 (cháng shā) Changsha prefecture-level city and capital of Hunan province in south central China. 番 (fān) foreign (non-Chinese); barbarian; classifier for occurrences (of an event, action or speech utterance); classifier for iterations: times, -fold (as in twofold etc); classifier for situations: kind, sort. 景象 (jǐng xiàng) scene; sight (to behold).

The Xiangjiang River is quiet,

湘江河畔一派宁静,

湘 (xiāng) abbr. for Hunan 湖南 province in south central China; abbr. for Xiangjiang river in Hunan province. 江河 (jiāng hé) Yangtze and Yellow rivers. 畔 (pàn) edge; side; boundary; bank (of a river etc); shore. 宁静 (níng jìng) tranquil; tranquility; serenity.

The hustle and bustle of the day
was dissolved in the shadow of
Lanshan,

白天的喧嚣化解在蓝山的灯影
里，

白天 (bái tiān) daytime; during the day; day. 喧嚣 (xuān xiāo) to clamor; to make noise. 化解 (huà jiě) to dissolve; to resolve (contradictions); to dispel (doubts); to iron out (difficulties); to defuse (conflicts); to neutralize (fears). 蓝山 (lán shān) Lanshan county in Yongzhou 永州 (yǒng zhōu), Hunan. 影 (yǐng) picture; image; film; movie; photograph; reflection; shadow; trace.

Of course people don't notice
that they are under the ground
in this city,

人们当然察觉不到在这座城市的
地底下，

察觉 (chá jué) to sense; to perceive; to become aware of; to detect. 不到 (bù dào) not to arrive; not reaching; insufficient; less than. 底下 (dǐ xià) the location below sth; afterwards.

Even deep in people's feet,

甚至就在人们的脚底深处，

脚底 (jiǎo dǐ) soles of the feet. 深处 (shēn chù) abyss; depths; deepest or most distant part.

A giant steel dragon is digging.

一条钢铁巨龙正在轰然掘进。

轰然 (hōng rán) loudly; with a loud bang; a loud rumble. 掘 (jué) to dig.

It weighs 3,000 tons,

它自重3000吨，

自重 (zì zhòng) to conduct oneself with dignity; to be dignified; deadweight.

It can generate 12,000 tons of
thrust during tunneling.

掘进时可产生12000吨的推力。

推力 (tuī lì) driving force; impetus; thrust (of a boat or aeroplane engine); repelling force.

Into the ground is soil,

入地是土，

Yushan gravel,

玉山碎石，

玉山 (yù shān) Mount Yu, the highest mountain in Taiwan (3952 m). 碎石 (suì shí) crushed or broken rock, stone etc.

Unstoppable.

无坚不摧。

无坚不摧 (wú jiān bù cuī) no stronghold one cannot overcome (idiom); to conquer every obstacle; nothing one can't do; to carry everything before one.

Tunnelling,

掘进、

Ballast,

出碴、

碴 (chá) fault; glass fragment; quarrel.

Lining,

衬砌，

砌 (qì) to build by laying bricks or stones.

Where the dragon passed,

巨龙身过之处，

It is a complete tunnel.

便是一条完整的隧道。

便是 (biàn shì) (emphasizes that sth is precisely or exactly as stated); precisely; exactly; even; if; just like; in the same way as. 隧道 (suì dào) tunnel.

With it,

有了它，

有了 (yǒu le) I've got a solution!; to have a bun in the oven (abbr. for 有了胎 (yǒu le tāi)).

It is expected that in 2020,

预计2020年，

预计 (yù jì) to forecast; to predict; to estimate.

The total mileage of China's
subway will reach 6000
kilometers,

中国的地铁总里程将达到6000公
里，

里程 (lǐ chéng) mileage (distance traveled); course (of development).

Become the country with the
fastest subway construction
speed in the world.

成为全球地铁建设速度最快的国家。

It is a large-scale tunnel boring
equipment independently
developed by China.

它就是中国自主研发的大型隧道
掘进装备，

自主 (zì zhǔ) independent; to act for oneself; autonomous. 研制 (yán zhì) to manufacture; to develop.

Large-diameter mud-water balance shield machine.

More than 400 kilometers north of Xiangjiang River came to Yichang, Hubei,

A majestic and majestic human super project,

The Three Gorges Project sits above the Yangtze River, the largest river in China.

In this thrilling water area known for its high water drop of 113 meters,

An unparalleled ship elevator is launching an aerial show.

This is currently worldwide,

The largest full balance is the vertical shiplift,

Can carry ships of 3,000 tonnage,

Lift the ship to 113 meters at a speed of 12 meters per minute,

Equivalent to the height of 40 floors.

It only takes 37 minutes,

It can allow ships to climb over a 100-meter drop from the downstream of the Three Gorges Dam

Arrive upstream,

大直径泥水平衡盾构机。

由湘江北上400多公里来到湖北宜昌，

一座雄奇巍峨的人类超级工程，

三峡水利枢纽工程雄居于中国的第一大河长江之上。

在这片以113米的高水位落差而著称的惊险水域，

一座举世无双的船舶电梯正在展开空中表演。

这是目前世界范围内，

规模最大的全平衡是垂直升船机，

能装载3000吨位的船舶，

以每分钟12米的速度将船舶提升到113米，

相当于40层楼的高度。

仅需37分钟，

就能让船舶从三峡大坝的下游翻越百米落差，

抵达上游，

直径 (zhí jìng) diameter. **泥 (ní)** mud; clay; paste; pulp.

江北 (jiāng běi) Jiangbei district of central Chongqing municipality, formerly in Sichuan; Chongqing's main airport; Jiangbei district of Ningbo city 宁波市 (níng bō shì), Zhejiang. **来到 (lái dào)** to come; to arrive. **湖北 (hú běi)** Hubei Province (Hupeh) in central China, abbr. 鄂 (è), capital Wuhan 武汉 (wǔ hàn). **宜昌 (yí chāng)** Yichang prefecture level city in Hubei.

巍峨 (wēi é) lofty; towering; majestic. **工程 (gōng chéng)** engineering; an engineering project; project; undertaking.

三峡 (sān xiá) Three Gorges on the Chang Jiang or Yangtze, namely: Qutang Gorge 瞿塘峡 (qú táng xiá), Wuxia Gorge 巫峡 (wū xiá) and Xiling Gorge 西陵峡 (xī líng xiá); Sanxia or Sanhsia town in New Taipei City 新北市 (xīn běi shì), Taiwan. **水利 (shuǐ lì)** water conservancy; irrigation works. **枢纽 (shū niǔ)** hub (e.g. of traffic network); hinge; pivot; fulcrum. **居 (jū)** to reside; to be (in a certain position); to store up; to be at a standstill; residence; house; restaurant; classifier for bedrooms. **大河 (dà hé)** large river (esp the Yellow River). **之上 (zhī shàng)** above.

水位 (shuǐ wèi) water level. **落差 (luò chā)** drop in elevation; (fig.) gap (in wages, expectations etc); disparity. **著称 (zhù chēng)** to be widely known as. **惊险 (jīng xiǎn)** thrilling; a thriller. **水域 (shuǐ yù)** waters; body of water.

举世无双 (jǔ shì wú shuāng) unrivaled (idiom); world number one; unique; unequaled. **船舶 (chuán bō)** shipping; boats.

垂直 (chuí zhí) perpendicular; vertical.

装载 (zhuāng zài) to load; to stow. **吨位 (dūn wèi)** tonnage.

层楼 (céng lóu) multistoried building; tower; pagoda. **高度 (gāo dù)** height; altitude; elevation; high degree; highly.

需 (xū) to require; to need; to want; necessity; need.

三峡大坝 (sān xiá dà bà) Three Gorges Dam on the Yangtze River. **下游 (xià yóu)** lower reaches (of a river); lower level; lower echelon; downstream. **翻越 (fān yuè)** to cross; to surmount; to transcend.

抵达 (dǐ dá) to arrive; to reach (a destination). **上游 (shàng yóu)** upper reaches (of a river); upper level; upper echelon; upstream.

It is the Three Gorges ship lift known as the ship elevator.

它**就是**被誉为**船舶**电梯的**三峡**升船机。

A mansion mine,

一个**雄居**矿山，

矿山 (kuàng shān) mine.

Open up new territory,

开疆拓土，

开疆 (kāi jiāng) to pioneer a frontier area; to open up new territory. **拓** (tuò) to expand; to push sth with the hand; to develop; to open up.

One dominates the underground,

一个**称霸**地下，

称霸 (chēng bà) lit. to proclaim oneself hegemon; to take a leading role; to build a personal fiefdom. **地下** (dì xià) underground; subterranean; covert.

Broken earth and gravel,

破土碎石，

破土 (pò tǔ) to break ground; to start digging; to plough; to break through the ground (of seedling); fig. the start of a building project.

A privately killed Dajiang,

一个**私斩**大江，

斩 (zhǎn) to behead (as form of capital punishment); to chop.

Support the giant ship.

提携巨轮。

提携 (tí xié) to lead by the hand; to guide; to support. **巨轮** (jù lún) large ship; large wheel.

Although the faces are quite different,

虽然**面貌迥异**，

面貌 (miàn mào) appearance; face; features. **迥异** (jiǒng yì) totally different.

Each has the ability,

各具**本领**，

But they all have a common name,

但**它们都****拥有**一个共同的名字，

它们 (tā men) they (for inanimate objects). **拥有** (yōng yǒu) to have; to possess.

Chinese equipment.

中国**装备**。

Hal Us,

哈尔乌素，

Mongolian,

蒙古语，

蒙古语 (měng gǔ yǔ) Mongolian language.

A place with lake water,

一个有**湖水**的地方，

湖 (hú) lake.

The largest single-pit single-well open-pit coal mine in Asia is located here.

全亚洲最大的**单坑单井****露天**煤矿就**坐落**于此。

坑 (kēng) hole; pit; tunnel; to defraud. **井** (jǐng) a well; neat; orderly. **露天** (lù tiān) outdoors; al fresco; in the open. **煤矿** (méi kuàng) coal mine; coal seam. **坐落** (zuò luò) to be situated; to be located (of a building).

Looking down from the sky,

从**空中俯瞰**，

Harwusu could not see the lake,

哈尔乌素**望不**湖水，

I can only see Wujin in the mountains.

只**望见**满山的**乌金**。

望见 (wàng jiàn) to spy; to spot.

Harwusu has abundant reserves of high-quality coal,

哈尔乌素**蕴藏**着**储量**丰富的**优质**煤炭，

蕴藏 (yùn cáng) to hold in store; to contain (untapped reserves etc). **储量** (chǔ liàng) remaining quantity; reserves (of natural resources, oil etc). **优质** (yōu zhì) excellent quality.

The thickness of the coal seam exceeds 20 meters.

煤层**厚度**超过20米。

煤层 (méi céng) a coal bed; a coal seam. **厚度** (hòu dù) thickness.

For the rising China,

对于正在**崛起**的中国，

崛起 (jué qǐ) to rise abruptly (to a towering position); to tower over; to spring up; to emerge suddenly; the emergence (e.g. of a power).

Coal is a combustion-supporting agent for China's economic take-off.

to this end,

The Chinese invented the mining excavator with the largest single bucket capacity in the world today.

But the steel giant was not born out of nowhere.

It was born in Taiyuan, Shanxi, 300 kilometers south of Harwusu.

Shanxi, China is rich in coal,

However, at the beginning of the founding of New China,

Since we will not manufacture large mining excavators,

The Chinese can only look forward to sigh in the face of Manshan Wujin.

Until 1961,

With the successful development of the 4 cubic meter excavator,

The history of Chinese people not being able to make mining excavators has come to an end.

From then on 10 cubic meters,

20 cubic meters,

35 cubic meters of excavators were born one after another.

In 2016, a mining excavator with a single bucket capacity of 75 cubic meters finally came out.

The 75 cubic meter mining excavator weighs 2000 tons,

The total length is 37.5 meters,

煤炭是中国经济**腾飞**的助燃剂,

为此,

中国人发明了当今世界上**单个铲斗容量最大**的矿用**挖掘机**。

不过钢铁**巨无霸并非横空出世**,

由**哈尔乌素向南300公里外的山西太原**才是它的**诞生之地**。

中国**山西盛产**煤炭,

然而新中国**建国之初**,

由于**不会制造大型矿用挖掘机**,

中国人面对**满山乌金**也**只能望为兴叹**。

直到1961年,

随着**4立方米挖掘机的研制成功**,

中国人**不会造矿用挖掘机的历史才宣告结束**。

从此**10立方米、**

20立方米、

35立方米挖掘机相继诞生。

2016年**单斗容量75立方米的矿用挖掘机终于问世**。

75立方米矿用挖掘机自重2000吨,

总长37.5米,

腾飞 (téng fēi) lit. to fly upwards swiftly; fig. rapid advance; rapidly developing (situation). **剂 (jì)** dose (medicine).

为此 (wèi cǐ) for this reason; with regards to this; in this respect; in order to do this; to this end.

中国人 (zhōng guó rén) Chinese person. **单个 (dān ge)** single; alone; individually; an odd one.

并非 (bìng fēi) really isn't. **横空 (héng kōng)** filling the atmosphere; covering the sky. **出世 (chū shì)** to be born; to come into being; to withdraw from worldly affairs.

向南 (xiàng nán) southward. **山西 (shān xī)** Shanxi province (Shansi) in north China between Hebei and Shaanxi, abbr. 晋 capital Taiyuan 太原. **太原 (tài yuán)** Taiyuan prefecture level city and capital of Shanxi province 山西省 in central north China. **诞生 (dàn shēng)** to be born.

盛产 (shèng chǎn) to produce in abundance; to be rich in.

建国 (jiàn guó) to found a country; nation-building; the foundation of PRC by Mao Zedong in 1949.

只能 (zhǐ néng) can only; obliged to do sth; to have no other choice. **叹 (tàn)** to sigh; to exclaim.

宣告 (xuān gào) to declare; to proclaim.

相继 (xiāng jì) in succession; following closely.

问世 (wèn shì) to be published; to come out.

总长 (zǒng zhǎng) name used for cabinet ministers between 1912-1927, superseded by 部长 (bù zhǎng).

17.3 meters wide.

From the inside to the top is 23.5 meters high,

The boom stretches up to 8 floors.

Drive the crawler belt to rotate through the motor drive gear,

Realize the back and forth walking and turning movements of the excavator.

Through the linear movement of the toothed stick,

Drive the boom to realize the up and down movement of the bucket.

Through the movement of the rotating gear,

Drive the excavator body to rotate 360 degrees at will.

To know the largest mining excavator in the world,

If you just enlarge the design parameters in equal proportions,

Then the bucket capacity is 18 times that of a 4 cubic meter excavator,

The 75 cubic meter excavator will become an indescribable iron bump with a weight of 5,600 tons.

In fact, the weight of a 75 cubic meter excavator is only 2000 tons.

Obviously a lot slimmer.

The large size has never been the original intention of manufacturing.

宽17.3米。

从里带到顶部高23.5米，

起重臂伸展高达8层楼。

通过电机驱动齿轮带动履带回转，

实现挖掘机的前后行走和转弯动作。

通过齿形斗杆直线运动，

带动起重臂实现铲斗的上下运动。

通过回转齿轮的运动，

带动挖掘机车身做360度任意旋转。

要知道世界上最大的矿用挖掘机，

如果只是把设计参数等比例放大，

那么铲斗容量是4立方米挖掘机18倍的，

75立方米挖掘机将成为体重达5600吨本重等无法形容的铁疙瘩。

而实际上75立方米挖掘机的体重不过2000吨，

显然要苗条的多。

体量上的大从来就不是制造的初衷，

里带(lǐ dài) inner tube (of tire).

重臂(zhòng bì) actuator (arm of a lever); lever; actuating arm. 伸展(shēn zhǎn) stretching; extension. 高达(gāo dá) Gundam, Japanese animation franchise; Jean-Luc Godard (1930-), French-Swiss film director.

电机(diàn jī) electrical machinery. 驱动(qū dòng) to drive; to propel; drive (vehicle wheel); drive mechanism (tape or disk); device driver (computing software). 齿轮(chǐ lún) (machine) gear; pinion (gear wheel). 带动(dài dòng) to spur; to provide impetus; to drive. 履(lǚ) shoe; to tread on. 带回(dài huí) to bring back.

前后(qián hòu) around; from beginning to end; all around; front and rear. 行走(xíng zǒu) to walk. 转弯(zhuǎn wān) to turn; to go around a corner.

齿(chǐ) tooth. 杆(gǎn) stick; pole; lever; classifier for long objects such as guns. 直线(zhí xiàn) straight line; sharply (rise or fall).

上下(shàng xià) up and down; top and bottom; old and new; length; about.

回转(huí zhuǎn) to rotate; to turn round; slalom.

车身(chē shēn) body of automobile. 任意(rèn yì) arbitrary; at will; at random. 旋转(xuán zhuǎn) to rotate; to revolve; to spin; to whirl.

参数(cān shù) parameter. 放大(fàng dà) to enlarge; to magnify.

体重(tǐ zhòng) body weight. 无法形容(wú fá xíng róng) unspeakable; indescribable. 疙瘩(gē da) swelling or lump on skin; pimple; knot; preoccupation; problem.

实际上(shí jì shàng) in fact; in reality; as a matter of fact; in practice.

体量(tǐ liàng) body weight; dimensions. 初衷(chū zhōng) original intention or aspiration.

practical,	实用、	
Efficient,	高效,	高效 (gāo xiào) efficient; highly effective.
Reach the maximum load with the smallest consumables,	以最小的耗材达到最大的 载荷 ,	小的 (xiǎo de) I (when talking to a superior). 耗材 (hào cái) consumables; to consume raw materials. 载荷 (zài hè) load; lading (weight).
This is China's super equipment.	这才是中国的 超级装备 。	
From design and development to processing and assembly,	从设计 研发 到 加工装配 ,	研发 (yán fā) research and development; to develop. 加工 (jiā gōng) to process; processing; working (of machinery). 装配 (zhuāng pèi) to assemble; to fit together.
Each of the tens of thousands of parts must be carefully crafted,	上万个零部件 每一件都必须 精雕细琢 ,	上万 (shàng wàn) over ten thousand; fig. untold numbers; innumerable; thousands upon thousands. 零部件 (líng bù jiàn) spare part; component. 雕 (diāo) bird of prey. 琢 (zuó) see 琢磨 (zuó mo).
Each of the thousands of control lines must be orderly.	几千根控制线 每一根都必须 有条不紊 。	几千 (jǐ qiān) several thousand. 有条不紊 (yǒu tiáo bù wěn) regular and thorough (idiom); methodically arranged.
It took more than 700 days,	花费700多天 时间,	花费 (huā fèi) expense; cost; to spend (time or money); expenditure.
After 8 rigorous procedures, it can finally become a big one.	经过 8道严格工序 才能 终成大器 。	工序 (gōng xù) working procedure; process. 大器 (dà qì) very capable person; precious object.
Cutting alloy steel plates up to 11 cm thick is the first step in the manufacturing process.	把厚达11厘米的 合金钢板切割 才是 制造工序的第一步 。	合金 (hé jīn) alloy. 钢板 (gāng bǎn) steel plate. 切割 (qiē gē) to cut. 成才 (chéng cái) to make sth of oneself; to become a person who is worthy of respect. 第一步 (dì yī bù) step one; first step.
Propane gas at 1000 degrees high temperature,	1000度高温的丙烷 气体,	高温 (gāo wēn) high temperature. 丙烷 (bǐng wán) propane. 气体 (qì tǐ) gas (i.e. gaseous substance).
Rigorously and grimly cutting the valuable thick steel plate.	严谨而冷峻的切割 着 价值不菲的厚钢板 。	严谨 (yán jǐn) rigorous; strict; careful; cautious; compact; well-knit. 冷峻 (lěng jùn) grave and stern. 不菲 (bù fěi) considerable (cost etc); bountiful (crop etc); high (social status etc).
Lightning stone fire room,	电光石火间 ,	电光 (diàn guāng) electric light; lightning; electro-optical.
Not only must every inch be accurate,	不仅每一 寸 都要 精准到位 ,	寸 (cùn) a unit of length; inch; thumb. 精准 (jīng zhǔn) accurate; exact; precise; precision. 到位 (dào wèi) to get to the intended location; to be in place; to be in position; precise; well (done).
Not bad at all.	毫厘不差 。	不差 (bù chā) to not lack.
The CNC cutting machine is more like an excellent tailor,	数控 切割机 更如同 一位优秀的裁缝 ,	同一 (tóng yī) identical; the same. 裁缝 (cái féng) tailor; dressmaker.
How to be the most scientific on a whole steel plate,	如何在一整块 钢板 上最科学、	
The most economical cutting material,	最经济的 裁剪 下料,	裁剪 (cái jiǎn) to cut out.

To ensure that the steel plate is not wasted,

This requires complicated and precise calculations,

Behind the calm steel plate cutting is low consumables,

High-efficiency optimized cutting program.

Compared to a cold cut,

The welding of excavator buckets is more enthusiastic,

More flying.

To weld the largest excavator bucket in the world,

Not only need to weld steel plates of different thicknesses together,

And according to the different strength requirements of each force part of the bucket,

It is also necessary to connect steel plates of different strength grades into a whole,

It poses a great challenge to the welding machine.

Due to the unsuitable thickness,

Different strength steel plates have different coefficients of thermal expansion and contraction.

Will form a huge stress at the weld,

Causes bucket deformation or cracks.

This requires every inch of welding seam to be operated strictly in accordance with the technological process,

There can be no sloppiness.

以**确保钢板**不被浪费,

这需要经过复杂和**精密**的计算,

在**波澜不惊**的**钢板切割**背后是低**耗材**、

高效能的**优化裁剪**方案。

比起冷峻的**切割**,

挖掘机铲斗的**焊接**则显得更**热情**、

更**飞扬**。

要**焊接**这世界上**尺寸**最大的**挖掘机铲斗**,

不仅需要把**薄厚不一**的**钢板****焊接****在一起**,

并且根据**铲斗各个**受力**部位**的**不同**的**强度**要求,

还要将**强度等级不一**的**钢板**连成**整体**,

就对**焊机**工作**提出**了**极大**的**挑战**。

由于**薄厚不宜**、

强度不同的**钢板****热胀冷缩****系数不同**,

会在**焊缝**处形成巨大的**应力**,

导致**铲斗****变形**或产生**裂缝**。

这要求每一**寸****焊缝**都严格按照**工艺****流程**来**操作**,

不能有**一丝**马虎。

确保 (què bǎo) to ensure; to guarantee.

精密 (jīng mì) accuracy; exact; precise; refined.

波澜 (bō lán) billows; great waves (fig. of a story with great momentum). **惊** (jīng) to startle; to be frightened; to be scared; alarm. **背后** (bèi hòu) behind; at the back; in the rear; behind sb's back.

高效能 (gāo xiào néng) highly efficient; effectivity. **优化** (yōu huà) optimization; to optimize; to make superior.

比起 (bǐ qǐ) compared with.

焊接 (hàn jiē) to weld; welding.

飞扬 (fēi yáng) to rise; to fly upward.

尺寸 (chǐ cun) size; dimension; measurement.

薄厚 (bó hòu) meanness and generosity; intimacy and alienation. **不一** (bù yī) to vary; to differ. **在一起** (zài yì qǐ) together.

各个 (gè gè) every; various; separately, one by one. **部位** (bù wèi) position; place. **强度** (qiáng dù) strength; intensity.

等级 (děng jí) grade; rank; status.

焊 (hàn) to weld; to solder. **提出** (tí chū) to raise (an issue); to propose; to put forward; to suggest; to post (on a website); to withdraw (cash). **极大** (jí dà) maximum; enormous.

不宜 (bù yī) not suitable; inadvisable; inappropriate.

胀 (zhàng) dropsical; swollen; to swell; to be bloated. **系数** (xì shù) coefficient; factor; modulus; ratio.

缝 (fèng) seam; crack; narrow slit. **应力** (yìng lì) stress (physics).

变形 (biàn xíng) deformation; to become deformed; to change shape; to morph. **裂缝** (liè fèng) crack; crevice.

工艺 (gōng yì) arts and crafts; industrial arts. **流程** (liú chéng) course; stream; sequence of processes; work flow in manufacturing. **操作** (cāo zuò) to work; to operate; to manipulate.

Under the welding spatter,

焊花飞溅之下，

飞溅 (fēi jiàn) to splash; to spatter. 之下 (zhī xià) under; beneath; less than.

Of course, people can't see the sweat of the people holding the welding gun behind the protective mask,

人们当然看不到防护面罩后面手持焊枪的人们汗流浹背，

防护 (fáng hù) to defend; to protect. 面罩 (miàn zhào) mask; visor; facepiece (e.g. diving suit, gas mask). 焊枪 (hàn qiāng) welding torch. 汗流浹背 (hàn liú jiā bèi) to sweat profusely (idiom); drenched in sweat.

Hard work day after day.

日复一日的辛勤付出。

日复一日 (rì fù yī rì) day after day. 辛勤 (xīn qín) hardworking; industrious. 付出 (fù chū) to pay; to invest (energy or time in a friendship etc).

This one is 9 meters high,

这台高9米、

Large-scale CNC gantry milling with a width of 6 meters,

宽6米的大型数控龙门铣，

龙门 (lóng mén) Longmen county in Huizhou 惠州 (huì zhōu), Guangdong; mythical Dragon gate where a carp can transform into a dragon. 铣 (xiǎn) shining metal; (old) the 16th of the month (abbreviation used in telegrams).

Is processing the reserve price beam for 75 cubic meters of excavators,

正在加工75立方米挖掘机的底价梁，

梁 (liáng) roof beam; beam (structure); bridge.

The underframe beam weighs 138 tons,

底架梁重138吨，

Huge body,

体型硕大，

体型 (tǐ xíng) build; body type. 硕大 (shuò dà) big; huge; massive.

Complex surface,

曲面复杂，

曲面 (qū miàn) curved surface; surface.

Very high requirements for machining accuracy.

对加工精度要求极高。

精度 (jīng dù) precision.

It is the chassis of the excavator,

它是挖掘机的底盘，

底盘 (dǐ pán) chassis.

It's equivalent to one person's third way,

相当于一个人的下三路，

A solid footing can only walk thousands of miles,

下盘扎实才能步行千里，

扎实 (zhā shí) strong; solid; sturdy; firm; practical. 步行 (bù xíng) to go on foot; to walk. 千里 (qiān lǐ) a thousand miles; a thousand li (i.e. 500 kilometers); a long distance.

Only large-scale CNC gantry milling can perform such extreme manufacturing tasks.

只有大型数控龙门铣才能胜任这样的极限制造工作。

胜任 (shèng rèn) qualified; competent (professionally); to be up to a task.

Moving back and forth through the gantry,

通过龙门的前后移动，

The left and right movement of the slide,

溜板的左右移动，

溜 (liū) to slip away; to escape in stealth; to skate. 板 (pàn) to catch sight of in a doorway (old).

The up and down movement of the beam and ram,

横梁与滑枕的上下移动，

横梁 (héng liáng) beam.

The cross swing of the horn head,

摆角头的十字次摆动，

角头 (jiǎo tóu) gang leader; mafia boss. 十字 (shí zì) cross road; cross-shaped; crucifix; the character ten. 摆动 (bǎi dòng) to sway; to swing; to move back and forth; to oscillate.

As well as changing different
cutter heads,
Cutting the bottom price beam
of excavators,
drilling,
Wide holes,
Complex processing such as
sanding.
Without these machines,
The excavator can't get out,
Because it is a working
machine,
I am his doctor,
Let the machine tool guarantee
its normal state at any time,
It can be processed into
qualified products at any time.
To complete such a difficult
extreme manufacturing,
Not only need a stable and
reliable machine,
More need a group of people
escorted by machines.
Zhang Dongyuan,
62 years old,
Senior Technician,
Primary school education level,
Working in the factory for 39
years,
Self-study night graduate,
Write down millions of words
of work notes in my spare time.
Has been doing maintenance
work,
39 years,

以及**更换不同的刀头**，
对挖掘机底价梁进行切削、
钻孔、
阔孔、
打磨等复杂**加工**。
如果没有这些**机床**，
挖掘机是出不来的，
因为它是工作**母机**，
我是他的医生，
让**机床**随时保证正常状态，
它就能随时**加工**成合格的产品
来。
要完成**如此高难度**的极限制造，
不仅需要一台稳定**牢靠**的机器，
更需要一群被机器**保驾护航**的
人。
张东元，
62岁，
高级技师，
小学文化程度，
在工厂工作39年，
自习夜大毕业，
业余时间**写下几百万字的工作笔**
记。
一直干维修工作，
39年了，

更换 (gēng huàn) to replace (a worn-out tire etc); to
change (one's address etc).
切削 (qiē xiāo) to cut; cutting; machining.
钻孔 (zuān kǒng) to bore a hole; to drill; drilled hole.
阔 (kuò) rich; wide; broad. **孔** (kǒng) hole; classifier for
cave dwellings.
打磨 (dǎ mó) polish; grind.
机床 (jī chuáng) machine tool; a lathe.
母机 (mǔ jī) machine tool; mother ship.
如此 (rú cǐ) in this way; so. **难度** (nán dù) trouble;
problem.
牢靠 (láo kào) firm and solid; robust; reliable.
保驾 (bǎo jià) (in former times) to escort the emperor
(or other important personage); (nowadays) to escort sb
(usually jocular). **护航** (hù háng) a naval escort; to
convoy.
技师 (jì shī) technician; technical expert.
小学 (xiǎo xué) elementary school; primary school.
自习 (zì xí) to study outside of class time (reviewing
one's lessons); to study in one's free time; individual
study.
写下 (xiě xià) to write down. **百万** (bǎi wàn) million;
millions. **作笔记** (zuò bǐ jì) to take notes.

I always have all work records and fault records.

我一直有所有的工作记录和**故障**记录。

故障 (gù zhàng) malfunction; breakdown; defect; shortcoming; fault; failure; impediment; error; bug (in software).

I have basically never interrupted my work record.

工作记录我**基本上**没**中断**过，

基本上 (jī běn shàng) basically; on the whole. **中断** (zhōng duàn) to cut short; to break off; to discontinue; to interrupt.

Including Saturday and Sunday.

包括**礼拜六** **礼拜天**。

礼拜六 (lǐ bài liù) Saturday.

Although the model worker medals and trophies won over the years cannot be placed together in a small studio,

虽然**历年**荣获的**劳模奖章**跟**奖杯**在**狭小**的**工作室**一块**摆放**不下，

历年 (lì nián) over the years; bygone years. **荣获** (róng huò) be honored with. **劳模** (láo mó) model worker. **奖章** (jiǎng zhāng) medal. **奖杯** (jiǎng bēi) trophy cup. **狭** (xiá) old variant of 狭 (xiá). **工作室** (gōng zuò shì) studio; workshop. **一块** (yī kuài) one block; one piece; one (unit of money); together; in the same place; in company. **放不下** (fàng bu xià) not to have room to put sth; to be unable to let go.

But Master Zhang is not at all complacent.

但张师傅却没有丝毫的**志得意满**，

志得意满 (zhì dé yì mǎn) fully content with one's achievements (idiom); complacent.

Still a craftsmanship is not in ordinary work.

依旧一颗**匠心**不在**平凡**的工作上。

依旧 (yī jiù) as before; still. **匠** (jiàng) craftsman. **不在** (bù zài) not to be present; to be out; (euphemism) to pass away; to be deceased. **平凡** (píng fán) commonplace; ordinary; mediocre.

Modern City,

现代**都市**，

都市 (dū shì) city; metropolis.

The subway is not only the first choice for people to travel,

地铁不仅是**人们出行**首选的**交通工具**，

出行 (chū xíng) to set out on a long journey; to travel afar. **首选** (shǒu xuǎn) first choice; premium; to come first in the imperial examinations. **交通工具** (jiāo tōng gōng jù) means of transportation; vehicle.

It is a standard configuration that reflects the modernization level of a city.

更是体现一座城市**现代化**水平的**标配**。

现代化 (xiàn dài huà) modernization. **配** (pèi) to join; to fit; to mate; to mix; to match; to deserve; to make up (a prescription); to allocate.

49 years ago,

49年前，

年前 (nián qián) before the end of the year; before the new year.

The Chinese built the first subway by cut and open method,

中国人以**明挖**方式**建造**了第一条**地铁**，

挖 (wā) to dig; to excavate; to scoop out. **建造** (jiàn zào) to construct; to build.

Beijing Line 1.

北京**一号线**。

一号 (yī hào) first day of the month; toilet; (slang) top (in a homosexual relationship).

To build this 23-kilometer subway,

建设这条**全长**仅23公里的**地铁**，

全长 (quán cháng) overall length; span.

People spent 10 years,

人们**花费**了10年时间，

仅仅 (jīn jīn) barely; only; merely; only (this and nothing more). **三分之一** (sān fēn zhī yī) one third.

If we build all the subway lines today at this speed,

如果按照**这个**速度来建设今天所有的**地铁线**，

China will take at least 100 years,

中国至少需要**花费**100年时间，

But in fact, China achieved this goal in only one-third of the time.

但**实际上**中国**仅仅**用了**三分之一**的时间就实现了这一目标。

So what makes China's subway construction speed up for more than 60 years?

Large diameter mud-water balance shield machine,

It weighs 3,000 tons,

Over 4 floors in height,

100 meters long,

It consists of a cutter head,

Shield body,

The rear supporting trolley consists of three parts.

The cutter head is responsible for digging forward,

The shield body is responsible for constructing the structural space,

The rear supporting trolley is responsible for transporting the slag crushed by the cutter head out of the tunnel.

And lining the tunnel body while digging.

The three work together,

It can complete the excavation of a two-way tunnel at one time.

To make such a huge body,

Super equipment with such a complicated structure,

Machining is essential.

First of all,

It is necessary to use a super-large coil industrial master machine to convert high-hardness steel plates up to 14 cm thick,

Rolled into a barrel.

那么是什么让中国地铁的建设速度**快进**了60多年呢?

大直径泥水平衡盾构机,

自重3000吨,

高度超过4层楼,

身长100米,

它由刀盘、

盾体、

后**配套**台车三部分组成。

刀盘负责**向前掘进**,

盾体负责**建造**结构空间,

后**配套**台车则负责把刀盘**碾碎**的**渣土碎石**输送出**隧道**,

并在**掘进**的同时进行**隧道**洞体的**衬砌**。

三者**协同**作战,

能**一次性**完成一条**双向隧道**的**掘进**工作。

要制造**体型如此庞大**、

结构**如此**复杂的**超级装备**,

机械加工必不可少。

首先,

要用超大型卷料工业**母机**将厚达14厘米的高**硬度**钢板,

弯卷成桶状。

快进 (kuài jìn) fast-forward (media player).

身长 (shēn cháng) height (of person); length of clothing from shoulders to bottom (tailor or dressmaker's measure).

体 (tǐ) body; form; style; system; substance; to experience; aspect (linguistics).

配套 (pèi tào) to form a complete set; coherent.

向前 (xiàng qián) forward; onward.

碾碎 (niǎn suì) to pulverize; to crush. **渣** (zhā) slag (in mining or smelting); dregs. **输送** (shū sòng) to transport; to convey; to deliver.

协同 (xié tóng) to cooperate; in coordination with; coordinated; collaborate; collaboration; collaborative.

一次性 (yī cì xìng) one-off (offer); one-time; single-use; disposable (goods). **双向** (shuāng xiàng) bidirectional; two-way; interactive.

庞大 (páng dà) huge; enormous; tremendous.

机械 (jī xiè) machine; machinery; mechanical; (old) cunning; scheming. **必不可少** (bì bù kě shǎo) absolutely necessary; indispensable; essential.

硬度 (yìng dù) hardness.

As we all know,

The larger the coil diameter of the steel plate,

The more difficult it is to maintain a standard circle,

To bend the back steel plate into a super large circle with a diameter of 13 meters,

Control the deformation of the steel plate due to gravity,

People must use a special arc ruler to measure every small distance.

To ensure that every inch of the round and thick steel plate maintains the same arc.

Next, 4 welding robots welded on both sides of the shield at the same time.

In order to reduce the possible deformation due to different forces.

Since the cutter head is the main part of the tunneling machine,

So in addition to machine welding,

There must also be an experienced welder using wear-resistant materials for manual surfacing on the surface of the cutter head,

Overlay the weld to 8 mm thickness,

Form a wear-resistant net,

Improve the wear resistance of the cutter head.

After hundreds of hours of cutting,

And precision control with an error of no more than 0.8 mm,

It took 4 to 8 months,

众所周知,

钢板卷圆直径越大,

要保持标准圆形越难,

要将后钢板弯卷成直径13米的超大正圆形,

控制钢板因重力而产生变形,

人们必须用特制的弧度尺每隔一小段距离就测量一次,

以确保卷圆厚的钢板每一寸都保持相同的弧度。

接下来有4名焊接机器人在盾体两侧同时进行焊接,

以减少因不同受力可能导致的变形。

由于刀盘是盾构机掘进的主要部件,

因此除了机器焊接外,

还必须有富有经验的焊工用耐磨材料在刀盘表面进行人工堆焊,

将焊缝堆焊到8毫米厚度,

形成耐磨网,

提高刀盘的耐磨性能。

再经过数百小时的切削,

以及误差不超过0.8毫米的精度控制,

花费4~8个月时间,

众所周知 (zhòng suǒ zhōu zhī) see 众所周知 (zhòng suǒ zhōu zhī).

圆形 (yuán xíng) round; circular.

大正 (dà zhèng) Taishō, Japanese era name, corresponding to the reign (1912-1926) of emperor Yoshihito **嘉仁 (jiā rén)**.

重力 (zhòng lì) gravity.

特制 (tè zhì) special; unique. **弧度 (hú dù)** radian; arc; curve; curvature. **每隔 (měi gé)** at intervals of; every (so often). **测量 (cè liáng)** survey; to measure; to gauge; to determine.

接下来 (jiē xià lái) to accept; to take; next; following. **机器人 (jī qì rén)** mechanical person; robot; android. **两侧 (liǎng cè)** two sides; both sides.

部件 (bù jiàn) part; component.

富有 (fù yǒu) rich; full of. **焊工 (hàn gōng)** welder; solderer; welding. **耐磨 (nài mó)** wear resistant. **人工 (rén gōng)** artificial; manpower; manual work.

毫米 (háo mǐ) millimeter.

性能 (xìng néng) function; performance.

数百 (shù bǎi) several hundred.

误差 (wù chā) difference; error; inaccuracy.

It takes 24 assembly processes to complete such extreme manufacturing.

Shield machine is the most technically difficult construction equipment.

Involves machinery,

electric,

Hydraulic,

Intelligent,

Informatization,

Optics,

Once there are any problems in the tunnel construction,

It cannot be poured out,

It can only be taken out by making a hole in the ground,

The loss is great.

Cutter,

It is undoubtedly the most critical on the shield fuselage,

It is also the most well-versed component.

When the shield machine is digging underground,

Not only does the cutter head rotate,

Every hob mounted on the cutter head will also rotate,

Just like the revolution and rotation of a planet.

The revolution of the cutter head produces rolling pressure,

The rotation of the hob produces cutting force,

In addition to the 12,000 tons of propulsion force applied to the cutter head by the shield machine,

经过**24道装配工序**才能完成这样的极限制造。

盾构机是**施工装备之中**技术难度最大的，

涉及到机械、

电气、

液压、

智能化、

信息化、

光学、

一旦在**隧道里面**施工出了任何问题，

它是**不能倒出来的**，

它**只能是地面**打个洞**下去取出来**，

损失很大的。

刀盘，

无疑是盾构机身上最关键，

也是**最谙打法的部件**。

盾构机在**地下掘进时**，

不仅刀盘会**旋转**，

镶嵌在刀盘上的每一刃滚刀也会**旋转**，

就像**行星的公转和自转**。

刀盘**公转**产生**碾压力**，

滚刀**自转**产生**切割力**，

加上盾构机作用于刀盘的**12000吨推进力**，

施工 (shī gōng) construction; to carry out construction or large-scale repairs. **之中** (zhī zhōng) inside; among; in the midst of (doing sth); during.

涉及 (shè jí) to involve; to touch upon (a topic).

电气 (diàn qì) electricity; electric; electrical.

液压 (yè yā) hydraulic pressure.

智能 (zhì néng) intelligent; able; smart (phone, system, bomb etc).

信息化 (xìn xī huà) informatization (the Information Age analog of industrialization).

光学 (guāng xué) optics; optical (instrument).

地面 (dì miàn) floor; ground; surface. **下去** (xià qù) to go down; to descend; to go on; to continue; (of a servant) to withdraw.

无疑 (wú yí) no doubt; undoubtedly. **身上** (shēn shang) on the body; at hand; among.

谙 (ān) to be versed in; to know well. **打法** (dǎ fǎ) to play (a card); to make a move in a game.

在地下 (zài dì xià) underground.

镶嵌 (xiāng qiàn) to inlay; to embed; to set (e.g. a jewel in a ring); tiling; tessellation. **刃** (rèn) edge of blade.

行星 (xíng xīng) planet. **公转** (gōng zhuàn) orbital revolution. **自转** (zì zhuàn) rotation.

碾 (niǎn) stone roller; roller and millstone; to grind; to crush; to husk.

加上 (jiā shàng) plus; to put in; to add; to add on; to add into; in addition; on top of that. **推进** (tuī jìn) to impel; to carry forward; to push on; to advance; to drive forward.

No matter how hard the rock layer is, under the action of these three forces, it will burst and shatter one after another.

This is the rock breaking mechanism of the shield machine.

watch carefully,

The cutter head is like the face of a shield machine,

Some look elegant,

Eyebrows stretched,

Some are serious,

Unsmiling,

And it was these knives of various shapes that were instigated,

And spread all over the surface of the cutter head,

A knife holder shaped like a ravine.

China has a vast territory,

The diversity and complexity of the geological structure exceeds that of any country in the world.

Therefore, the shield machine's brute force is not enough.

Have to learn to deal with various formations.

And the designer is through the personalized design of the cutter head,

再坚硬的岩层在这三重力量的作用下也会纷纷崩裂震碎，

这就是盾构机的破岩机理。

仔细看，

刀盘就像是盾构机的脸面，

有的神情飘逸、

眉目舒展，

有的则表情严肃、

不苟言笑，

而始作俑者正是这些形状各异的刀具，

以及遍布于刀盘表面，

形似沟壑的刀座。

中国幅员辽阔，

地质结构的多样性和复杂性超过世界上任何一个国家。

因此盾构机光有千钧蛮力还不够，

还得学会与各种地层打交道。

而设计师正是通过对刀盘进行个性化设计，

坚硬 (jiān yìng) hard; solid. 岩层 (yán céng) rock strata. 三重 (sān chóng) Sanchong or Sanch'ung city in New Taipei City 新北市 (xīn běi shì), Taiwan; Mie Prefecture in central Japan. 崩裂 (bēng liè) to rupture; to burst open; to break up.

岩 (yán) cliff; rock. 机理 (jī lǐ) mechanism.

脸面 (liǎn miàn) face.

有的 (yǒu de) (there are) some (who are...); some (exist). 神情 (shén qíng) look; expression. 飘逸 (piāo yì) graceful; elegant; to drift; to float.

眉目 (méi mù) general facial appearance; features; arrangement; sequence of ideas; logic (of writing); rough sketch or general idea of things. 舒展 (shū zhǎn) to roll out; to extend; to smooth out; to unfold.

不苟 (bù gǒu) not lax; not casual; careful; conscientious.

始作俑者 (shǐ zuò yǒng zhě) lit. the first person to bury funerary dolls (idiom); fig. the originator of an evil practice. 正是 (zhèng shì) (emphasizes that sth is precisely or exactly as stated); precisely; exactly; even; if; just like; in the same way as. 各异 (gè yì) all different; each unto his own. 刀具 (dāo jù) cutting tool.

遍布 (biàn bù) to cover the whole (area); to be found throughout.

形似 (xíng sì) similar in shape and appearance. 沟壑 (gōu hè) gorge; gulch; ravine; deep ditch.

幅员 (fú yuán) size (i.e. area) of a country, geographical region or school campus etc; (fig.) scope; extent. 辽阔 (liáo kuò) vast; extensive.

地质 (dì zhì) geology. 多样性 (duō yàng xìng) variegation; diversity. 复杂性 (fù zá xìng) complexity.

钧 (jūn) 30 catties; great; your (honorific). 蛮力 (mán lì) brute force. 不够 (bù gòu) not enough; insufficient; inadequate.

学会 (xué huì) to learn; to master; institute; learned society; (scholarly) association. 地层 (dì céng) stratum (geology).

设计师 (shè jì shī) designer; architect. 个性化 (gè xìng huà) to personalize; to customize; customization.

Through different permutations and combinations of tools,

The width and depth of the ravine changes to cope with the vastly different geological environment.

Encounter hard rock formations,

Use hob.

Encounter softer rock formations,

Use a cutter.

Encounter soft soil,

A shell knife is used.

The knife seat on the cutter head looks like a ravine,

In fact, it is to discharge the slag and gravel into the slag outlet of the pipeline.

When encountering soft soil,

Due to the thick soil,

The gully is relatively wide,

The muck on one side can be discharged smoothly.

When encountering hard rock formations,

Since the stones have been crushed,

The gully is relatively delicate.

Tens of thousands of tons of debris and gravel from the excavation of a tunnel,

It is discharged into the pipeline in this way,

Transported out of the tunnel.

It turned out to have to deal with the ever-changing geological environment,

The ever-changing cutterhead is the magic weapon.

通过**刀具的不同**排列组合,

沟壑的宽窄深浅变化来**应对千差万别**的地质环境。

遇到**坚硬岩层**,

采用**滚刀**。

遇到较软**岩层**,

采用**切刀**。

遇到软土,

则采用**贝壳刀**。

刀盘上**形似沟壑**的刀座,

其实是为了把**渣土碎石排入输送管道**的出渣口。

当遇到**松软**的土质时,

由于**土壤粘稠**,

沟壑也就相对宽,

一边**渣土能够顺利排出**。

而当遇到**坚硬**的**岩层**时,

由于**石块儿已被碾碎**,

沟壑也就相对**细腻**。

挖掘一条**隧道**所产生的数以万吨计的**渣土碎石**,

正是通过这种方式被排入管道,

输送出隧道的。

原来要**应对千变万化**的地质环境,

百变刀盘才是**法宝**。

宽窄 (kuān zhǎi) width; breadth. **深浅** (shēn qiǎn) deep or shallow; depth (of the sea); limits of decorum. **应对** (yìng duì) response; to answer; to reply. **千差万别** (qiān chā wàn bié) manifold diversity.

切刀 (qiē dāo) cutter; knife.

贝壳 (bèi ké) shell; conch; cowry; mother of pearl; hard outer skin; also pr. (bèi qiào).

排入 (pái rù) to discharge into; to secrete into. **管道** (guǎn dào) tubing; pipeline; (fig.) channel; means.

松软 (sōng ruǎn) flexible; not rigid; spongy; soft or runny (not set hard); loose (soil).

土壤 (tǔ rǎng) soil. **稠** (chóu) dense; crowded; thick; many.

排出 (pái chū) to discharge.

石块 (shí kuài) stone; rock.

细腻 (xì nì) exquisite; meticulous.

计 (jì) to calculate; to compute; to count; to regard as important; to plan; ruse; meter; gauge.

千变万化 (qiān biàn wàn huà) countless changes; constant permutation.

法宝 (fǎ bǎo) Buddha's teaching; Buddhist monk's apparel, staff etc; (Daoism) magic weapon; talisman; fig. specially effective device; magic wand.

With the versatile cutter head,

Every shield machine in the world can be called private customization.

It's just that the versatile cutter head is not the only magic weapon of the shield machine.

This is not a performance show with snowflakes,

It is an experiment of spraying modifier on the cutter head.

When the shield machine was digging in the clay layer,

I am most afraid of the phenomenon of knife sticking,

The so-called paste knife plate is clay,

It forms mud cakes on the surface of the cutter head,

Block the slag outlet,

As a result, the gravel and mud cannot be removed smoothly,

This is like an intestinal obstruction caused by a tunneling project.

at this time,

The special nozzle installed on the cutter head began to work.

Through the nozzle,

Spray modifier on the clay,

Reduce the viscosity of the soil,

Increase soil mobility,

The problem of the paste cutter plate will be solved.

7 o'clock in the morning,

The Yangtze Three Gorges cruise ship No. 5 appeared upstream of the Three Gorges Dam,

有了**百变刀盘**,

世上每一台盾构机都**堪称私人定制**。

只不过百变刀盘**并非**是盾构机的**唯一法宝**,

这不是一场**喷雪花**的表演秀,

而是刀盘**喷洒改良剂**的**一次实验**。

原来盾构机在**粘土层掘进**时,

最怕出现**糊刀盘**现象,

所谓**糊刀盘****就是**粘土,

在刀盘表面**结成泥饼**,

把**出渣口堵死**,

导致**碎石渣土**无法**顺利排除**,

这就好比**掘进工程**得了**肠梗阻**。

这个时候,

安装在刀盘上的**特制喷头**就开始**发挥作用**了。

通过**喷头**,

向**粘土****喷洒改良剂**,

降低**土壤**的**粘度**,

增加**土壤**的**流动性**,

糊刀盘问题就会**迎刃而解**。

早晨7点,

长江三峡5号邮轮出现在**三峡大坝上游**,

世上 (shì shàng) on earth. **堪称** (kān chēng) can be rated as; can be said to be. **定制** (dìng zhì) custom-made; made-to-order; to have something custom made.

只不过 (zhǐ bu guò) only; merely; nothing but; no more than; it's just that

雪花 (xuě huā) snowflake.

而是 (ér shì) rather. **喷洒** (pēn sǎ) to spray; to sprinkle. **改良** (gǎi liáng) to improve (sth); to reform (a system).

土层 (tǔ céng) layer of soil; ground level.

结成 (jié chéng) to form; to forge (alliances etc).

堵死 (dǔ sǐ) to block (a road); to plug (a hole); to stop up.

排除 (pái chú) to eliminate; to remove; to exclude; to rule out.

这就 (zhè jiù) immediately; at once. **好比** (hǎo bǐ) to be just like; can be compared to. **得了** (dé liǎo) (emphatically, in rhetorical questions) possible. **肠** (cháng) old variant of 肠 (cháng). **梗阻** (gǎng zǔ) to hamper; to obstruct.

喷头 (pēn tóu) nozzle; spray-head.

流动性 (liú dòng xìng) flowing; shifting; fluidity; mobility; liquidity (of funds).

迎刃而解 (yíng rèn ér jiě) lit. (bamboo) splits when it meets the knife's edge (idiom); fig. easily solved.

早晨 (zǎo chén) early morning.

长江三峡 (cháng jiāng sān xiá) Three Gorges or Yangtze Gorges, namely: Qutang Gorge 瞿塘峡 (qú táng xiá), Wuxia Gorge 巫峡 (wū xiá) and Xiling Gorge 西陵峡 (xī líng xiá). **邮轮** (yóu lún) ocean liner; cruise liner.

A request for crossing the dam was sent to the shiplift control room.

The Three Gorges Dam is the largest in the world today.

It is also the most technically difficult water conservancy project.

The world's rare 113-meter high water level drop,

So that it has a strong hydropower capacity.

The Three Gorges Hydropower Station generates hundreds of billions of kilowatt-hours each year,

It accounts for 14% of China's total hydropower generation.

The Yangtze River is known as China's golden waterway,

The annual carrying capacity of the Three Gorges exceeds 100 million tons.

In addition to the power generation and flood control functions of the Three Gorges Dam,

It also shoulders the important task of navigating ships.

The Chinese must be on the world's largest concrete gravity dam,

Build a water elevator.

In the shortest time,

Carrying ships from upstream to downstream of the dam,

This is the dam crossing action to be completed by the cruise ship No. 5 of the Yangtze Three Gorges.

The manufacturer Sanxia No. 5 can now prepare cars.

向升船机集控室发出了过坝请求。

三峡大坝是当今世界上规模最大,

也是技术难度最高的水利枢纽工程。

举世罕见的113米高水位落差,

使它拥有了强劲的水力发电能力。

三峡水电站每年发电千亿度,

占中国水利发电总量的14%。

长江被誉为中国的黄金水道,

三峡每年的运载量超过1亿吨。

三峡大坝除了发电和防洪功能之外,

还肩负着船舶通航的重任。

中国人必须在这全球最大的混凝土重力坝上,

建造一座水上电梯。

用最短的时间,

将船舶从大坝的上游运载到下游,

这就是长江三峡5号游轮要完成的过坝动作。

厂家三峡5号现在可以备车了。

室 (shì) room; work unit; grave; scabbard; family or clan; one of the 28 constellations of Chinese astronomy. 发出 (fā chū) to issue (an order, decree etc); to send out; to dispatch; to produce (a sound); to let out (a laugh). 坝 (bà) dam; dike; embankment.

最高 (zuì gāo) tallest; highest; supreme (court etc).

举世 (jǔ shì) throughout the world; world ranking (e.g. first). 罕见 (hǎn jiàn) rare; rarely seen.

强劲 (qiáng jìng) strong; powerful; robust. 水力发电 (shuǐ lì fā diàn) hydroelectricity.

水电站 (shuǐ diàn zhàn) hydroelectric power plant. 千亿 (qiān yì) myriads; hundred billion.

总量 (zǒng liàng) total; overall amount.

水道 (shuǐ dào) aqueduct; sewer.

运载量 (yùn zài liàng) transport volume.

防洪 (fáng hóng) flood control; flood prevention. 之外 (zhī wài) outside; excluding.

肩负 (jiān fù) to shoulder (a burden); to bear; to suffer (a disadvantage). 通航 (tōng háng) connected by air, sea traffic or service. 重任 (zhòng rèn) heavy responsibility.

混凝土 (hùn níng tǔ) concrete.

水上 (shuǐ shàng) on water; aquatic.

大坝 (dà bà) dam. 运载 (yùn zài) to carry; to convey; delivery; supply.

游轮 (yóu lún) cruise ship.

厂家 (chǎng jiā) factory; factory owners.

Used to be the cruise ship No. 5 of the Three Gorges of the Yangtze River,

It takes 4 hours to pass the Three Gorges Dam.

Now that the Three Gorges Elevation Period is reached,

The cruise ship departs from upstream,

Turn over the dam to reach the downstream,

The time to cross the dam is only 37 minutes.

Three Gorges ship lift,

The total length of the whole line is 7,300 meters,

The height of the tower is 146 meters.

There are 4 groups,

A total of 8 powerful motors are driven.

Connect 16 groups with 256 steel wire ropes with a diameter of 74 mm,

A total of 240 counterweights.

At a speed of 12 meters per minute,

Elevate the Yangtze Three Gorges Cruise Ship 5 to 113 meters,

Equivalent to the height of 40 floors.

However, at the beginning of the design,

The Three Gorges of the Yangtze River has a rare high water drop in the world,

But how to climb the ship lift,

Raised unprecedented problems.

The universal climbing method of ship lift in the world,

曾经做**长江三峡5号游轮**,

经过**三峡大坝**要**花费**4个小时。

如今**达成三峡**升船期,

游轮从**上游**出发,

翻越大坝抵达**下游**,

过坝时间仅为37分钟。

三峡升船机,

全线总长度7300米,

塔柱高度146米。

有4组,

共8台**强有力的电机驱动**。

以256根**直径**为74**毫米的钢丝绳**连接16组,

共240块**配重块**。

以每分钟12米的速度,

将**长江三峡5号游轮**提升至113米,

相当于40层楼的高度。

然而在设计之初,

长江三峡举世**罕见**的高水**落差**,

却对升船机采用何种方式**爬升**,

提出了前所未有的难题。

世界上**通用**的升船机**爬升**方式,

达成 (dá chéng) to reach (an agreement); to accomplish.

全线 (quán xiàn) the whole front (in a war); the whole length (of a road or railway line). **长度** (cháng dù) length.

柱 (zhù) pillar.

强有力 (qiáng yǒu lì) strong; forceful.

钢丝绳 (gāng sī shéng) hawser; steel rope. **连接** (lián jiē) to link; to join; to attach; connection; a link (on web page).

配重 (pèi zhòng) bobweight; (diving) weight.

爬升 (pá shēng) to rise; to ascend; to climb (airplane etc); to go up (sales figures etc); to gain promotion.

前所未有 (qián suǒ wèi yǒu) unprecedented. **难题** (nán tí) difficult problem.

通用 (tōng yòng) common (use); interchangeable.

There are mainly hoist climbing and gear climbing schemes.

After multiple rounds of selection and demonstration,

The Rack and Pinion climb plan was finally selected during the ship lift of the Three Gorges Project.

Because you have to cross the dam from a height difference of 113 meters,

Ships need to be safer,

A more secure way to improve.

Rack and pinion climbing type refers to the use of gears symmetrically installed on both sides of the boat box.

Interlock with the rack mounted on the tower column of the ship lift,

To drive the boat box up or down.

Due to the scale of the Three Gorges ship lift,

Far more than any shiplift in the world.

therefore,

When the ship enters the huge boarding box,

The electric drive system must ensure that the lifting rate of the four driving points of the boat box is consistent.

The synchronization error must be less than two millimeters,

That is the thickness of a one-yuan coin,

This is the high-level synchronization scheme for electrical appliances.

主要有**卷扬式爬升**和**齿轮式爬升**等方案。

经过**多轮**比选和**论证**后，

三峡升船期**最终**选择了**齿轮齿条爬升**方案。

因为要从113米的高**落差**水域过**坝**，

船舶需要更安全、

更稳妥的**提升**方式。

齿轮齿条爬升式是指利用**对称**安装在**乘船箱**两侧的**齿轮**，

与安装在升船机塔**柱**上的**齿条****相互咬合**，

来**带动乘船箱****上升**或**下降**。

由于**三峡**升船机的规模，

远远超过现在世界上任何一座升船机。

因此，

当**船只**进入巨大的**乘船箱**后，

电器传动系统必须保证**乘船箱**四个**驱动点**的**提升速率**达到一致，

同步误差必须**小于**两毫米，

也就是一枚一元硬币的厚度，

这就是电器高层同步方案。

卷扬 (juǎn yáng) a whirlwind.

多轮 (duō lún) in many stages; multilayered; multipronged (attack). **论证** (lùn zhèng) to prove a point; to expound on; to demonstrate or prove (through argument); proof.

最终 (zui zhōng) final; ultimate. **齿条** (chǐ tiáo) rack (and pinion).

稳妥 (wěn tuǒ) dependable.

对称 (duì chèn) symmetry; symmetrical. **乘船** (chéng chuán) to embark; to travel by ship; to ferry.

相互 (xiāng hù) each other; mutual. **咬合** (yǎo hé) (of uneven surfaces) to fit together; (of gear wheels) to mesh; (dentistry) occlusion; bite.

上升 (shàng shēng) to rise; to go up; to ascend. **下降** (xià jiàng) to decline; to drop; to fall; to go down; to decrease.

远远超过 (yuǎn yuǎn chāo guò) surpassing by far.

船只 (chuán zhī) ship; boat; vessel.

电器 (diàn qì) (electrical) appliance; device. **传动系统** (chuán dòng xì tǒng) transmission system; power drive. **速率** (sù lǜ) speed; rate.

同步 (tóng bù) synchronous; to synchronize; to keep step with. **小于** (xiǎo yú) less than, <.

也就是 (yě jiù shì) that is; i.e.. **枚** (méi) classifier for coins, rings, badges, pearls, sporting medals, rockets, satellites etc; tree trunk; whip; wooden peg, used as a gag for marching soldiers (old). **一元** (yī yuán) single variable (math.); univariate. **硬币** (yìng bì) coin.

高层 (gāo céng) high level; high class.

After all, as a world-class project,

There are too many professions involved,

The interface is too complicated,

It is equivalent to a lot of effort for each step.

The 4 racks that the ship lift depends on to climb,

Each rack is 125 meters long,

What material is used to make such a huge rack?

How to make it?

Not to mention that China has no experience,

There is no precedent in the world.

Chinese engineers decided to do it themselves,

Repeated research,

Practice improvement.

The final modulus is as high as 62.7 mm,

10 special steels with a hardened layer depth of 6 mm were successfully developed.

At the same time,

A complete manufacturing plan is also released,

Divide the 125-meter rack into 25 sections,

Segmented manufacturing,

Finally, they are assembled into a whole.

But even so,

毕竟是作为**世界级的工程**,

牵涉到的专业太多,

接口太复杂,

相当于每走一步都要**付出**很大的努力。

升船机**赖以爬升**的4根**齿条**,

每个**齿条**长125米,

如此巨大的齿条用什么材料制造?

如何制造?

别说中国没有经验,

全世界都没有**先例**。

中国工程师决定**自己动手**,

反复研究,

实践改进。

最终模数高达62.7毫米,

淬硬层深度6毫米的10条特供**钢材**被**研制成功**,

同时**化整为零**,

齐零为整的制造方案也**随之出炉**,

将125米的**齿条分成**25节,

分段制造,

最后再**拼装**成整体。

但即便如此,

世界级 (shì jiè jí) world-class.

牵涉到 (qiān shè dào) to involve; to drag in.

接口 (jiē kǒu) interface; port; connector.

赖以 (lài yǐ) to rely on; to depend on.

全世界 (quán shì jiè) worldwide; entire world. **先例** (xiān lì) antecedent; precedent.

自己动手 (zì jǐ dòng shǒu) to do (sth) oneself; to help oneself to.

模数 (mó shù) analog-to-digital; abbr. for 模拟到数字.

淬 (cuì) dip into water; to temper. **深度** (shēn dù) depth; (of a speech etc) profundity; advanced stage of development. **钢材** (gāng cái) steel (as raw material); steel sheets, bars, tubes, ingots, wire etc.

化整为零 (huà zhěng wéi líng) to break up the whole into pieces (idiom); dealing with things one by one; divide and conquer.

随之 (suí zhī) thereupon; subsequently; accordingly. **出炉** (chū lú) to take out of the furnace; fresh out of the oven; fig. newly announced; recently made available.

分成 (fēn chéng) to divide (into); to split a bonus; to break into; tenths; percentage allotment.

分段 (fēn duàn) segment.

拼装 (pīn zhuāng) to assemble.

即便 (jí biàn) even if; even though; right away; immediately.

The difficulty of manufacturing a single-section 4.7-meter-long rack is also unprecedented.

Smelting,

Pouring,

Heat treatment,

Surface induction hardening,

Machining,

Every process is a world problem.

gear,

In the case of rack life lubrication, the structure has a life of 70 years,

The mechanical equipment is thirty-five years old.

After more than three years of extreme manufacturing,

Passed 420,000 fatigue life tests,

The maximum lifting height is 113 meters,

The ship lift rack with a maximum lifting weight of 15,500 tons was finally completed.

The Harwusu Open-pit Coal Mine in Inner Mongolia is a few thousand kilometers away from the Three Gorges of the Yangtze River.

It's time to change shift again,

Lu Hongshuai boarded the high cockpit,

Started a day's work,

单节4.7米长的**齿条制造难度**也是**史无前例的**,

冶炼、

浇筑、

热处理、

表面**感应淬火**、

机械加工、

每一**道工序**都是世界**难题**。

齿轮、

齿条寿命**润滑**情况下结构是**七十**年的**寿命**，

机械设备是**三十五年**的。

经过**三年多**的**极限**制造，

通过**42万次**疲劳**寿命****试验**，

最大**提升****高度**为**113米**，

最大**提升**重量为**15500吨**的**升船机****齿条**终于**大功告成**。

距离**长江三峡****几千公里**外的**内蒙****古****哈尔乌素****露天****煤矿**，

又到了**换班**时间，

卢鸿帅登上**高高**的**驾驶舱**，

开始了一天的**工作**，

史无前例 (shǐ wú qián lì) unprecedented in history.

冶炼 (yě liàn) to smelt metal.

筑 (zhù) to build; to construct; to ram; to hit; Taiwan pr. (zhú).

热处理 (rè chǔ lǐ) hot treatment (e.g. of metal).

感应 (gǎn yìng) response; reaction; interaction; irritability (biol.); induction (elec.); inductance. **淬火** (cuì huǒ) to quench; to temper; to harden by quenching.

一道 (yī dào) together.

润滑 (rùn huá) smooth; oily; sleek; to lubricate. **七十** (qī shí) seventy; 70.

三十 (sān shí) thirty; 30.

试验 (shì yàn) experiment; test; to experiment; experimental.

大功告成 (dà gōng gào chéng) successfully accomplished (project or goal); to be highly successful.

换班 (huàn bān) to change shift; the next work shift; to relieve (a workman on the previous shift); to take over the job.

卢 (lú) (old) rice vessel; black; old variant of 庐 (lú); (slang) (Tw) troublesome; fussy. **鸿** (hóng) eastern bean goose; great; large. **登上** (dēng shàng) to climb over; to ascend onto; to mount. **驾驶舱** (jià shǐ cāng) cockpit; control cabin.

Lu Hongshuai graduated from Inner Mongolia University of Science and Technology in Mechatronics seven years ago.

After graduation, he became the only driver of a 75 cubic meter excavator in the world.

A 75 cubic meter excavator,

Every three to four buckets excavated can be filled with a 360-ton slag dump truck.

An excavator must be equipped with six to eight dump trucks to meet its mining capacity.

However, such a powerful steel giant can walk freely when working.

Flexible completion of forward,

Back,

Uphill,

downhill,

Complex movements such as turning,

And the speed is similar to that of human walking.

Not only that,

During the excavation,

Once you hit a hard rock,

The bucket will also avoid automatically,

Get around obstacles,

So how does it do this?

All this thanks to the sophisticated design of a smart team,

Wang Xiaoming,

Chief designer of 75 cubic meter excavator,

卢鸿帅七年前毕业于内蒙古科技大学机电一体化专业,

毕业后成为了这世上唯一一台75立方米挖掘机的驾驶员。

一台75立方米挖掘机,

每挖掘三到四铲斗便能装满一辆360吨位的矿渣自卸车。

一台发掘机必须配备六到八台自卸车才能满足它的采掘量,

然而如此强悍庞大的钢铁巨无霸在作业时却能行走自如,

灵活的完成前进、

后退、

上坡、

下坡、

拐弯等复杂动作,

并且速度与人类行走的速度相似。

不仅如此,

在挖掘过程中,

一旦碰到尖硬的石头,

铲斗还会自动避让,

绕开障碍,

那么它是如何做到这一点的呢?

这一切得益于一个智慧团队的精密设计,

王晓明,

75立方米挖掘机主任设计师,

科技大学 (kē jì dà xué) university of science and technology. 机电 (jī diàn) machinery and power-generating equipment; electromechanical. 一体化 (yī tǐ huà) integration; incorporation; unification.

驾驶员 (jià shǐ yuán) pilot; driver.

矿渣 (kuàng zhā) slag (mining). 自卸车 (zì xiè chē) dump truck.

发掘 (fā jué) to excavate; to explore; (fig.) to unearth; to tap into. 配备 (pèi bèi) to allocate; to provide; to outfit with. 采掘 (cǎi jué) to excavate; to extract (ore).

强悍 (qiáng hàn) valiant. 自如 (zì rú) unobstructed; unconstrained; smoothly; with ease; freely.

前进 (qián jìn) to go forward; to forge ahead; to advance; onward.

后退 (hòu tuì) to recoil; to draw back; to fall back; to retreat.

上坡 (shàng pō) uphill; upslope; to move upwards; to climb a slope.

下坡 (xià pō) downhill.

不仅如此 (bù jǐn rú cǐ) not only that, but

碰到 (pèng dào) to come across; to run into; to meet; to hit.

避让 (bì ràng) to avoid; to yield (in traffic); to get out of the way.

障碍 (zhàng ài) barrier; obstruction; hindrance; impediment; obstacle.

做到 (zuò dào) to accomplish; to achieve.

得益 (dé yì) to derive benefit.

晓 (xiǎo) dawn; daybreak; to know; to let sb know; to make explicit.

He passed the transmission system of the excavator,

The lifting system and the pushing system are designed with sensors to sense and control the working status of the excavator.

When the bucket encounters a hard object,

The sensing system will automatically retract or lift the bucket,

This is the intelligent feature given to it in the design process.

When people are digging materials,

He has a brain,

He has to think about how far I have to stand to dig,

What kind of material do I want to dig,

If you encounter a harder one during digging,

For example, bricks,

In the case of stones,

Maybe I might let go of the shovel,

It also has this function,

Through some of the sensing devices designed in my design process,

To automatically retract the bucket,

Put or mention.

75 cubic bucket capacity bucket,

Can load 135 tons of ore,

And to lift the fully loaded bucket into the air,

And rotate half a circle,

他通过在**挖掘机的传动系统**,

提升系统和**推压系统**安装**传感器**的设计来**感知**和控制**挖掘器**的工作状态。

当**铲斗**遇到**坚硬物体**时,

感知系统会自动对**铲斗**进行**收放**或**提升**,

这就是在设计过程中**赋予**它的**智能化**特点。

人在**挖物料**的时候,

他有个**大脑**,

他要思考我要站多远去**挖**,

我要**挖**什么样的**物料**,

如果**挖**的过程中**碰见**一个比较硬的,

比方说砖头,

石头的**话**,

可能**铲子**我可能会**让开**,

它**同样**具有**这个**功能,

能够通过我的设计过程中设计的**一些感知装置**,

来自动的对**铲斗**进行**收**、

放或者**提**。

75立方斗容的**铲斗**,

可**装载**135吨的**矿石**,

而要将**满负荷**的**铲斗****提升**到**空中**,

并且**旋转**半圈,

压 (yā) to press; to push down; to keep under (control); pressure. **传感器 (chuán gǎn qì)** sensor; transducer. **感知 (gǎn zhī)** perception; awareness.

物体 (wù tǐ) object; body; substance.

赋予 (fù yǔ) to assign; to entrust (a task); to give; to bestow.

大脑 (dà nǎo) brain; cerebrum.

什么样 (shén me yàng) what kind?; what sort?; what appearance?.

碰见 (pèng jiàn) to run into; to meet (unexpectedly); to bump into.

比方说 (bǐ fang shuō) for example; for instance. **砖头 (zhuān tóu)** brick.

铲子 (chǎn zi) shovel; spade; trowel; spatula (kitchen utensil). **让开 (ràng kāi)** to get out of the way; to step aside.

同样 (tóng yàng) same; equal; equivalent.

装置 (zhuāng zhì) to install; installation; equipment; system; unit; device.

立方 (lì fāng) cube (math.); abbr. for 立方体 (lì fāng tǐ); abbr. for 立方米 (lì fāng mǐ).

矿石 (kuàng shí) ore.

负荷 (fù hè) load; burden; charge.

The engine needs to run at high speed,

The tremor intensity of its stick will reach 7.9 kilometers per second,

This is equivalent to the mechanical shaking force of the first universe speed,

So the whole excavator was dismantled to pieces.

But at this moment, Lu Hongshuai was sitting in the cockpit a few meters away from the bucket.

Why was he not thrown out of the cockpit by the strong tremor?

We spent about ten years,

For some of the trajectories of the bucket during the movement of the material,

Including its cut-in angle for simulation,

Simulation,

Conduct analysis and calculation research,

Finally, we determined a reasonable excavation load spectrum and reasonable excavation gauge.

Tremor is an unavoidable problem in any large machinery.

Not to mention lifting a weight of 135 tons.

The manufacturing and assembly accuracy of parts,

The running-in accuracy of the engine is the cause of the tremor.

发动机需要高速运转,

其斗杆的震颤强度将达到每秒7.9千米,

这相当于第一宇宙速度的机械震颤力,

所以将整台挖掘机拆卸的七零八落。

但此刻卢洪帅正安坐在距离铲斗几米远的驾驶舱里,

他为什么没有被强烈的震颤抛出驾驶舱呢?

我们花了大概十几年的时间,

就针对铲斗在物料运动过程中的一些运动轨迹,

包括它的切入角度进行模拟,

进行仿真,

进行分析计算研究,

最后我们确定了一个比较合理的挖掘载荷谱和合理的挖掘轨距。

震颤是任何大型机械都难以避免的问题,

更何况要举起135吨的重量。

零部件的制造装配精度,

发动机的运转磨合精度都是导致震颤的始作俑者。

发动机 (fā dòng jī) engine; motor. **高速** (gāo sù) high speed. **运转** (yùn zhuǎn) to work; to operate; to revolve; to turn around.

震颤 (zhèn chàn) to tremble; to quiver. **千米** (qiān mǐ) kilometer.

宇宙速度 (yǔ zhòu sù dù) escape velocity.

拆卸 (chāi xiè) to unload; to dismantle. **七零八落** (qī líng bā luò) (idiom) everything broken and in disorder.

此刻 (cǐ kè) this moment; now; at present. **洪** (hóng) flood; big; great. **正安** (zhèng ān) Zheng'an county in Zun'yi 遵义 (zūn yì), Guizhou. **几米** (jǐ mǐ) Jimmy Liao (1958-), pen name of 廖福彬 (liào fú bīn), Taiwanese illustrator and picture book writer.

抛出 (pāo chū) to toss; to throw out.

十几 (shí jǐ) more than ten; a dozen or more.

轨迹 (guǐ jì) locus; orbit; trajectory; track.

切入 (qiē rù) to cut into; to incise; to penetrate deeply into (a topic, area etc); cut (offensive moves in basketball). **模拟** (mó nǐ) imitation; to simulate; to imitate; analog (device, as opposed to digital).

仿真 (fǎng zhēn) to emulate; to simulate; emulation; simulation.

谱 (pǔ) chart; list; table; register; score (music); spectrum (physics); to set to music. **轨距** (guǐ jù) gauge.

难以 (nán yǐ) hard to (predict, imagine etc).

举起 (jǔ qǐ) to heave; to lift; to raise up; to uphold.

磨合 (mó hé) to break in; to wear in.

From steel plate cutting to bucket welding,

Cut from the part,

To the assembly assembly,

Optimize the configuration from the vibration element parameters,

To use hydraulic transmission technology to reduce the intensity of tremor.

Thousands of craftsmanship,

Each path must be refined.

Thousands of power lines and control lines,

Every one must be meticulous,

Only in this way can the tremor be minimized.

In other words,

It is king to make a steel giant as an embroidery job.

The cockpit where Lu Hongshuai is located is the control center of the entire excavator.

Equivalent to the brain of a steel giant,

Thanks to the embroidery technology in the development of the excavator.

Far from being shaken out of the cockpit, Lu Hongshuai

And also through sensors installed in key parts,

Clearly perceive the subtle changes in the excavation load,

从**钢板切割**到**铲斗焊接**,

从**零件切削**,

到**部装总成**,

从**震动元件参数优化配置**,

到利用**液压传导技术减缓震颤强度**。

上万道制作工艺,

每一道都必须不厌其精。

几千根动力线和控制线,

每一根都必须一丝不苟,

只有**这样才能把震颤降到最低**。

换句话说来说,

把**打造钢铁巨无霸当作一件绣花活来做才是王道**。

卢洪帅所在的驾驶舱是整台挖掘机的控制中枢,

相当于钢铁巨无霸的大脑,

得益于挖掘机研制过程中的绣花工艺。

卢洪帅非但没有被震颤出驾驶舱,

并且还通过安装在**关键部位的传感器**,

清晰感知到挖掘载荷的细微变化,

震动 (zhèn dòng) to shake; to vibrate; to strongly affect; shock; vibration. **元件** (yuán jiàn) element; component. **配置** (pèi zhì) to deploy; to allocate; configuration; allocation.

传导 (chuán dǎo) to conduct (heat, electricity etc). **减缓** (jiǎn huǎn) to slow down; to retard.

不厌 (bù yàn) not to tire of; not to object to.

动力 (dòng lì) motive power; force; (fig.) motivation; impetus.

一丝不苟 (yī sī bù gǒu) not one thread loose (idiom); strictly according to the rules; meticulous; not one hair out of place.

打造 (dǎ zào) to create; to build; to develop; to forge (of metal). **当作** (dàng zuò) to treat as; to regard as. **绣花** (xiù huā) to embroider; to do embroidery. **王道** (wáng dào) the Way of the King; statecraft; benevolent rule; virtuous as opposed to the Way of Hegemon **霸道**.

所在 (suǒ zài) place; location; (after a noun) place where it is located. **中枢** (zhōng shū) center; backbone; hub (e.g. of transport network); the central administration.

研制过程 (yán zhì guò chéng) manufacturing environment.

非但 (fēi dàn) not only.

清晰 (qīng xī) clear; distinct. **细微** (xì wēi) tiny; minute; fine; subtle; sensitive (instruments).

In order to make timely adjustments to the working posture of the excavator.

From Harwusu, Inner Mongolia, more than 1,000 kilometers south of Changde, Hunan,

The construction site of Yuanjiang Tunnel,

Today is the day for Yuan Enhao to change his knife again.

Cutter heads and knives are like the gums and teeth of a shield machine,

The tool is mounted on the cutter head,

As if the teeth meet the gums,

Push forward with a mighty force.

Into the ground is soil,

Invincible by broken mountains and gravel,

But this also makes the cutter head and knives the most worn-out parts on the shield body.

In general,

The shield machine needs to change the cutter every 200 meters on average.

There are hundreds of tools on the cutter head,

With every replacement,

It takes as little as 10 hours,

It takes three or four days to grow.

As we all know,

The deeper the ground,

The higher the water and soil pressure,

以便及时对**挖掘机**的工作**姿态**做出调整。

由**内蒙古****哈尔乌素**往南1000多公里外的**湖南常德**,

沅江隧道**施工现场**,

今天又到了**袁恩浩**换刀的日子。

刀盘和**刀具**就像盾构机的**牙床**和**牙齿**,

刀具镶嵌在刀盘上,

犹如牙齿与**牙床**相合,

以**万钧**之力**向前**推进。

入地是土,

破山**碎石**所向**披靡**,

但这也**使得**刀盘和**刀具**成为了盾构机**身上****磨损****消耗**最厉害的部分。

一般情况下,

盾构机平均每**前进**200米就需要**更换**刀具,

刀盘上**大大小小**上百把**刀具**,

每**更换**一把,

少则需要10小时,

长则需要三四天。

众所周知,

地下越深,

水土压力就越高,

以便 (yǐ biàn) so that; so as to; in order to. 姿态 (zī tài) attitude; posture; stance. 做出 (zuò chū) to put out; to issue.

常德 (cháng dé) Changde prefecture-level city in Hunan.

沅江 (yuán jiāng) river in Hunan, flowing into Lake Dongting 洞庭湖; Yuanjiang county level city in Yiyang 益阳 (yì yáng), Hunan. 现场 (xiàn chǎng) the scene (of a crime, accident etc); (on) the spot; (at) the site.

恩 (ēn) favor; grace; kindness. 浩 (hào) grand; vast (water).

牙床 (yá chuáng) gum; ivory bedframe.

犹如 (yóu rú) similar to; appearing to be. 相合 (xiāng hé) to conform to; to fit with; to be compatible with.

所向披靡 (suǒ xiàng pī mǐ) to sweep everything before one; to be invincible (idiom).

使得 (shǐ de) usable; workable; feasible; doable; to make; to cause. 磨损 (mó sǔn) wear and tear; abrasion. 消耗 (xiāo hào) to use up; to consume.

大大小小 (dà dà xiǎo xiǎo) large and small; of all sizes.

水土 (shuǐ tǔ) water and soil; surface water; natural environment (extended meaning); climate.

Generally every 10 meters,

The ground water and soil pressure will increase by one atmosphere.

When the shield machine is digging forty to fifty meters underground,

The cutter head and shield body will withstand 4~5 atmospheres,

Is 4~5 times the atmospheric pressure on the ground,

In order to facilitate the tool change,

The designer set up a closed transition chamber between the cutter head and the shield body,

Also called the human cabin,

Rush into compressed air,

Keep it at 4~5 atmospheres,

Balance with the surrounding soil pressure.

When the tool wears out,

The tool changer must enter the high-pressure working chamber for manual tool change.

The normal human body cannot work under high pressure.

This requires divers with high-pressure operation experience before entering the high-pressure working chamber to change to,

First enter a transition cabin connected to the working cabin,

After 4 hours of pressurization process.

When the pressure in the transition compartment is consistent with the pressure in the working compartment,

一般每下降10米,

地下水土压力就会增加一个大气压。

当盾构机在地下四五十米处掘进时,

刀盘和盾体会承受4~5个大气压,

是地面大气压的4~5倍,

为了便于更换刀具,

设计师在刀盘和盾体之间设置了密闭过渡舱,

也叫人舱,

冲入压缩空气,

使之保持在4~5个大气压,

与周围土体压力达到平衡。

当刀具磨损后,

换刀员必须进入高压工作舱进行人工换刀,

而正常人体是无法在高压下工作的。

这需要具备高压作业经验的潜水员在进入高压工作舱换到之前,

先进入一个与工作舱连通的过渡舱,

经历长达4小时的加压过程。

当过度舱内的压力与工作舱内的压力达到一致时,

地下水 (dì xià shuǐ) groundwater. 大气压 (dà qì yā) atmospheric pressure.

五十 (wǔ shí) fifty.

便于 (biàn yú) easy to; convenient for.

之间 (zhī jiān) between; among; inter-. 设置 (shè zhì) to set up; to install. 密闭 (mì bì) sealed; airtight. 过渡 (guò dù) to cross over (by ferry); transition; interim; caretaker (administration). 舱 (cāng) cabin; the hold of a ship or airplane.

冲入 (chōng rù) to rush into; to break into. 压缩 (yā suō) to compress; compression.

员 (yuán) person; employee; member. 高压 (gāo yā) high pressure; high-handed.

人体 (rén tǐ) human body.

潜水员 (qián shuǐ yuán) diver; frogman. 仓 (cāng) barn; granary; storehouse; cabin; hold (in ship).

连通 (lián tōng) to connect; to communicate; to relate; (math.) connected.

长达 (cháng dá) to extend as long as; to lengthen out to. 加压 (jiā yā) to pressurize; to pile on pressure.

过度 (guò dù) excessive; over-; excess; going too far; extravagant; intemperate; overdue.

It means that the operators have adapted to the high pressure,

You can enter the work compartment to change the tool.

After the tool change is completed,

The operator must return to the transition compartment again,

After 4 hours of decompression before returning to the ground.

The time for tool change at the construction site has come,

However, the workers in front of them do not seem to be strong.

What is even more incredible is that they actually passed the step of pressurizing the transition chamber.

And did not take other protective measures,

He went straight into the gun body located behind the shield machine and started the tool change operation.

This is not only a sweat,

The atmospheric pressure of Xinjiang's underground is 3~5 times higher than the ground,

It is equivalent to placing a gas tank on a matchbox,

Tool changers who have not been pressurized in the transition chamber,

Can their bodies bear it?

We designed a cutter head,

It has a function of entering the warehouse under normal pressure.

意味着作业人员已经适应了高压,

可以进入工作仓进行换刀了。

待完成换刀后,

作业人员必须再返回过渡舱,

经过4小时的减压才能重新回到地面。

施工现场换刀时间已到,

不过眼前这几位作业人员看上去似乎并不强壮,

而更令人匪夷所思的是他们居然越过了在过渡舱加压的环节,

并且也没有采取其他防护措施,

就径直进入位于盾构机包含后方的枪体开始了换刀作业。

这不仅令人捏了一把汗,

援疆地下比地面高出3~5倍的大气压,

相当于在一枚火柴盒上放置一个煤气罐,

没有经过过渡舱加压的换刀员,

他们的身体能承受得住吗?

我们设计了一种刀盘,

它具有常压进仓的一个功能。

意味着 (yì wèi zhe) to signify; to mean; to imply.

减压 (jiǎn yā) to reduce pressure; to relax.

眼前 (yǎn qián) before one's eyes; now; at present. 看上去 (kàn shàng qu) it would appear; it seems (that). 强壮 (qiáng zhuàng) strong; sturdy; robust.

令人 (lìng rén) to cause one (to do sth); to make one (angry, delighted etc). 匪夷所思 (fěi yí suǒ sī) unimaginable; outrageous; freakish. 越过 (yuè guò) to cross over; to transcend; to cover distance; to overcome; to rise above. 环节 (huán jié) (zoology) segment (of the body of a worm, centipede etc); (fig.) a part of an integrated whole: aspect (of a project), element (of a policy), sector (of the economy), stage (of a process), etc.

径直 (jìng zhí) directly. 后方 (hòu fāng) the rear; far behind the front line.

捏 (niē) to pinch (with one's fingers); to knead; to make up.

援 (yuán) to help; to assist; to aid. 疆 (jiāng) border; boundary.

放置 (fàng zhì) to put. 煤气 (méi qì) coal gas; gas (fuel).

In the past, changing the tool under pressure meant that the tool did not move.

People enter the front excavation surface,

Replace it under high pressure.

Nowadays, the process of changing the tool at atmospheric pressure is not moving.

The tool is drawn back to the normal pressure environment to be replaced.

It performs a tool change work under a normal pressure state,

The first is to reduce the safety risks of my personnel,

The other is to save my time for tool change.

The Yuan'an is one of the first large-diameter shield machines in China to use atmospheric tool change technology.

When the tool needs to be replaced after wear,

The tool can pierce the pressure box behind the pushed cutter head,

The tool changer can complete the tool change work under normal pressure.

High-precision gas-liquid pressure balance control technology,

Ensure the continuous voltage stabilization in the atmospheric tank.

Between the sky above the river,

The air show of the ship lift continues,

However, the Three Gorges shiplift has tens of thousands of parts and components.

以前带**压换刀就是刀不动**,

人**进入到前面的开挖面**,

在**高压下把它更换掉**。

现在常**压换刀工艺就是人不动**,

刀具抽回到常压的环境下人去更换。

它在一个常**压**的状态下进行一个换刀的工作,

第一个是**减少我的人员的安全风险**,

另外一个**是节约我的换刀的时间**。

沉安号是中国首先使用常**压换刀技术的大直径盾构机之一**,

当**刀具磨损后需要更换时**,

刀具可以刺动后推的刀盘后方的承压箱体内,

换刀**员在常压状态下便能完成换刀工作**。

高精度气液压力平衡控制技术,

保证了常**压箱体**内的持续**稳压**。

大江**之上天水之间**,

升船机**空中表演还在继续**,

然而**三峡升船机全身上下共有上万个零部件**,

不动 (bù dòng) motionless.

面的 (miàn dì) abbr. of 面包车的士 (miàn bāo chē dī shì); minivan taxi. **开挖** (kāi wā) to dig out; to excavate; to scoop out.

沉 (yuán) Yuan river in Guizhou and Hunan.

体内 (tǐ nèi) within the body; in vivo (vs in vitro); internal to.

高精度 (gāo jīng dù) high precision. **液** (yè) liquid; fluid; Taiwan pr. (yì).

稳压 (wěn yā) stable voltage.

天水 (tiān shuǐ) Tianshui prefecture level city in Gansu.

共有 (gòng yǒu) to have altogether; in all.

With impeccable rack and pinion,

Can the entire elevator building be guaranteed to be safe?

In case of a leak in the cabin,

The motor is powered off,

Even during an earthquake disaster,

Can the designer come up with a comprehensive strategy to ensure the absolute safety of the ship lift?

A total of 8 motors in 4 groups are driven synchronously,

16 sets of balance weight pulleys are strenuous at the same time,

The bottom synchronous shaft runs at a speed of 248 revolutions per minute,

All the parts of the ship lift are running at high speed and stably,

But there is only one structure hidden in the trough of the tower column and it is idling,

How is this going?

The water depth of the container is 3.5 meters,

Weighs 15,500 tons,

The ship sailed into the container,

光有**无懈可击**的**齿轮齿条**,

就能保证整**栋**电梯大厦都安全无余吗?

万一**遭遇**船厢**漏水**,

电机断电,

甚至地震灾害时,

设计师能**拿出****确保**升船机绝对安全的**万全**之策吗?

4组共**8台****电机****同步驱动**,

16组平衡重**滑轮**同时**吃力**,

底层**同步轴**以每分钟248转的速度**运行**,

升船机所有的**部件**都在**高速**稳定的**运行**,

却**唯有**一个**构建**隐藏于**塔柱****槽沟**内**兀自**空转,

这是**怎么回事**?

盛船箱**水深**3.5米,

重15500吨,

船只驶入**盛**船箱,

无懈可击 (wú xiè kě jī) invulnerable.

栋 (dòng) classifier for houses or buildings; ridgepole (old).

遭遇 (zāo yù) to meet with; to encounter; (bitter) experience. **漏水** (lòu shuǐ) to leak (of water).

断电 (duàn diàn) power cut; electric power failure.

拿出 (ná chū) to take out; to put out; to provide; to put forward (a proposal); to come up with (evidence). **万全** (wàn quán) Wanquan county in Zhangjiakou 张家口 (zhāng jiā kǒu), Hebei.

滑轮 (huá lún) block and tackle. **吃力** (chī lì) to entail strenuous effort; to toil at a task; strenuous; laborious; strain.

底层 (dǐ céng) ground or first floor; bottom (of a pile); lowest rung (of society). **轴** (zhóu) axis; axle; spool (for thread); roller (for scrolls); classifier for calligraphy rolls etc. **运行** (yùn xíng) to move along one's course (of celestial bodies etc); (fig.) to function; to be in operation; (of a train service etc) to operate; to run; (of a computer) to run.

唯有 (wéi yǒu) only. **构建** (gòu jiàn) to construct (sth abstract). **隐藏** (yǐn cáng) to hide; to conceal; to mask; to shelter; to harbor (i.e. keep sth hidden); to hide oneself; to lie low; to nestle; hidden; implicit; private; covert; recessed (lighting). **槽** (cáo) trough; manger; groove; channel; (Tw) (computing) hard drive. **兀自** (wù zì) (literary) still; yet.

怎么回事 (zěn me huí shì) what's the matter?; what's going on?; how could that be?; how did that come about?; what's it all about?.

盛 (shèng) flourishing; vigorous; magnificent; extensively. **水深** (shuǐ shēn) depth (of waterway); sounding.

驶入 (shǐ rù) (of a car, ship, train etc) to enter.

According to Archimedes' law, the same weight of water will be eliminated,

The total weight of the container remains unchanged,

Has the vessel received the vertical movement of the container?

However, the standard water depth of 3.5 meters and its length of 132 meters,

Compared to the 23-meter-wide scale,

Like a diving plate filled with water,

The boat is like a boat in the plate.

Once the container is out of balance when it rises and falls,

The water in the diving disk will fluctuate to one side from left to right,

And the steel cable on the other side will lift up due to weightlessness,

The boat in the plate capsized,

This is the undercover effect.

Because it's an elevator that crosses the ship,

How to ensure that a bowl of water is level,

It is balanced during operation,

No shaking,

Feels very stable,

The water is calm,

This is our biggest technical difficulty.

根据**阿基米德定律**会**排除同等重量**的水，

盛船箱总重量**不变**，

船只接受**盛**船箱的**垂直**运动实现过吧？

然而**盛**船箱3.5米的标准**水深**与它长132米，

宽23米的**尺度**相比，

犹如一只**盛**满了水的**潜盘**，

船只则**如同**盘中之**舟**。

盛船箱**升降**时一旦**失衡**，

潜盘中的水就会左右**波动**涌向**一侧**，

而**另一侧**的**钢索**会因为**失重**向上**翘起**，

盘中之**舟**随之**倾覆**，

这就是**潜盘效应**。

因为它是个过船的**电梯**，

如何保证它一碗水**端平**，

在**运营**过程中它是**平衡式**的，

没有**晃动**，

感觉很**平稳**，

水面风平浪静，

这就是我们最大的**技术难度**。

阿基米德 (ā jī mǐ dé) Archimedes (c. 287-212 BC). **定律** (dìng lǜ) scientific law (e.g. law of conservation of energy); (in human affairs) a generalization based on observation (e.g. "power corrupts"). **同等** (tóng děng) equal to; having the same social class or status.

不变 (bù biàn) constant; unvarying; (math.) invariant.

尺度 (chǐ dù) scale; yardstick. **相比** (xiāng bǐ) to compare.

潜 (qián) hidden; secret; latent; to hide; to conceal; to submerge; to dive.

如同 (rú tóng) like; as. **舟** (zhōu) boat.

升降 (shēng jiàng) rising and lowering. **失衡** (shī héng) to unbalance; an imbalance.

波动 (bō dòng) to undulate; to fluctuate; wave motion; rise and fall. **涌** (yǒng) to bubble up; to rush forth. **侧** (cè) the side; to incline towards; to lean; inclined; lateral; side.

另一 (lìng yī) another; the other. **失重** (shī zhòng) weightlessness. **向上** (xiàng shàng) upward; up; to advance; to try to improve oneself; to make progress. **翘起** (qiào qǐ) to stick up; to point sth up.

倾覆 (qīng fù) to capsize; to collapse; to overturn; to overthrow; to undermine.

效应 (xiào yìng) effect (scientific phenomenon).

端 (duān) end; extremity; item; port; to hold sth level with both hands; to carry; regular.

运营 (yùn yíng) to be in operation; to do business; (of train, bus etc) to be in service; operation; service.

晃动 (huàng dòng) to sway; to rock.

平稳 (píng wěn) smooth; steady.

水面 (shuǐ miàn) water surface. **风平浪静** (fēng píng làng jìng) lit. breeze is still, waves are quiet (idiom); tranquil environment; all is quiet; a dead calm (at sea).

So how to overcome the submarine effect,

How to ensure that the cabin is safe to operate?

The secret lies in the groove of the tower column.

This is the screw and nut columns embedded in the tower columns on both sides of the container.

When the container is raised and lowered normally,

The short screw is idling in the nut column,

There is a gap of 60 mm between the thread of the screw and the thread of the nut.

When the undercover effect occurs,

The drive system will automatically stop,

The gap between the short screw and the nut column gradually disappears,

The screw teeth and the screw teeth bite tightly,

Securely lock the container on the nut post.

This kind of rack and pinion climbing ship lift,

The Three Gorges is the first,

It can be said to be unprecedented,

No one will come later.

With the accuracy of the climb stroke error not exceeding two millimeters,

Only the ship lift can move up and down smoothly,

As if walking on the ground.

那么该如何**攻克潜盘效应**,

确保船厢运行万无一失呢?

秘密就在**塔柱的槽沟**内。

这是**镶嵌在盛船箱两侧塔柱上的螺杆和螺母柱**,

当**盛船箱正常升降**时,

短螺杆在螺母柱里空转,

螺杆的螺牙与螺母柱的螺牙之间保持着60毫米的间隙,

当发生**潜盘效应**时,

驱动系统就会自动停机,

短螺杆与螺母柱之间的间隙逐渐消失,

螺牙与螺牙紧紧咬合,

将**盛船箱牢牢锁定在螺母柱上**。

这种齿轮齿条爬升式的升船机,

三峡是第一座,

可以说是**前无古人**,

后无来者。

有了爬升行程误差不超过两毫米的精度,

升船机才能得以平稳升降,

如履平地。

攻克 (gōng kè) to capture; to take; to overcome; to solve.

万无一失 (wàn wú yī shī) surefire; absolutely safe (idiom).

螺杆 (luó gǎn) screw. **螺母** (luó mǔ) nut (female component of nut and bolt).

螺 (luó) spiral shell; snail; conch. **牙** (yá) tooth; ivory. **间隙** (jiàn xì) interval; gap; clearance.

停机 (tíng jī) (of a machine) to stop; to shut down; to park a plane; to finish shooting (a TV program etc); to suspend a phone line; (of a prepaid mobile phone) to be out of credit.

紧紧 (jǐn jǐn) closely; tightly.

牢牢 (láo láo) firmly; safely. **锁定** (suǒ dìng) to lock (a door); to close with a latch; to lock into place; a lock; a latch; to lock a computer file (to prevent it being overwritten); to lock (denying access to a computer system or device or files, e.g. by password-protection); to focus attention on; to target.

古人 (gǔ rén) people from ancient times; the ancients; the late (i.e. person who has passed away).

行程 (xíng chéng) journey; course of a journey; distance traveled; trajectory; itinerary; route; course (of history); (Tw) (computing) process.

得以 (dé yǐ) able to; so that sb can; enabling; in order to; finally in a position to; with sth in view.

平地 (píng dì) to level the land; level ground; plain.

With 4 groups of 8 synchronous drive motors,

Even if any two motors are shut down at the same time,

The ship lift can also continue to operate,

Safe and sound.

With a balance weight equal to the weight of the container,

The ship lift only needs to use less than 2.5% of the driving force of its total positive volume,

Can lift weights lightly,

Up and down freely.

With the foolproof brake device of the screw nut column,

Even if the weather is unexpected,

The ship lift can also be safe and sound,

Stay away from the undercut effect.

The endless Harwusu Mine in Inner Mongolia,

The 75 cubic meter excavator is working day and night,

If all the coal it mines is converted into thermal power,

It can supply 2% of China's electricity demand.

And in the factory in Taiyuan, Shanxi,

The 75 cubic meter excavator will no longer be alone in despair,

Larger and more advanced mining excavator equipment is being developed.

有了4组8台同步驱动电机，

哪怕遭遇任意两台电机同时停工，

升船机也能继续运行，

安全无虞。

有了与盛船箱等重量的平衡块，

升船机只需动用不到自身总正量的2.5%的驱动力，

便能举重若轻，

上下自如。

有了螺杆螺母柱万无一失的刹车装置，

哪怕天有不测风云，

升船机也能安然无恙，

远离潜盘效应。

一望无际的内蒙古哈尔乌素矿
山，

75立方米挖掘机正在昼夜不停的工作，

如果将它挖掘的煤炭全部转化为火电，

可供应整个中国2%的电力需求。

而在山西太原的工厂里，

75立方米挖掘机将不再独孤求败，

更大更先进的矿用挖掘机装正在为研制。

停工 (tíng gōng) to stop work; to shut down; to stop production.

安全无虞 (ān quán wú yú) safe and secure.

动用 (dòng yòng) to utilize; to put sth to use. 自身 (zì shēn) itself; oneself; one's own. 驱动力 (qū dòng lì) driving force.

举重 (jǔ zhòng) to lift weights; weight-lifting (sports). 若 (ruò) to seem; like; as; if.

刹车 (shā chē) to brake (when driving); to stop; to switch off; to check (bad habits); a brake.

不测 (bù cè) unexpected; measureless; unexpected circumstance; contingency; mishap. 风云 (fēng yún) weather; unstable situation.

安然无恙 (ān rán wú yàng) safe and sound (idiom); to come out unscathed (e.g. from an accident or illness).

远离 (yuǎn lí) to be far from; to keep away from.

一望无际 (yī wàng wú jì) as far as the eye can see (idiom).

昼夜 (zhòu yè) day and night; period of 24 hours; continuously, without stop. 不停 (bù tíng) incessant.

转化 (zhuǎn huà) to change; to transform; isomerization (chemistry). 火电 (huǒ diàn) thermal power.

供应 (gōng yìng) to supply; to provide; to offer. 个中 (gè zhōng) therein; in this. 电力 (diàn lì) electrical power; electricity. 需求 (xū qiú) requirement; to require; (economics) demand.

独孤求败 (dú gū qiú bài) Dugu Qiubai, a fictional character appearing in 金庸 (jīn yōng) novels.

先进 (xiān jìn) advanced (technology); to advance.

I have been doing this for 30 years,

In fact, I have done such a thing in my life,

Thousands of parts,

Put any thing there,

We know where this is,

What are you doing.

Today in Russia,

Peru,

Chile,

More than 10 countries and regions including South Africa can see the towering figure of Chinese mining excavators.

The Chinese are using wisdom and sweat to reshape our planet.

In Changsha, Hunan,

The manufacturing and processing of shield machines is underway,

And this is just the tip of the iceberg,

More than 85% of subway tunnels in China are excavated by shield machines.

Before 2008,

We use foreign shield machines,

We know what are the advantages of foreign shield machines,

What are its disadvantages.

We came from the site project.

So from this perspective, we will develop and design,

This is a technical route that no one else has taken,

Problem-oriented,

干这个东西已经是30年,

实际上就这辈子就干了这么个东西,

上万个零件,

随便哪个东西往那一放,

我们知道这个是在哪个部位,

干什么的东西。

今天在俄罗斯、

秘鲁、

智利、

南非等10多个国家和地区都能看到中国矿用挖掘机的巍峨身姿,

中国人正在用智慧与汗水重新塑造着我们的地球。

在湖南长沙,

盾构机的制造加工正在火热进行,

而这只是冰山一角,

在中国85%以上的地铁隧道都是由盾构机开掘的。

2008年以前,

我们是使用国外的盾构机,

我们知道国外盾构机它的优点是什么,

它存在的缺点是什么。

我们从现场工程中走过来的。

所以站在这个角度我们来研发设计,

这是别人没有走过的一条技术路线,

以问题为导向,

辈子 (bèi zi) all one's life; lifetime.

干什么 (gàn shén me) what are you doing?; what's he up to?.

俄罗斯 (é luó sī) Russia.

秘鲁 (bì lǔ) Peru.

智利 (zhì lì) Chile.

南非 (nán fēi) South Africa. 多个 (duō ge) many; multiple; multi- (faceted, ethnic etc).

汗水 (hàn shuǐ) sweat; perspiration. 塑造 (sù zào) to model; to mold; (fig.) to create (a character, a market, an image etc); (literature) to portray (in words).

火热 (huǒ rè) fiery; burning; fervent; ardent; passionate.

冰山一角 (bīng shān yī jiǎo) tip of the iceberg.

开掘 (kāi jué) to excavate; to dig out; fig. to investigate (in an archive).

国外 (guó wài) abroad; external (affairs); overseas; foreign.

走过 (zǒu guò) to walk past; to pass by.

路线 (lù xiàn) itinerary; route; political line (e.g. right revisionist road).

导向 (dǎo xiàng) to be oriented towards; orientation.

What problem to solve.

Chinese brand shield machines not only occupy more than 90% of the Chinese market,

The share of the global market has reached 2/3.

In many countries along the Belt and Road,

The Chinese shield machine is creating a better life for the local people.

In the Three Gorges of the Yangtze River,

In one year, nearly 6,000 ships took the shiplift over the Three Gorges Dam.

As the final work of the Three Gorges Project,

The ship lift shortens the navigation time of the Three Gorges to 1/6 of the original,

The navigation capacity and the same navigation quality of the Three Gorges Project are guaranteed.

From the unparalleled 75 cubic meter mine excavator to the invincible large-diameter mud-water balance tunnel collection,

Then to the high-speed elevator on the water,

Three Gorges ship lift,

They are the lone rangers in the acceleration of Chinese super equipment,

Strong and powerful,

Dominate one side.

The people who created them,

Not only give them kilotons of weight,

解决什么问题。

中国**品牌**盾构机不仅**占据**了中国市场**90%以上**的**份额**,

在**全球**市场的**占有**率也达到**2/3**。

在**一带一路**多个**沿线**国家,

中国盾构机正在为当地人民创造更**美好**的生活。

在**长江三峡**,

一年当中有**将近**6000艘船舶搭乘了升船机**翻越**三峡大坝。

作为**三峡工程**的**收官**之作,

升船机将**三峡**的**通航**时间缩短为原来的**1/6**,

保证了**三峡水利枢纽**的**通航**能力和同航质量。

从**举世无双**的**75立方米**矿有**挖掘机**到**所向披靡**的**大直径泥水平衡洞沟集**,

再到**水上**高速电梯,

三峡升船机,

它们是中国**超级装备**加速中的**独行侠**,

强悍有力,

独霸一方。

缔造他们的人,

不仅**赋予**他们**千吨**重量,

占据 (zhàn jù) to occupy; to hold. **份额** (fèn é) share; portion.

占有 (zhàn yǒu) to have; to own; to hold; to occupy; to possess; to account for (a high proportion etc).

一带一路 (yī dài yī lù) Belt and Road Initiative, Chinese government plan to provide finance and engineering expertise to build infrastructure across Eurasia and northeast Africa, unveiled in 2013. **沿线** (yán xiàn) along the line (e.g. railway); the region near the line.

美好 (měi hǎo) beautiful; fine.

将近 (jiāng jìn) almost; nearly; close to. **艘** (sōu) classifier for ships; Taiwan pr. (sāo). **搭乘** (dā chéng) to ride as a passenger; to travel by (car, plane etc).

收官 (shōu guān) final part of a go game (see 官子 (guān zǐ)); endgame; to finish up; to come to the final stage.

加速 (jiā sù) to speed up; to expedite. **独行侠** (dú xíng xiá) loner; single person; bachelor.

有力 (yǒu lì) powerful; forceful; vigorous.

独霸一方 (dú bà yī fāng) to exercise sole hegemony (idiom); to dominate a whole area (market, resources etc); to hold as one's personal fiefdom.

缔造 (dì zào) to found; to create.

千吨 (qiān dūn) kiloton.

It also engraved the height of human wisdom on them.

in the factory,

Manufacturing activities that push the limits continue.

In the workshop,

Innovative research and development to light up tomorrow is underway.

In the near future,

Chinese equipment will bring people a better life.

更在**他们身上镌刻**下人类智慧的高度。

在工厂，

突破极限的制造活动还在继续。

在**车间**，

点亮明天的**创新研发**正在展开。

在不远的未来，

中国**装备**将为**人们带来更美好的生活**。

镌刻 (juān kè) to engrave.

突破 (tū pò) to break through; to make a breakthrough; to surmount or break the back of (a task etc); (of ball sports) to break through a defense. **极限** (jí xiàn) limit; extreme boundary.

车间 (chē jiān) workshop.

点亮 (diǎn liàng) to illuminate; to turn on the lights; to light (a blaze). **创新** (chuàng xīn) innovation; to bring forth new ideas; to blaze new trails.