YLSK-212 型电脑数控卷簧机

YLSK-212 CNC Spring Coiling Machine

Operation Manual

使用说明书

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一、本机用途：

本电脑机是由一个控制器和二个伺服系统构成,主要用于制造左、右旋圆柱形压缩弹簧、变形拉力簧及两端拼圈弹簧,特别是对制造细长形油封弹簧,选择 YLSK-212 型电脑数控弹簧机是最理想设备。

本机主要提供二绕圈顶杆系统。但如果需要可装备成单顶杆系统，可加工带尾巴形弹簧及其它种类的弹簧如扭簧等。

本机传动系统为 CNC 控制，精密度高，主要部位采用高耐磨性材料，精密耐磨性轴承，精心制造装配而成，生产能力大，通用性强，调机快而且容易，是理想的弹簧制造业之生产利器。

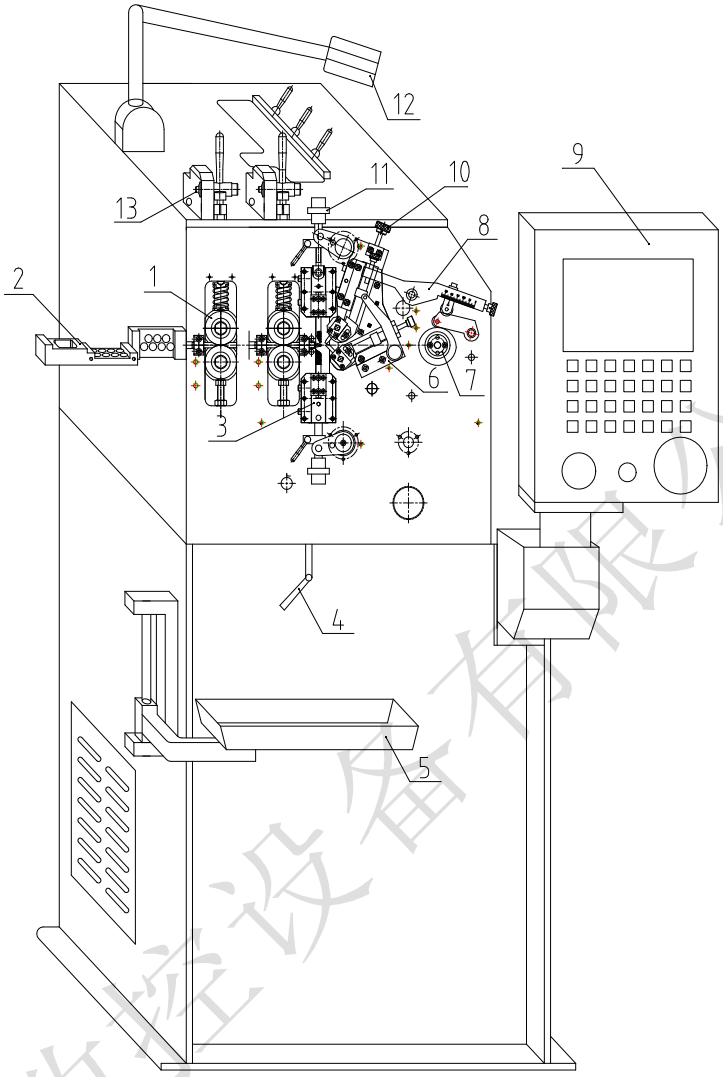
一、 技术参数：

名称	规格	单位
加工线径	Φ0.15～Φ1.2	mm
最大弹簧外径	Φ18	mm
最大送线长度	10000	mm
每分钟生产量	10～500	件/min
伺服电机功率	2×1	kw
绕圈方向	左/右	
机器重量	450	kg
机械尺寸	610×820×1580	mm

二、 机器的组成部分

图一、为机器外观简图

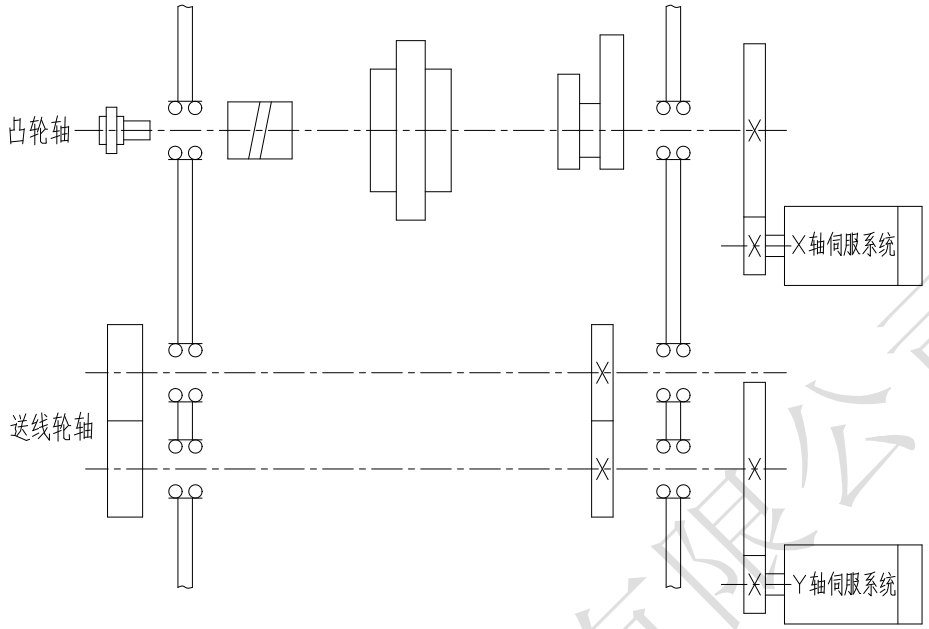
图二、为传动原理图



1、送线轮
2、校直架
3、切料刀架
4、芯轴刀锁紧手柄
5、托盘
6、变径刀架
7、变径凸轮
8、变径微调摇臂
9、控制器
10、弹簧直径调整螺杆
11、切料滑块调整螺母
12、照明灯
13、送线轮压紧装置

（图一）机器外观简图

本机由二轴控制：送线 Y 轴和凸轮 X 轴,详细说明请看操作手册：



（图二）传动原理

三、 本机安装：

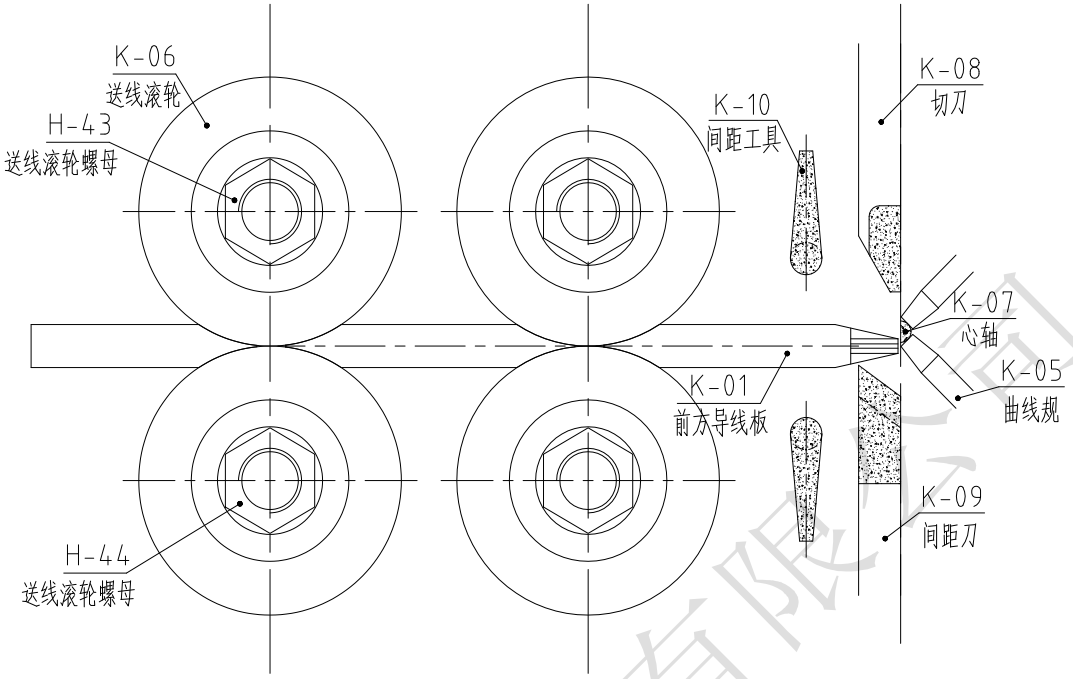
本机在出厂时已全部装配完成并经试车、加工样件，安装本机时必须找平固定，以确保正常运转。

本机应依照国家标准规定，妥善予以接地保护，连接电源后观察控制器信号，用手动试调电机旋向是否正确，启动伺服电机试空运转，保证一切正常工作。

四、 校直架：

为了弹簧产品的质量，必须选用优质的钢丝，校直装置使用于校正较小的偏差，它由两个相互垂直方向的校直单元组成，钢丝通过校直后进入线轮到达芯轴再经两个顶杆（曲线规）弯曲即可形成各种所须弹簧，当然成形之弹簧取决于操作人员的知识和经验，特别是对电脑控制器的使用必须经过一定的专业训练才能操作。

五、 送线滚轮及顶杆（曲线规）等简单示图：



（图三）右旋

七、送线部件：

送线滚轮（K-06）具有两沟槽，装于本机时将后面的沟槽与线材导板平行垂直，利用 13 送线轮压紧装置给予压力，确保绕出弹簧即可。

前方导线板（K-01）可防止线材在送线滚轮与第一绕圈顶杆之间发生缠结。前方导线板之前不用盖板予以遮盖，而是以间距刀（K-09）予以遮盖，此间距刀之定位通过摆杆调节螺丝（H-37）图九予以调整，在进行拉力弹簧制造时，弹簧不应抵住间距刀运转。

制造左旋弹簧时,将芯轴、间距刀、切刀与右旋安装相反，曲线规下移既可。

注意：加工不同线径时，需更换不同的送线滚轮，更换线轮时，必须注意里面的线轮垫圈装配方向，小平面压住里面的轴承，线轮与大平面接触，然后用线轮锁紧螺母 H-43，H-44（左旋螺纹）锁紧，反之，若安装垫

圈方向相反，则会损坏设备。

八、 绕圈系统：

（K-06）曲线规（图三）装在变径刀夹（C-23）图六上可以任何方向转动调正，绕圈杆尖之面应朝前，二曲线规绕圈尖可同时对称移动或分别移动，二绕圈尖相对之正确位置由变径滑块拔杆（D-05）予以决定。

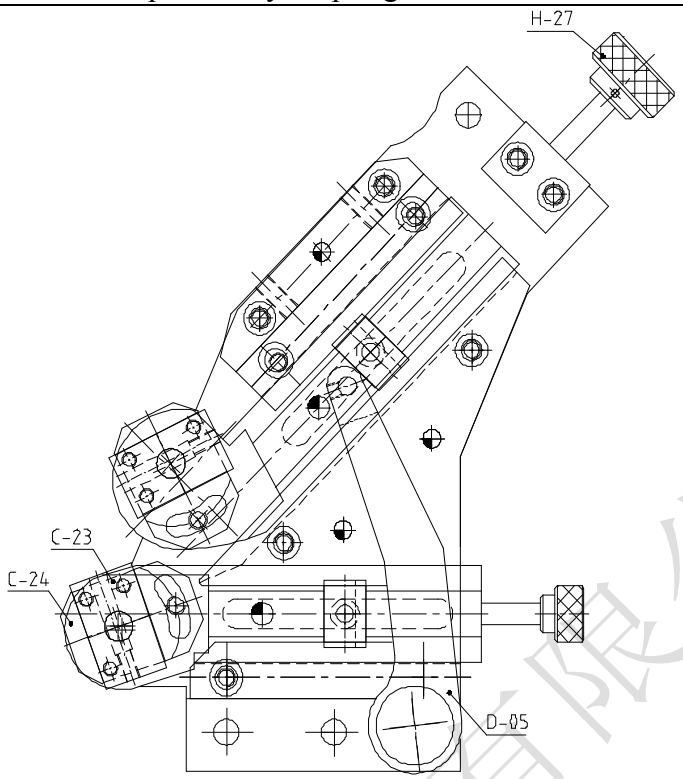
九、 变径弹簧辅助装置：

当使用变径弹簧辅助装置时，二曲线规由变径微调摇臂（D-02）图七，促使配合工作，变径微调摇臂之动作由变形凸轮（见附件明细表）经滚子，变径短摇臂（D-04）而传递，通过变径调节螺杆帽（H-17）移动小游标座可改变动程。因为曲线规由一弹簧控制复位，因此滚子开始接触凸轮板，绕圈尖到极限位置（即弹簧最大外径）应由弹簧直径调整螺杆 10（图一）予以限制，而不是靠凸轮板限制。

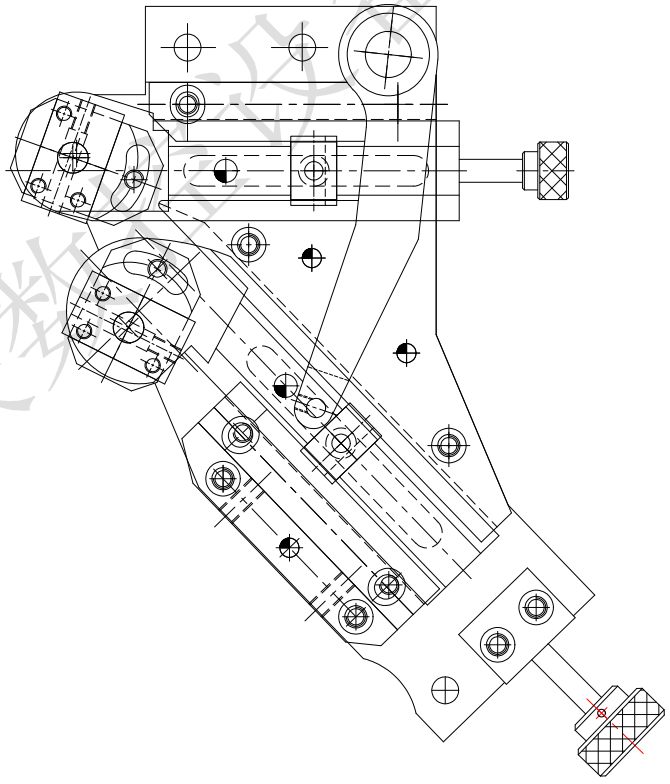
十、 弹簧外径修正装置：

弹簧外径修正中间盘（E-22）图七包括变形凸轮，便可与变径弹簧装置连同使用，此中间盘装置可安装变形凸轮。当用平行轴之间距工具进行具有大节距弹簧之绕圈时，使用本装置。在制造紧密绕圈端之压缩弹簧时，因间距工具压迫弹簧而使弹簧外径减小，因此造成弹簧外径不一致，借助变形凸轮可控制绕圈顶杆，使用弹簧端之绕圈外径减小，此减小值与间距工具造成的值抵消，从而使得整体弹簧之外径符合所需之值（即为正确之圆柱状）。

在制造小或中等节距压缩弹簧时，用垂直弹簧轴之间距刀进行，一般不用此装置。

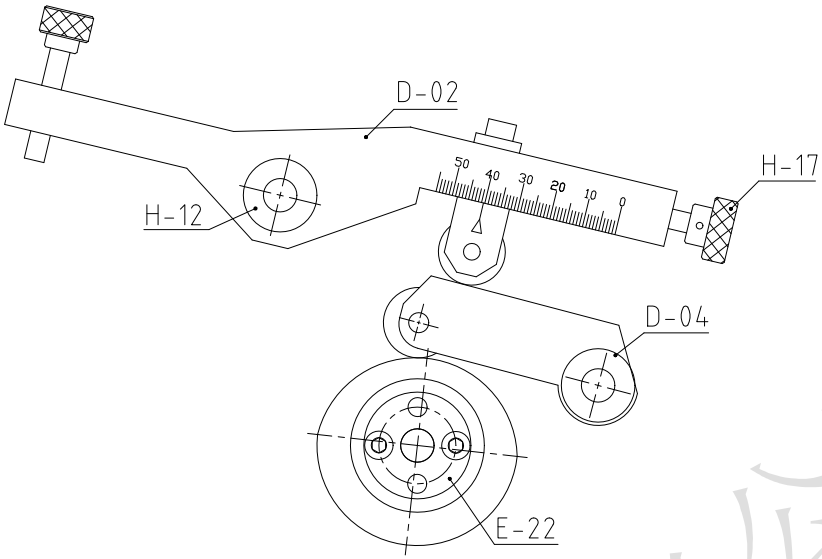


（a）



（b）

（图六）曲线规座　（a）右旋　（b）左旋



（图七） 变径弹簧辅助装置

十一、依弹簧垂直方向调整节距装置：

本节距调整装置用于制造压缩弹簧，绕密圈时，间距刀插入迫使展开，间距刀（K-09 见附件明细表）分小锥面和大锥面两种，小锥端在制造小节距弹簧时使用。而具有大锥面的间距刀系用于制造较大节距之弹簧。将间距刀装入切料滑块（C-03）图八槽中，使之能恰好通过线材导板——由右旋绕圈弹簧之下方或左旋绕圈弹簧之上方通过。

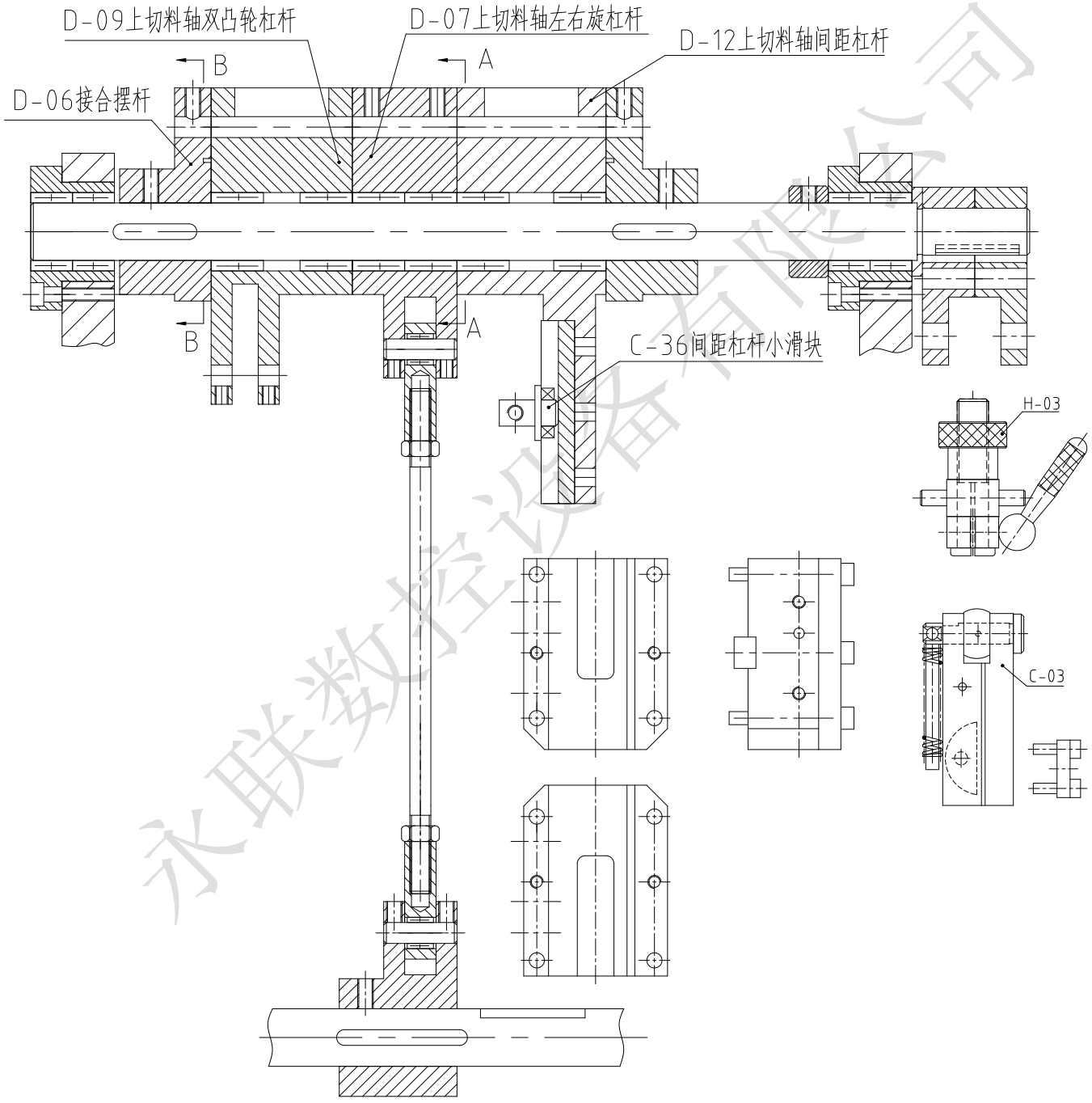
切料滑块（C-03）由间距凸轮经由上切料间距杠杆、摇臂轴间距微调杠杆(D-12,D-13)图九操作。位于上切料间距杠杆(D-12)之杠杆拔销(H-16)在制造右旋弹簧时,必须退后到上切料轴左右旋杠杆（D-07）图八中；而在制造左旋弹簧时，必须前进到图八左边驱动上切料轴离合摆杆（D-06）中，在中央位置时，间距刀则不产生作用。

告诫：必须确使间距连杆及切割连杆之两杠杆拔销 H-16（图九 A-A，B-B）不得同时插入上切料轴左右旋杠杆（D-07）图八中，否则会造成机器损坏。

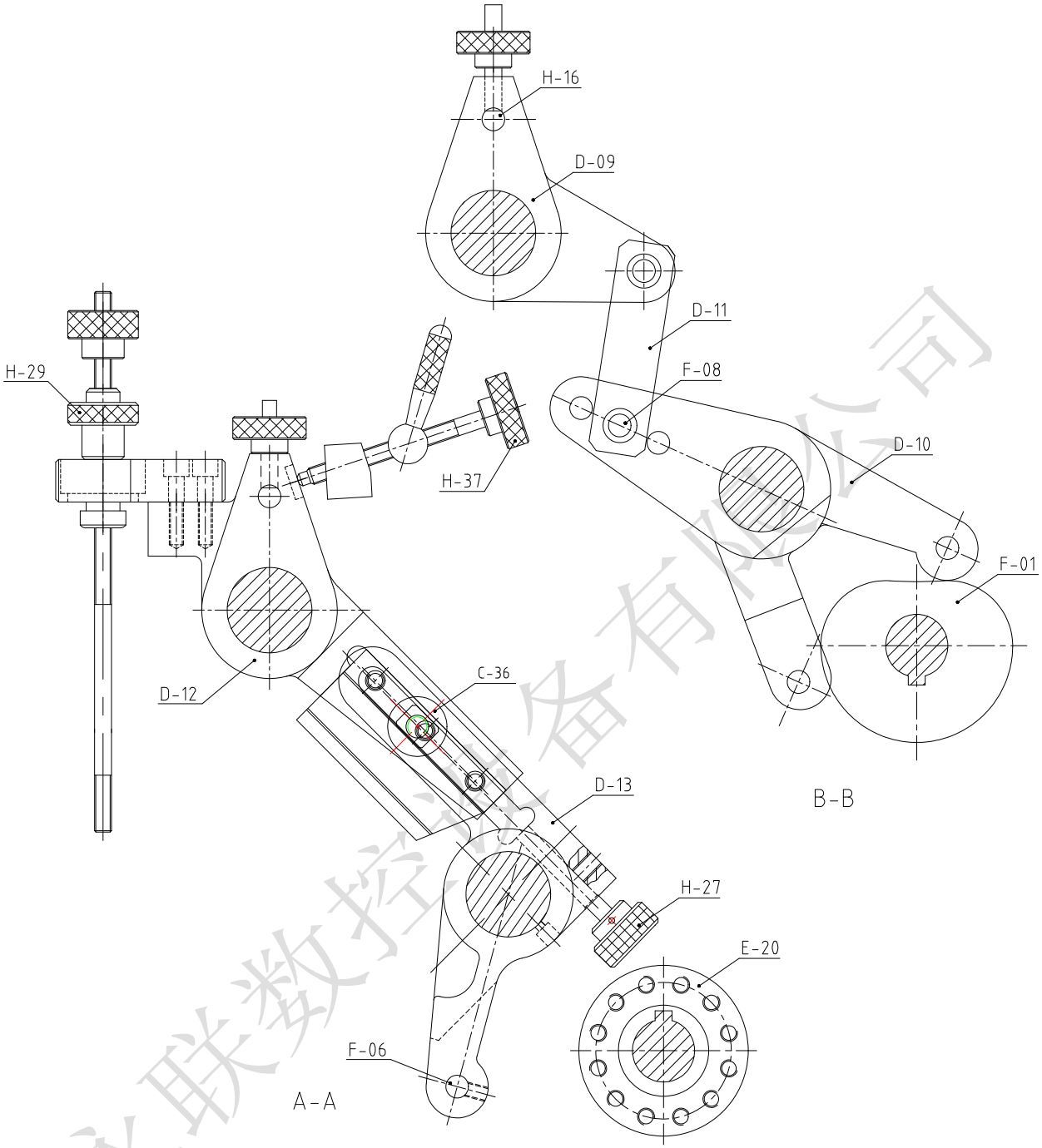
间距凸轮应依照所制弹簧规格选用。凸轮上之大幅形状改变系针对长

弹簧而用，而较缓之形状改变系用于制造短弹簧。

间距刀之行程可通过间距杠杆微调螺杆帽（H-27）图九来移动间距杠杆小滑块（C-36）改变杠杆比可以调整。间距刀之最前位置能以（H-27）予以改变，其后退位置可由摆杆调节螺杆（H-37）予以限制。



（图八）



（图九）

十二、依弹簧轴平行方向调整节距：

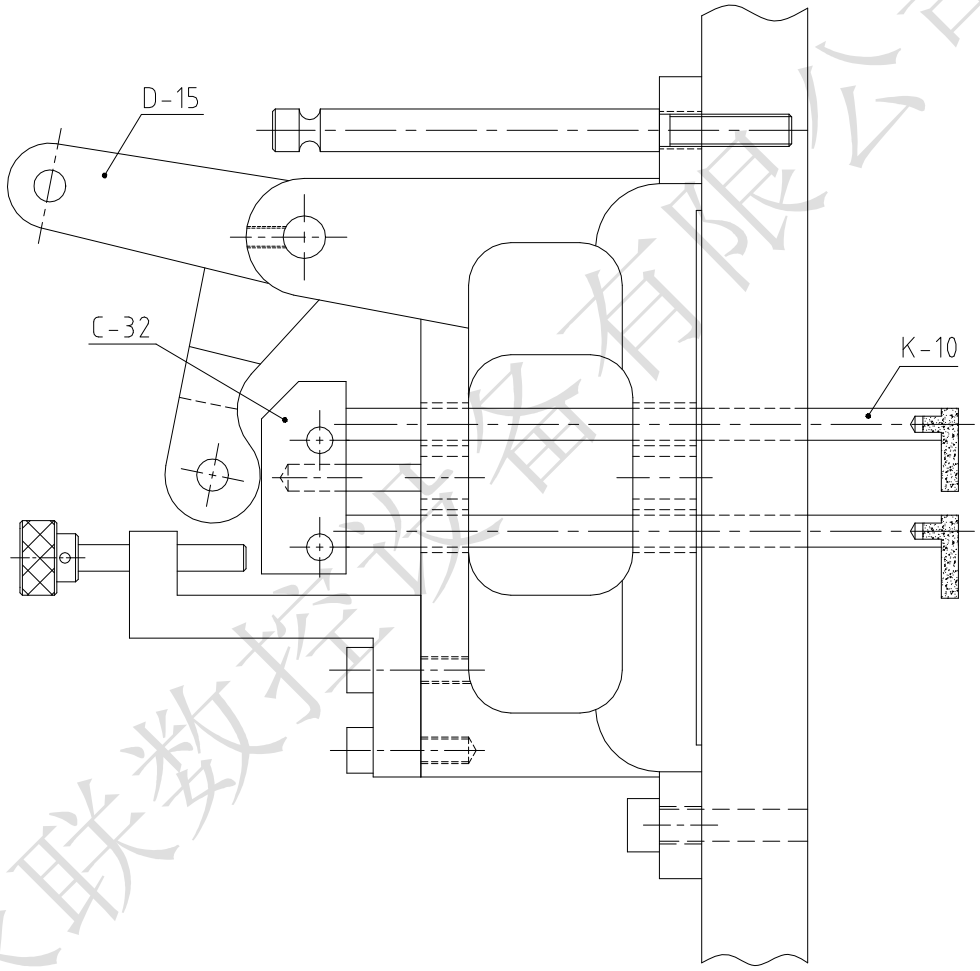
在绕制较大节距之弹簧时，宜配合与弹簧轴平行方向之节距调整操作。

二间距工具（K-10）图十固定于间距推轴推块（C-32）上，且通过间距凸轮带动上切料间距杠杆、摇臂轴间距微调杠杆（D-12,D-13）图九及间

距推轴杠杆(D-15)图十而予推动。杠杆拨销(H-16)必须确保固定于(D-12)中心以使弹簧轴垂直方向之节距调整脱离操作。

间距工具前方位置靠间距杠杆调节螺母（H-29）予以调整。

注意：必须切记此间距工具在进行切断时，应位于后方位置，以避免切刀撞及此工具。



（图十）

十三、切断：

盘绕的弹簧必须在每一操作循环之最后给予切断。切断操作由凸轮控制。切刀的回程靠凸轮而不是靠拉簧。因此，避免了切刀返回失败的可能。

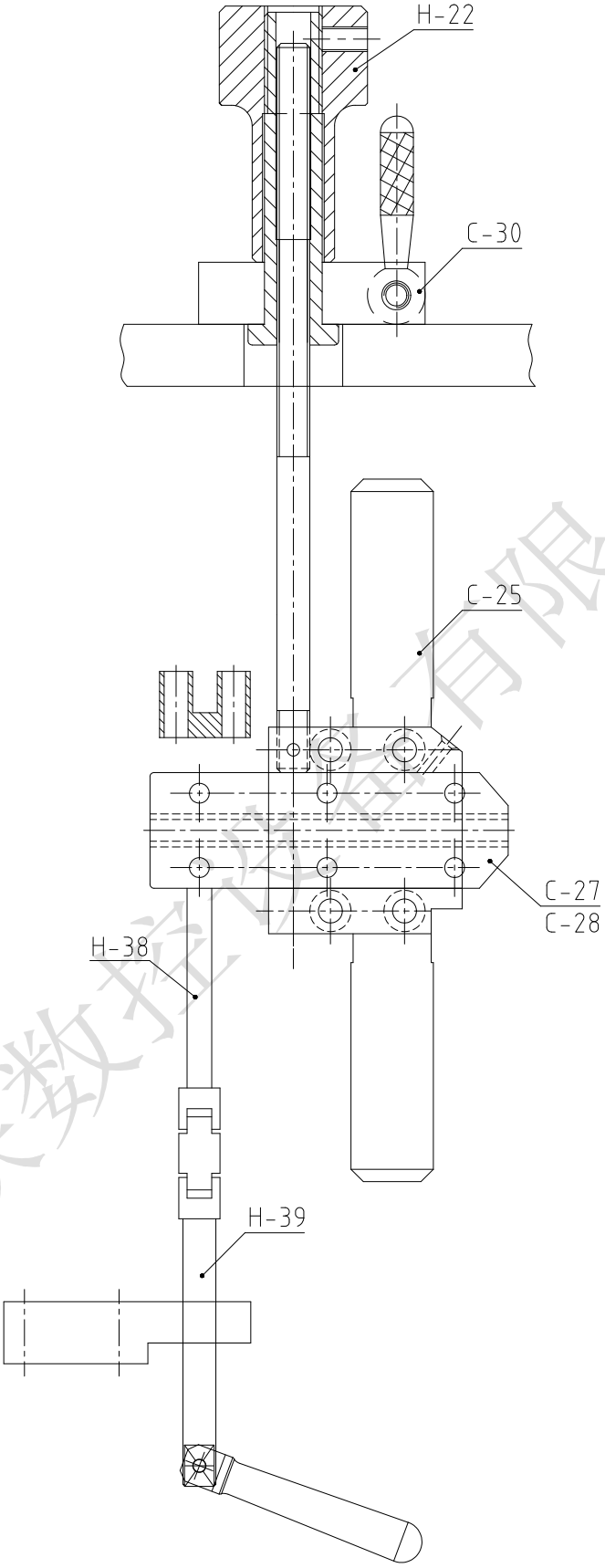
切断由芯轴（K-07，图三）及可动之切刀（K-08）图三相辅而成。因

顾及相当应力之产生，芯轴较弹簧之内径稍小，根据以往的经验，弹簧之外径较线径大五倍时仍可以切断，但此五倍为切断条件之限。

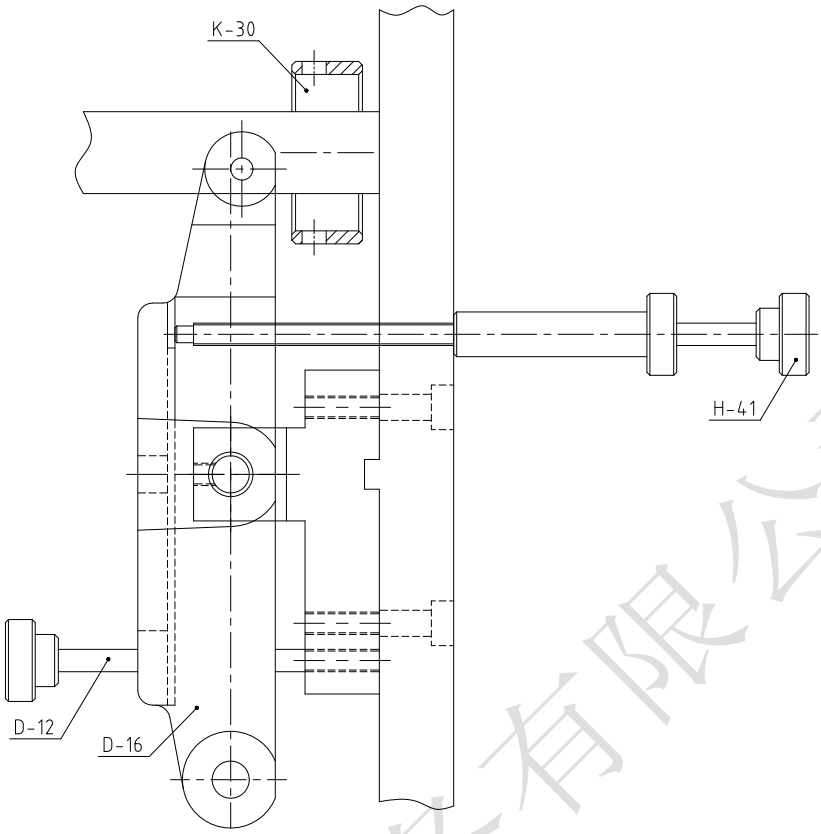
芯轴位于芯轴刀夹、芯轴刀夹压板（C-27，C-28）图十一中，并由万向螺杆（H-38）紧固。此芯轴刀夹可通过芯轴杠杆调节螺杆（H-41）图十二调整向前位置，其后退靠弹簧力。芯轴调节滑板（C-25）与芯轴刀夹及芯轴一起可通过转动芯轴上下调节螺母（H-22）在垂直方向调整。

切刀（K-08）图三位于切料滑块（C-03）图八中，可通过切刀调整垫（H-11）和两固定螺钉旋转调整调。在进线停止时，由切断凸轮（F-01）图九经上切料轴凸轮杠杆、摇臂轴凸轮杠杆（D-9，D-10）控制切断操作。切刀之行程越短越好，可通过改变凸轮杠杆连杆（D-11）和凸轮杠杆连杆销（F-08）之位置可以调整。切刀的前后位置由转动调整螺母（H-03）可以调整。切刀的最前位置以超过芯轴的切刀以小距离为宜。

通过移动上切料轴凸轮杠杆（D-09）上的杠杆拔销（H-16）可带动上滑块或下滑块。绕制右旋弹簧时，切断由上方进行，杠杆拔销向后插入图八中左边的结合杠杆拔销（H-16）中，而绕制左旋弹簧时，杠杆拔销则要向前插入上切料轴左右旋杠杆（D-07）中，切断由下方进行。



图（十一）



图（十二）

十四、芯轴移动装置：

在制造双锥，中央锥，腰形之弹簧时，必须使芯轴移位。

固定于芯轴刀夹、芯轴刀夹压板（C-27、C-28）图十一中的切断芯轴在进行弹簧绕圈时，由抽芯凸轮片（K-30）图十二操作芯轴调节杠杆（D-16）使其移出绕圈平面。在切断弹簧时，芯轴短暂被推向前。注意：当使用此芯轴装置时，芯轴杠杆调节螺杆（H-41）应当向后旋转不再与芯轴调节杠杆（D-16）下接触。

十五、左旋绕圈弹簧装置：

当绕制左旋弹簧时，绕圈向下展开，应将左旋曲线规座装上以替换右旋曲线规座，切刀装于下方滑块中而间距刀则装于上方滑块中。

双锥弹簧辅助装置选用于右向及左向绕圈弹簧。变径微调摇臂，变径

短摇臂（D-02）和（D-04）图七必须换至位于凸轮轴下方的变径微调摇臂小轴，万向节螺杆（H-12），（H-39）上。

十六、调整：

当送线滚轮，线板导板，绕圈顶杆及芯轴根据线径或弹簧外径要求装好后，即可开始，为了有效的进行第一圈绕制，绕圈顶杆尖端应调到较大的弹簧外径位置。待线材通过校直装置，送线滚轮及右向线材导板后，线端应以圆头板手予以成一环并将其置入绕圈尖之沟槽内，即可使用送线轮压紧装置将其压紧，但此压力足以将线材顺利引进本机即可。

转动手轮以引进线材，同时调整绕圈杆达到所需的弹簧外径。若需要时，同时转动绕圈杆变径刀夹座（C-24）图六变径短摇臂（D-04）以正确定位及调整绕圈尖的位置。

十七、压缩弹簧：

在制造具有紧密绕圈端之压缩弹簧时，绕圈尖应妥为调整使弹簧之绕圈相列而不产生拉力。弹簧的节距靠间距工具获得。

1、　圆柱形弹簧的调整：

a、安装需要的送线滚轮，调节这对送线滚轮使其能相互接触（不能插入钢丝）。

b、安装带盖板的线材导板并向送线滚轮方向移动，直到导板接触到送线滚轮为止。然后再将其退回约0.5～1mm(避免在操作期间接触送线滚轮)。

c、安装芯轴刀，应根据弹簧直径确定芯轴刀的尺寸，芯轴刀的凸出部位应比弹簧内径小0.5mm，其凸出部位的磨光长度约为相应的钢丝直径的约二倍。

d、调整送线滚轮与芯轴刀之间的右方线材导板。绕制细线材时，间隙不能超过 0.2～0.3mm。线材导板的另一端做成直边。如果加工小弹簧，靠近芯轴刀的线材导板的直角应削成约 45 度（绕制右旋弹簧时削上部；而绕制左旋弹簧时削下部）。

e、安装导板盖板，注意盖板不要碰到运动部件。

f、通过芯轴杠杆调节螺杆（H-41）图十二调整芯轴刀夹使的超出刀夹滑座约 1mm。将芯轴刀对准线材导板后锁紧卡紧块（C-30）图十一。

g、插入节距刀。一般情况下用 45 度刀（绕制细钢丝时用 30 度尖刀）。移动节距刀使其超出线材导板上边 5mm。调节压紧螺钉使节距刀接触线材导板，但应自由运动，安装切断刀时，须注意切刀的刀口应与芯轴的刀口一致。调整切刀行程，使其在芯轴刀的上方之行程量不超过线径的二倍。

h、安装绕圈顶杆之前应核对所要绕制弹簧的技术要求。如果要绕制的是细钢丝，绕圈顶杆前端的多余部分及靠进沟槽的多余均应磨去，沟槽两侧边缘应成弧状。如果弹簧外径小于 4mm，绕圈顶杆前端须做成尖状。

i、近似的调整进线长度，检查绕圈数。调整准确的进线长度。

j、安装间距凸轮并调整到获得理想的尾圈为止。

2、单元锥形弹簧的调整：

制造单元锥形弹簧时，应由弹簧的最小外径开始绕圈。位于变径短摇臂（D-04）图七上的滚子位于凸轮板的最高点。在弹簧盘绕时，滚子依凸轮板之间下弧度抽其最低点（大弹簧外径）进行。

两绕圈顶杆之半圈为下一弹簧之开始，因此凸轮板具有一大幅升起弧形，可使顶杆快速至最小的弹簧外径，同时停止进线。弹簧于此由完成大

外径至欲开始小外径的转折点处进行切断。

3、双锥弹簧

制造两端均成锥形之双锥弹簧时，变径短摇臂（D-04）图七上之滚子于绕圈过程中由变形凸轮的最高点进至最低再返回。若弹簧中央部分为柱状，则变形凸轮于弧度起落之间应有一段同心圆部分。

4、腰形弹簧

绕制向中央成双锥形之腰形弹簧时，芯轴必须在绕圈时移离绕圈平面，为此须连上芯轴移动装置。

十八、电气操作及维护：

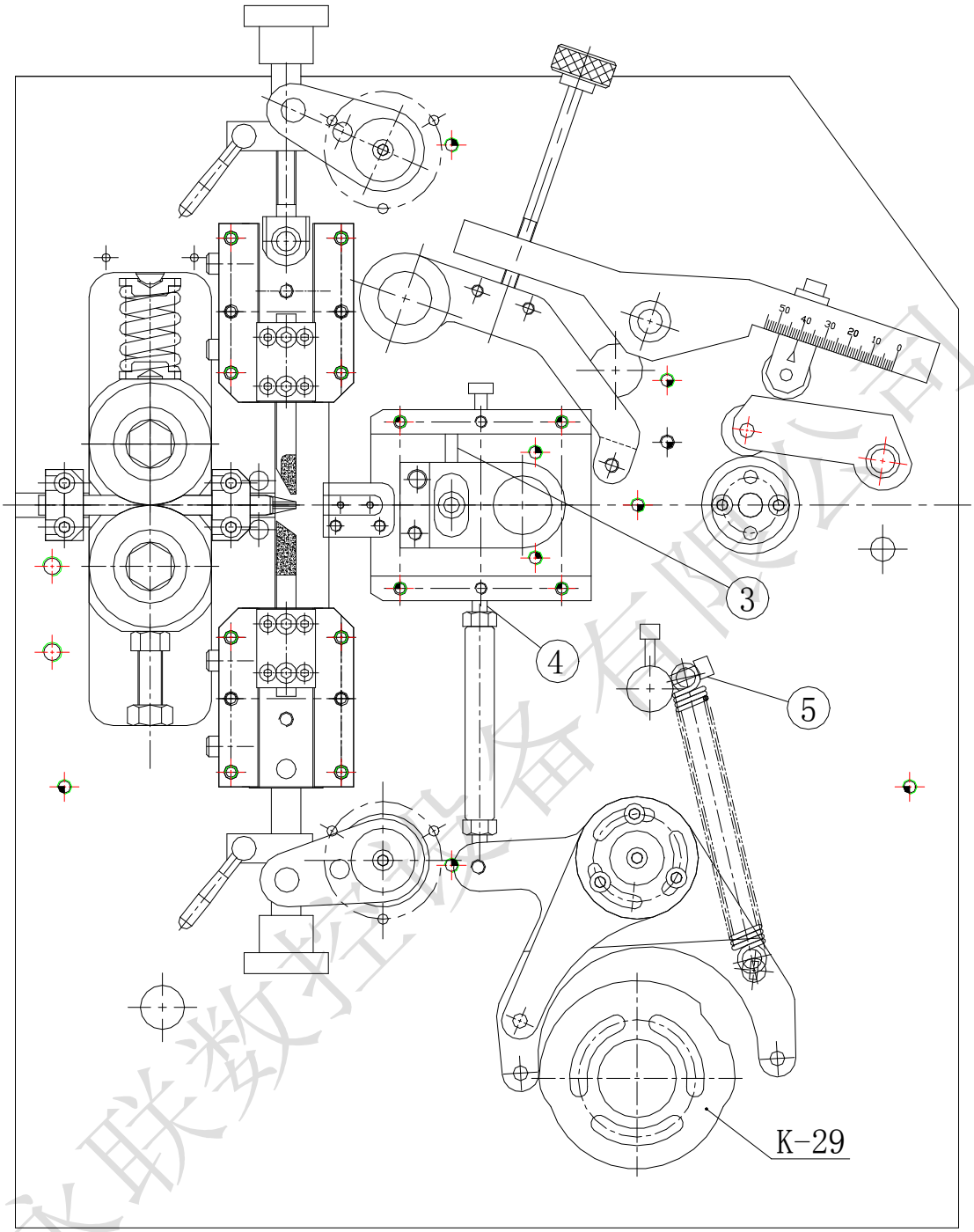
1、故障开关：当送线架出现故障时，电脑机自动停机。

2、继续送线和连续送线（快速补偿）。

在送线架的引线架上有一拨动开关用于控制送线架马达的连续或继续转动。当该开关拨至继续位置时，通过机器所在卷制的钢丝拉动微动开关，使送线马达继续转动，当开关拨至连续位置时，送线架将以调定的速度连续转动放线，并且可以在放线不及时时自动继续加速放线，放线速度由开关旁的调速旋钮控制。

十九、扭簧装置：用户选配

本机除了能做上述各类弹簧外,还特别为用户设计了一套扭簧装置。即带尾巴形弹簧。图十三是全部做扭簧机构的传动部件。在刀架滑块装一件刀夹，夹上装有切刀，右侧装有刀座，通过连杆上下移动可以做放尾巴单件，具体安装方法见图（十四）五条说明，在扭簧凸轮座（E-20）上应装上扭簧凸轮片（K-29）。



（图十三）

标准弹簧滑板装置替换右向扭簧滑板装置：

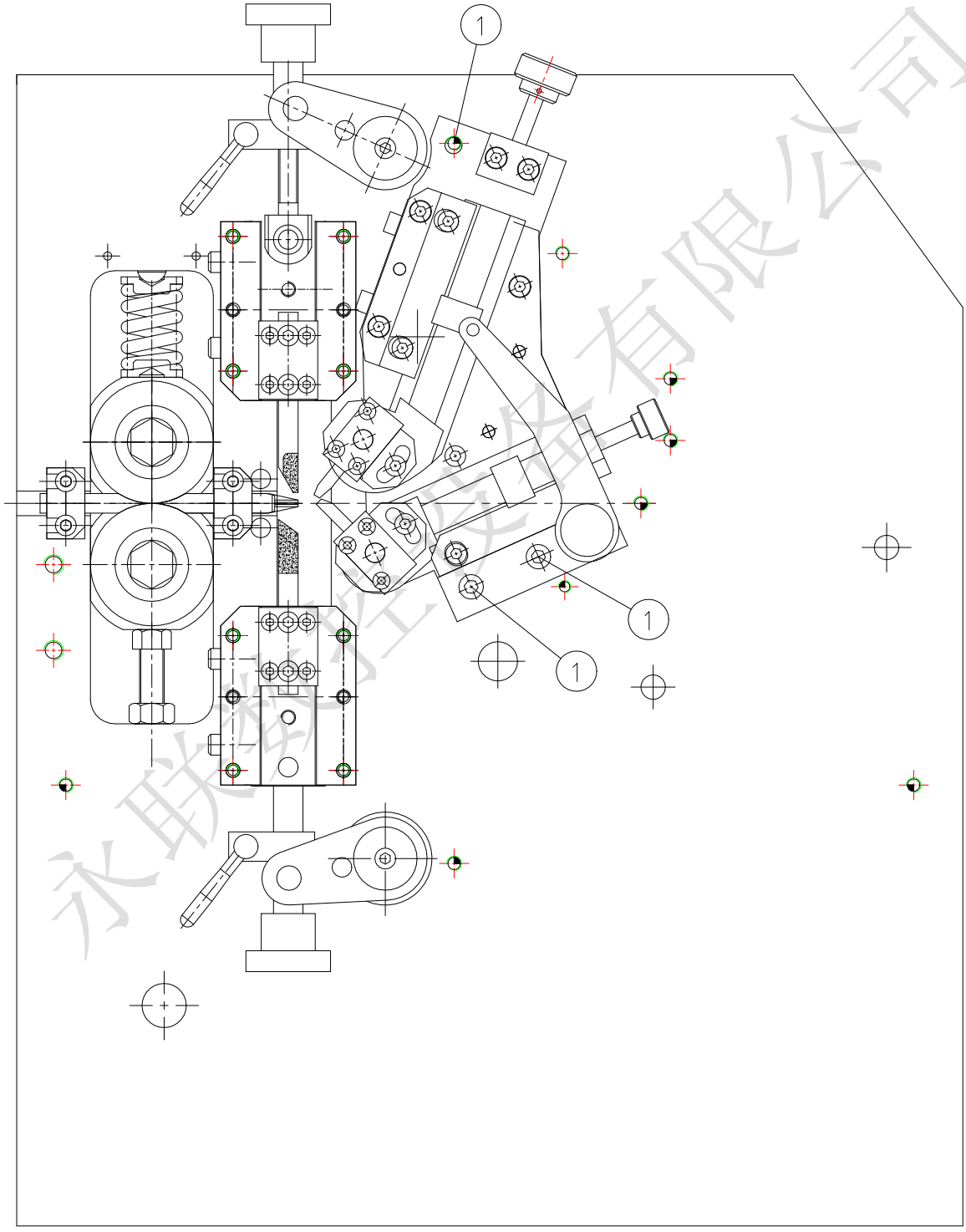
1、拆除标准弹簧滑板上三个固定螺丝（编号 1）

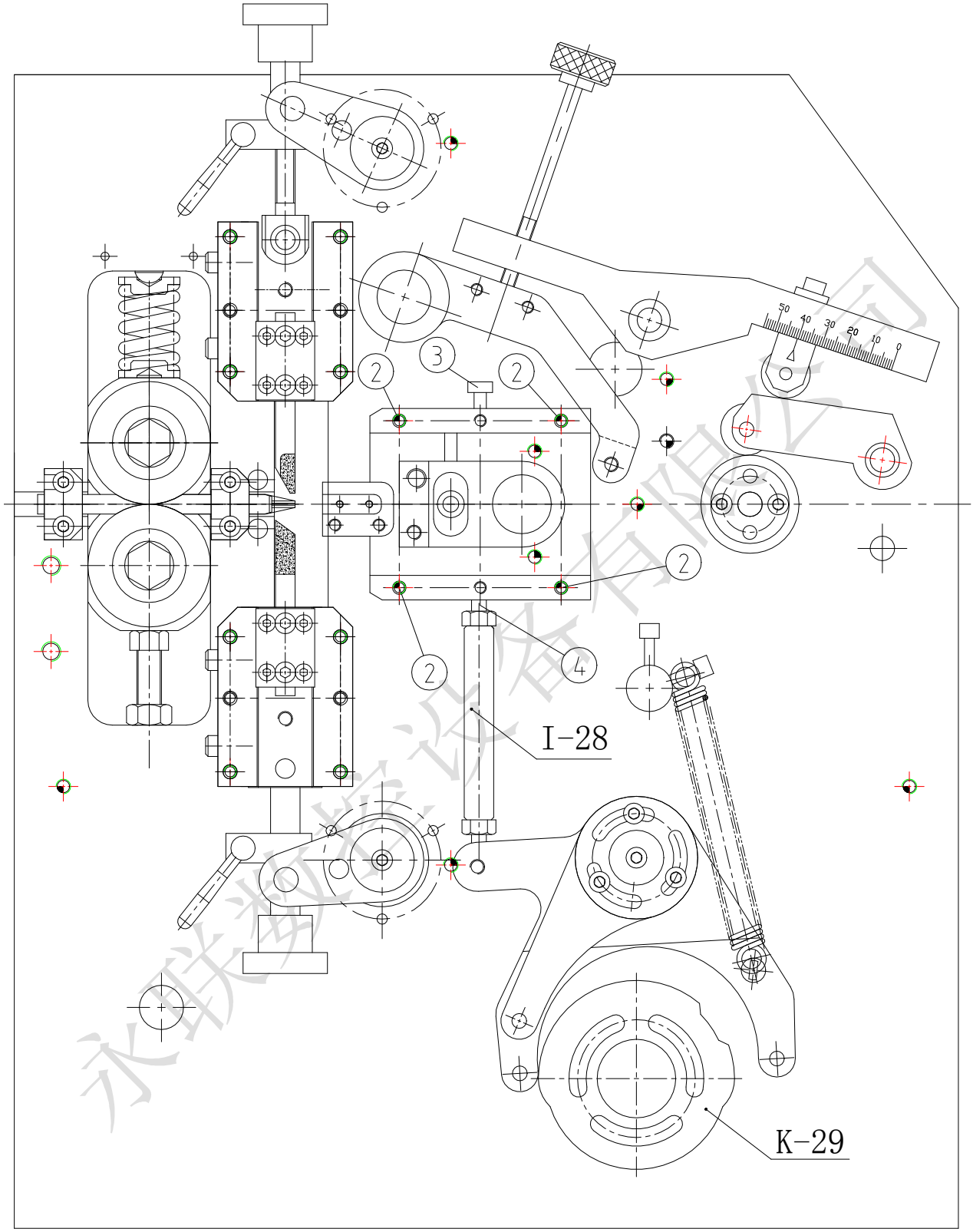
2、安装扭簧滑板紧固四个螺丝（编号 2）

3、安装扭簧用的倒顺六角接头（I-28）及主件扭簧凸轮片（K-29）

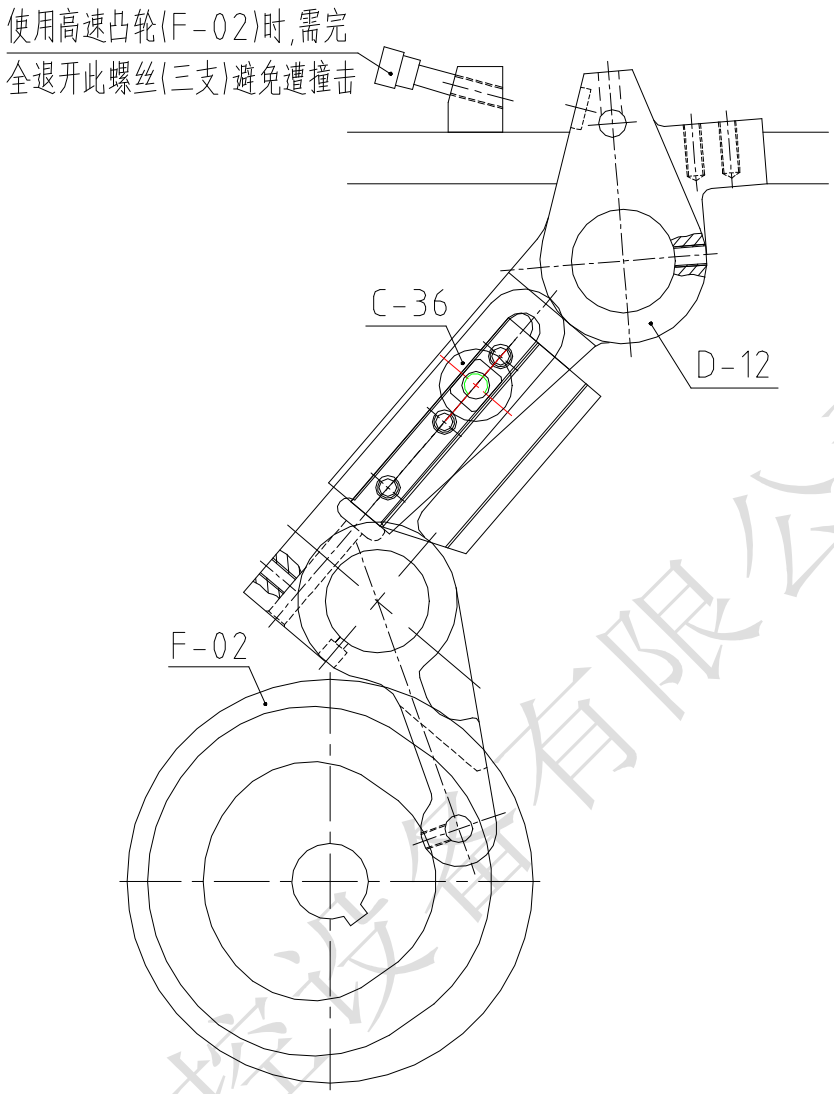
4、放松编号 3 之螺丝，以拆弯刀座上指明（凸轮最高点）不可碰撞此螺丝为原则。

5、放松编号 4 之螺丝，以拆弯刀座复归时（凸轮最低点）不可碰撞间隙刀为原则。





（图十四）



（图十八）

二十、高速凸轮使用方法：

此高速凸轮主要用于弹簧间距，当做各种压缩弹簧间距时应使用代圆轴间距刀，配合槽内凸轮（F-02）用（C-36）间距杠杆小滑块调整各式间距大小，在做间距弹簧时应注意使用左旋刀还是右旋刀，客户可根据具体情况稍加修改左右旋间距刀头就可以工作了。

二十一、安全，保养，维护

1、机器在使用中必须加以维护保养，才能长期保持稳定的精度，和使用寿命，操作者在开机时必须每隔 3 天在杠杆轴承注一次油，基面板上滑轨和滑槽用喷雾润滑油每天一、二次，工作完毕要清除表面和周围的污物。

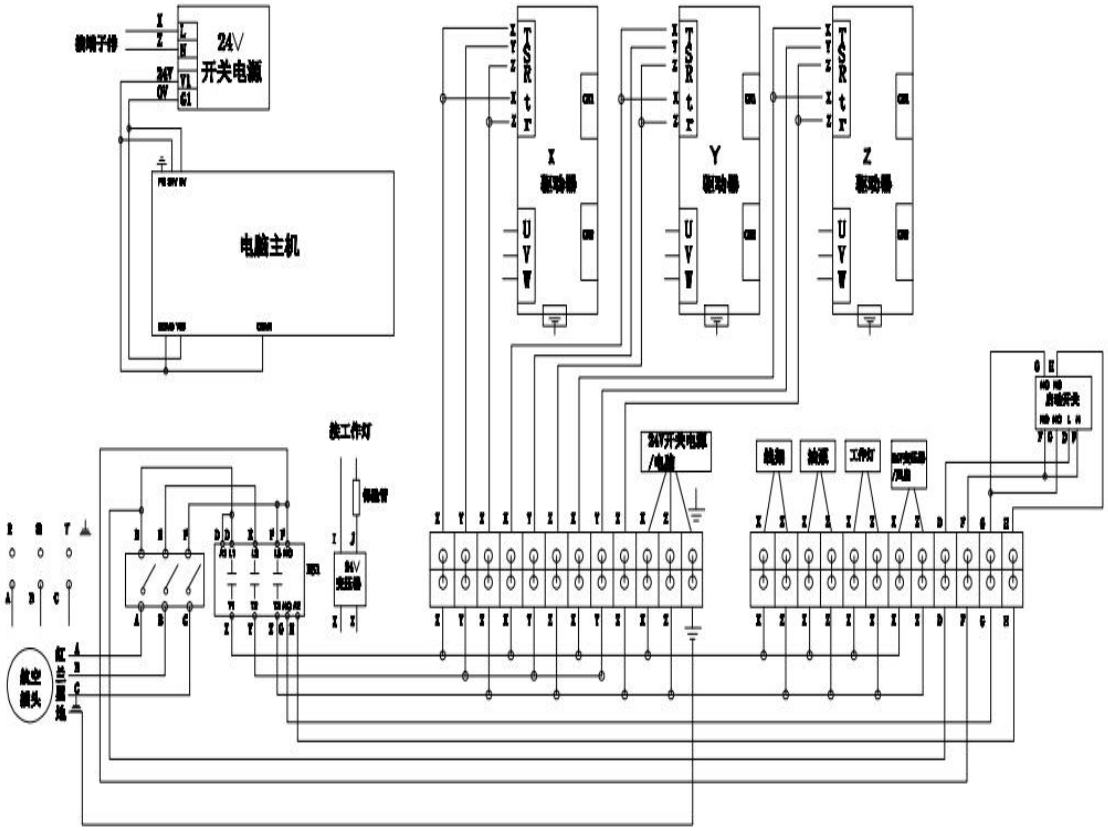
2、在卷制弹簧时一定要按规定的钢丝直径，不要随意加大直径，以勉损坏机器，作异型材时按照最大线径的同等面积计算即可。

3、在工作时操作者不准把手伸进机器内，更不准把铁器伸入机器内去清理弹簧等物件，因机器在运转时速度很快，特别注意不要出事故。如在工作中发现有问题可以立即停机然后再处理故障。

4、工作室（电脑机房）内除了保持清洁、卫生外，不要阳光直接照在机器上，不准在室内加热任何物品，要保持室内正常工作温度（16°—26°之间）最佳，不准有任何灰尘。

二十二. 电路接线图

永联数控弹簧机接线图



注意：1、此图为3相220V或2相220V通用接线图。
2、R、S、T、地线颜色对应使用红、蓝、黑、黄绿，接线要求美观大方。
3、380V电源输入必须外接变压器。

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YLSK-212 CNC Spring Coiling Machine

Operation Manual

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I. Purpose of this machine:

This CNC machine which consists of a controller and two servo systems is mainly used for manufacturing left-handed and right-handed cylindrical compression springs, deformed tension springs, and spring . In particular, the YLSK-212 CNC spring coiling machine is the most ideal equipment selected for manufacturing slender oil seal springs.

This machine is mainly provided with two coiling ejector pin systems. However, this machine may be provided with a single ejector pin system for machining springs, torsion springs and other kinds of springs if necessary.

The transmission system of this machine is CNC controlled and high in precision, with its main parts being elaborately formed by assembling

wear-resistant precision bearings made of high wear-resistant material, so that this machine has large production capacity, strong universality, fast and easy machine regulation, and is an ideal production tool in spring manufacturing industry.

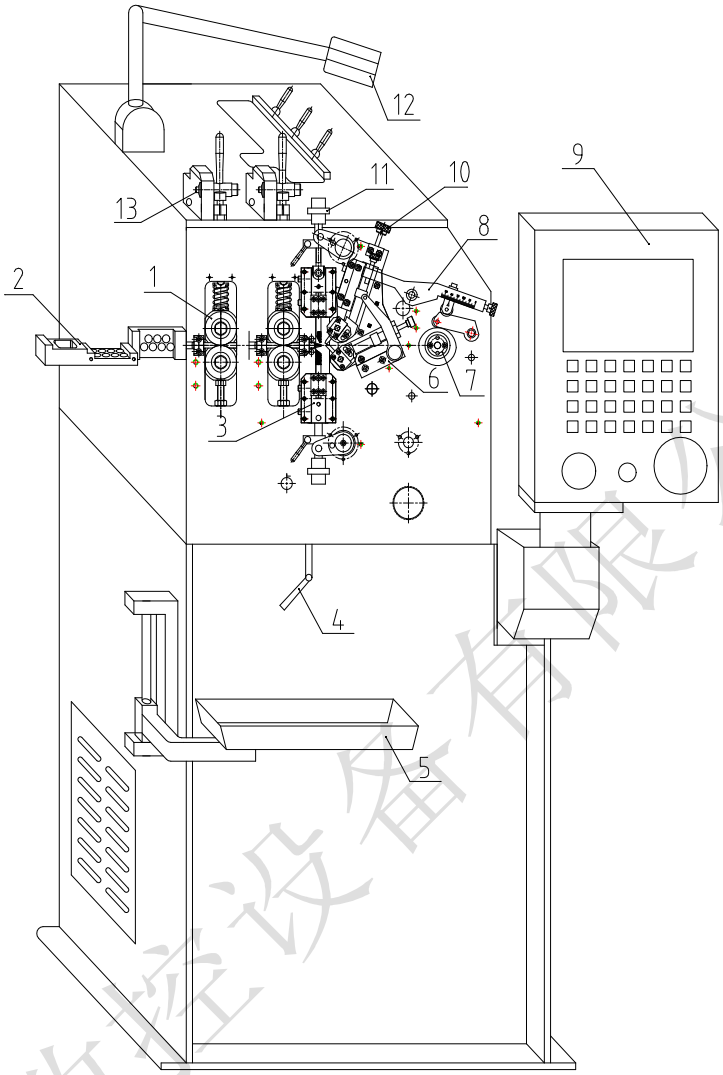
I. Technical parameters:

Description	Specification	Unit
Machining wire diameter	φ0.15~φ1.2	mm
Max. outer diameter of spring	φ18	mm
Max. wire feed length	10000	mm
Output/min	10~500	Pcs./min
Servo motor power	2×1	kw
Coiling direction	Left-handed/right-handed	
Machine weight	450	kg
Machine dimension	610×820×1580	mm

II. Components of machine

Fig. 1 is an outline drawing of the machine

Fig.2 is a schematic diagram of transmission principle

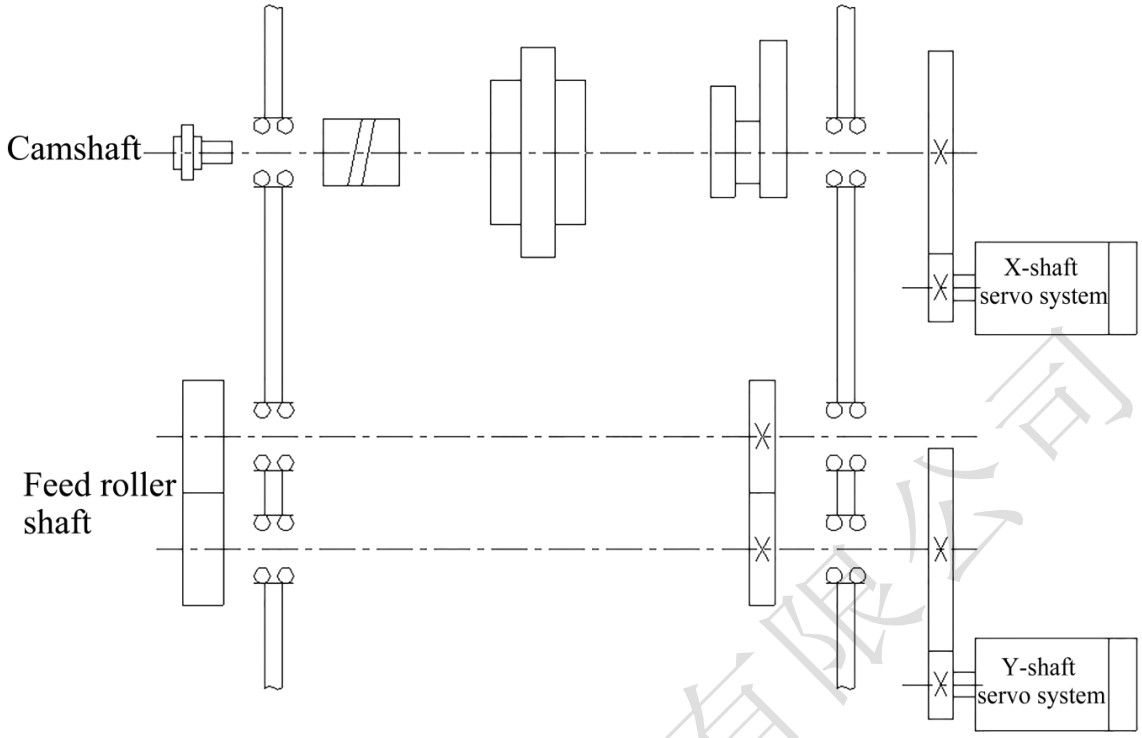


1. Feed roller 6. Reducing tool rest 11. Cutting slider adjusting nut
2. Straightening bracket 7. Reducing cam 12. Illuminating lamp
3. Cutting tool rest 8. Reducing fine adjustment rocker 13. Feed roller hold-down gear
4. Mandrel tool locking lever 9. Controller
5. Tray 10. Spring diameter adjusting screw

(Fig. 1) Outline drawing of the machine

This machine is controlled by two shafts: a wire feed Y shaft and a cam X shaft.

Please refer to the Operation Manual for detailed description.



(Fig. 2) Transmission principle

III. Installation of this machine:

This machine has already been completely assembled and subject to trial run and prototype machining before delivery, so it is required to be fixed on flat ground during installation to ensure normal operation.

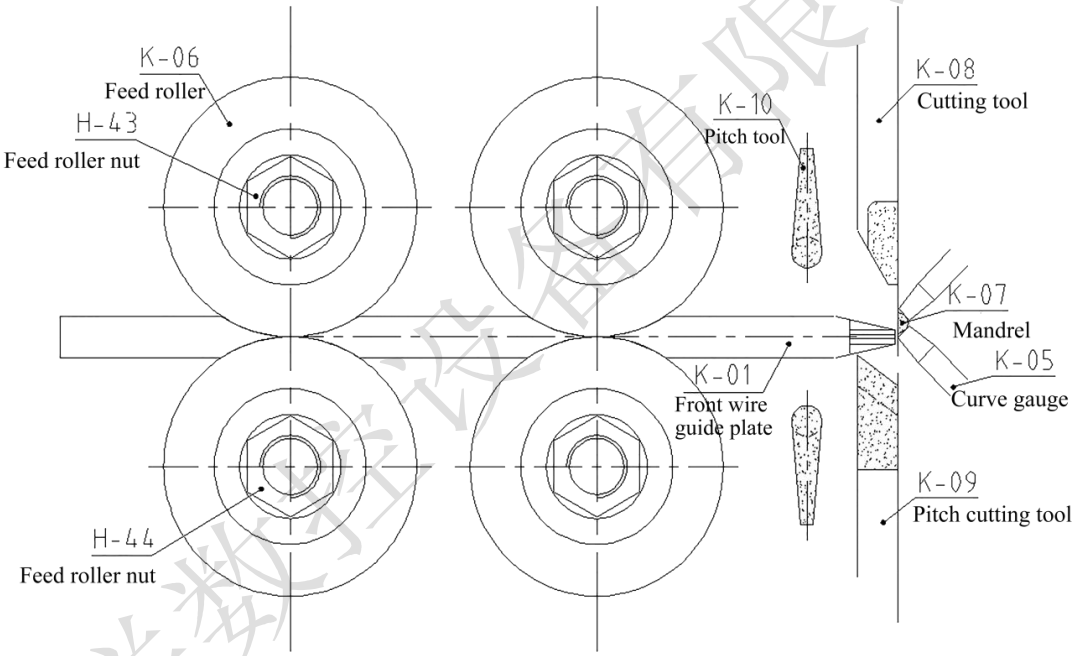
This machine shall be subject to proper ground protection in accordance with national standards, and ensures all in normal operation after power on by observing the controller signal, manually testing and adjusting to judge whether the rotation direction of the motor is correct, and starting the servo motor to test idle running.

IV. Straightening bracket:

In order to ensure the quality of spring products, it is required to adopt high-quality wire. The straightener for correcting smaller deviations consists of

two straightening units which are perpendicular to each other. After being straightened, the wire enters the feed roller to reach the mandrel and then is bent by two ejector pins (curve gauges) to form various springs desired. Of course, the formed springs depend on the knowledge and experience of the operator, especially the operator can operate the CNC machines only after being professionally trained.

V. Simple diagram of feed rollers and ejector pins (curve gauges):



(Fig. 3) Right-handed

VII. Wire feed component:

The feed roller (K-06) is provided with two grooves in which the rear groove is parallel and perpendicular to the wire guide plate when installing the feed roller on this machine. The feed roller hold-down gear 13 imposes a stress on the feed roller to ensure that the springs can be coiled.

The front wire guide plate (K-01) can prevent the wire from tangling between

the feed roller and the first coiling ejector pin. The front wire guide board is covered by a pitch cutting tool (K-09) rather than a cover plate, and the positioning of the pitch cutting tool is adjusted by the swing lever adjusting screw (H-37) as shown in Fig. 9. In the manufacture of the tension springs, the machine should not run in such a way that the spring resists against the pitch cutting tool.

In the manufacture of the left-handed springs, the mandrel, the pitch cutting tool and the cutting tool should be installed in the opposite direction to those in the machine for manufacturing the right-handed springs, and the curve gauge should be moved downward.

Note: When machining springs of different wire diameters, it is necessary to replace different feed rollers. Do pay attention to the assembly direction of the feed roller washer in the feed roller during replacement of the feed roller, where the small plane compresses the bearing therein, and the feed roller is in contact with the large plane and then locked by the feed roller locking nuts H-43 and H-44 (left-handed thread). Otherwise, the equipment will be damaged if the washer is installed in the opposite direction.

VIII. Coiling system:

The curve gauge (K-06) as shown in Fig. 3 installed on the reducing tool rest (C-23) (as shown in Fig. 6) can be rotated and aligned in any direction. The surface of the coiling pin tip should face forward, and two coiling pin tips of the curve gauge can move symmetrically or separately at the same time. The

correct relative positions of the two coiling pin tips are determined by the reducing slider driving lever (D-05).

IX. Reducing spring auxiliary device:

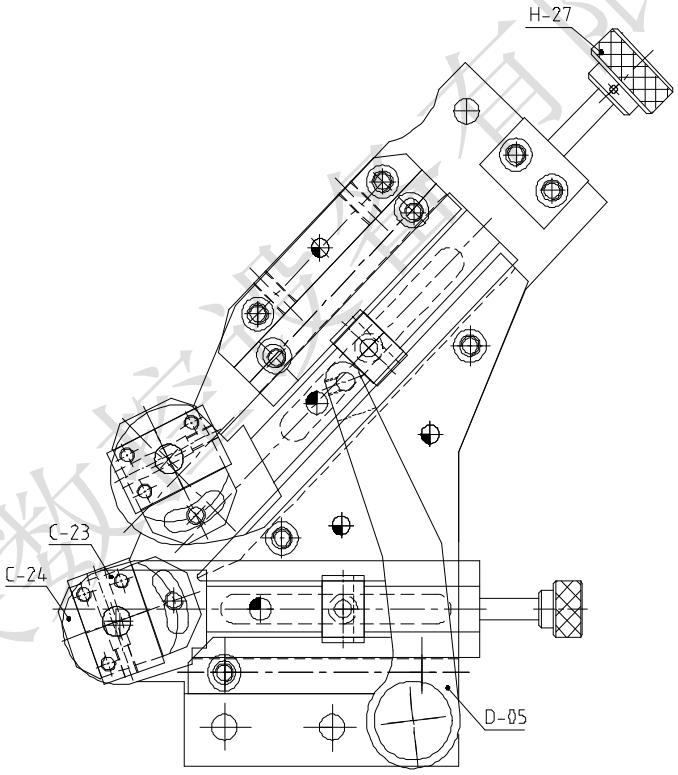
When using the reducing spring auxiliary device, the two curve gauges are driven by a reducing fine adjustment rocker (D-02) as shown in Fig. 7 to work in conjunction, and the movement of the reducing fine adjustment rocker is transmitted by the deformed cam (see Breakdown of Accessories) through the roller and a short reducing rocker (D-04). The stroke can be changed by moving the small cursor base through the reducing adjusting screw cap (H-17). As the curve gauge is reset under the control of a spring, the roller starts to be in contact with the cam plate, and the distance between the coiling tip and the extreme position (i.e., the maximum outside diameter of spring) should be limited by the spring diameter adjusting screw 10 as shown in Fig. 1 rather than by the cam plate.

X. Spring outside diameter correction device:

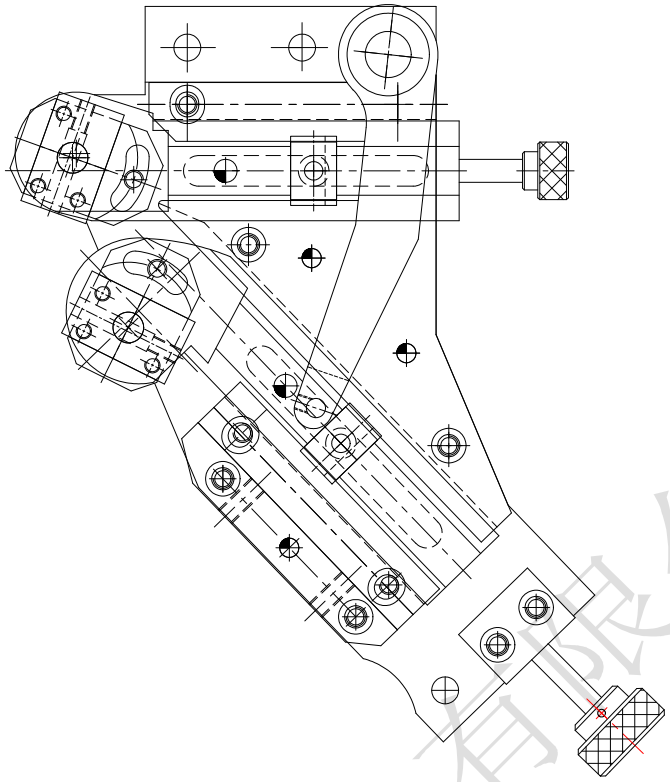
A spring outer diameter correction intermediate disc (E-22) as shown in Fig. 7 includes a deformed cam, so that it can be used in conjunction with a reducing spring device. This intermediate disc device can be fitted with the deformed cam, and can be adopted when coiling springs of coarse pitch with a pitch tool of parallel shaft. In the manufacture of compression springs with tightly coiled ends, the outside diameter of the spring is reduced due to the compression force imposed on the spring by the pitch tool, thus forming spring

of different outside diameters. The coiling ejector pin can be controlled by means of the deformed cam, allowing the coiling outside diameter of the spring end to be reduced and such reduction is offset by the value caused by the pitch tool, so that the outside diameter of the whole spring conforms to the value desired (i.e., the correct cylindrical spring).

A pitch cutting tool of the vertical spring shafts, which is not used generally, is adopted to manufacture compression springs with fine or medium pitch.

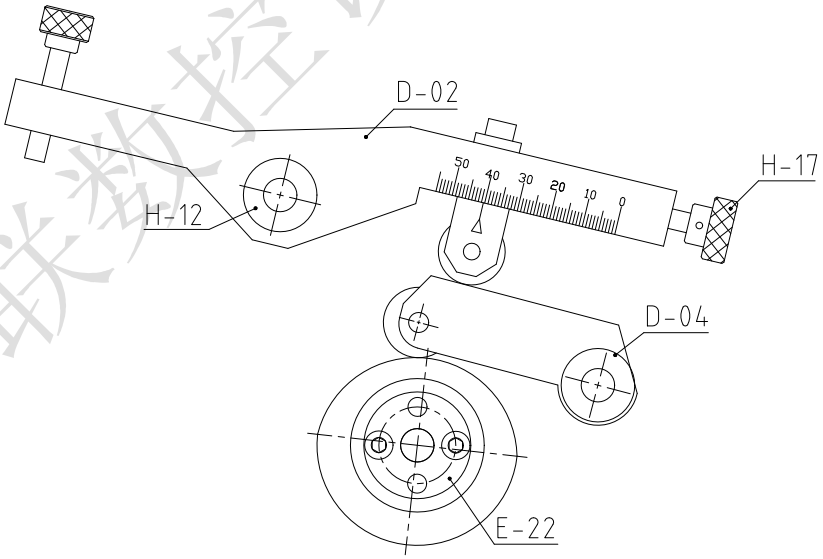


（a）



(b)

(Fig. 6) Curve gauge holder (a) Right-handed (b) Left-handed



(Fig. 7) Reducing spring auxiliary device

XI. Device for adjusting the pitch along the vertical direction of spring:

This pitch adjustment device is configured to manufacture compression

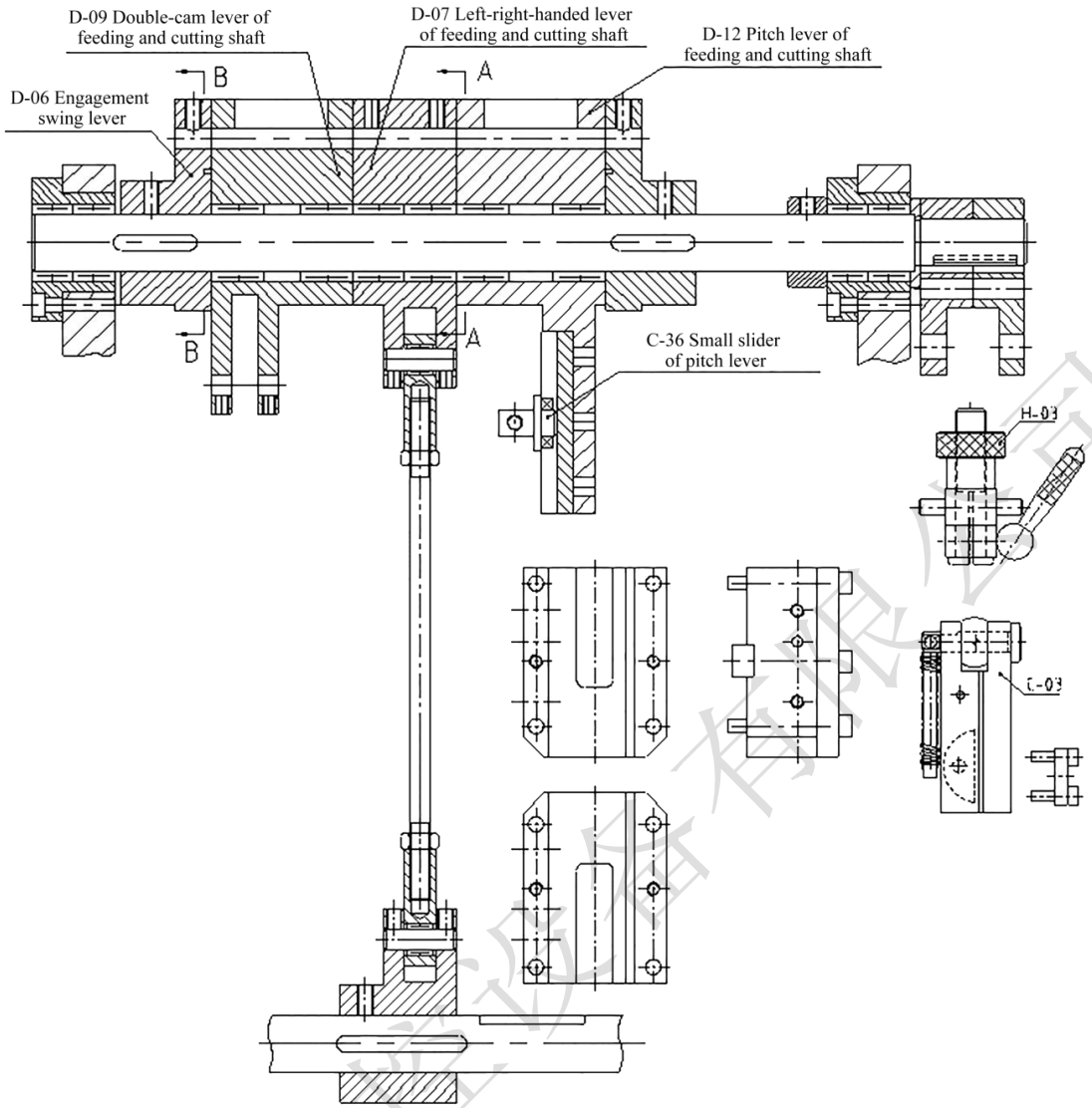
springs, and is forced to unfold by inserting the pitch cutting tool therein when coiling a tightly coiled spring. The pitch cutting tool (K-09 see Breakdown of Accessories) is divided into two types: pitch cutting tool with small cone and pitch cutting tool with large cone, in which the pitch tool with small cone is used in the manufacture of springs with fine pitch, while the pitch cutting tool with large cone is used in the manufacture of springs with coarse pitch. The pitch cutting tool is installed in a cutting slider (C-03) as shown in Fig. 8 in such a way that it can just pass through the wire guide plate from below the right-handed coil spring or above the left-handed coil spring.

The cutting slider (C-03) is operated by a pitch cam through the feeding and cutting pitch lever (D-12) and the rocker shaft pitch fine adjustment lever (D-13) as shown in Fig. 9. In the manufacture of the right-handed springs, the lever driving pin (H-16) located at the feeding and cutting pitch lever (D-12) must go back to the left-right-handed lever (D-07) of the feeding and cutting shaft as shown in Fig. 8. However, when manufacturing the left-handed springs, it must go forward into a left clutch swing lever (D-06) which drives the feeding and cutting shaft as shown in Fig. 8. The pitch cutting tool does not work when the lever driving pin is in the middle.

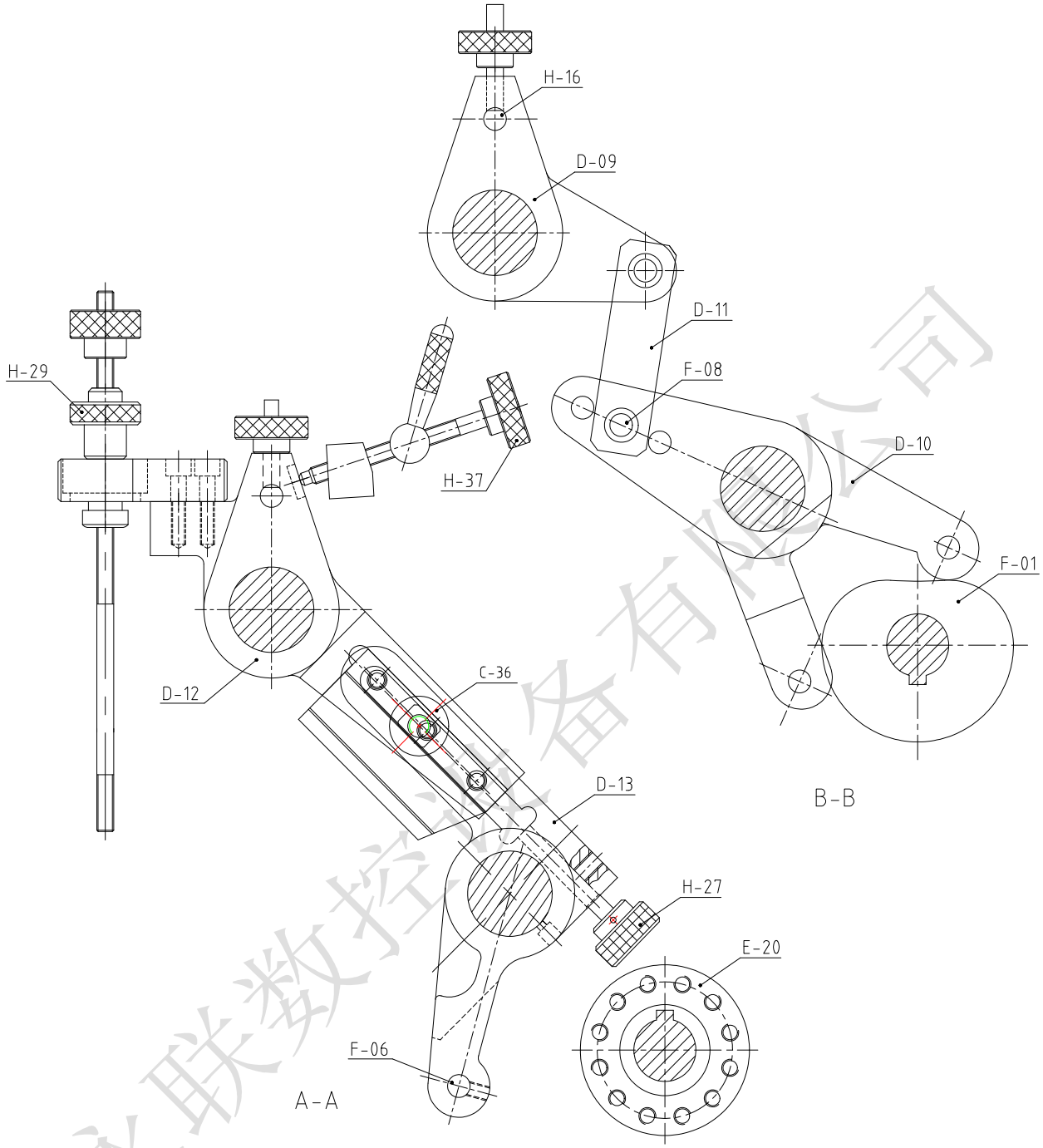
Suggestion: Be sure that the two lever driving pins H-16 (A-A and B-B as shown in Fig. 9) of the pitch link and the cutting link will not be inserted into the left-right-handed lever (D-07) of the feeding and cutting shaft at the same time. Otherwise, damage might be caused to the machine.

The pitch cam shall be selected according to the specifications of the spring to be manufactured. The large change in shape of the cam is made for long springs, while the smaller change in shape of the cam is made for short springs.

The stroke of the pitch cutting tool can be adjusted by moving the small slider (C-36) of the pitch lever through the pitch lever fine adjustment screw cap (H-27) as shown in Fig. 9 to change the lever ratio. The extreme position for the pitch cutting tool to go forward can be changed by (H-27), and the position for it to go back can be limited by the swing lever adjusting screw (H-37).



(Fig. 8)



(Fig. 9)

XII. Adjustment of the pitch along the parallel direction of spring shaft:

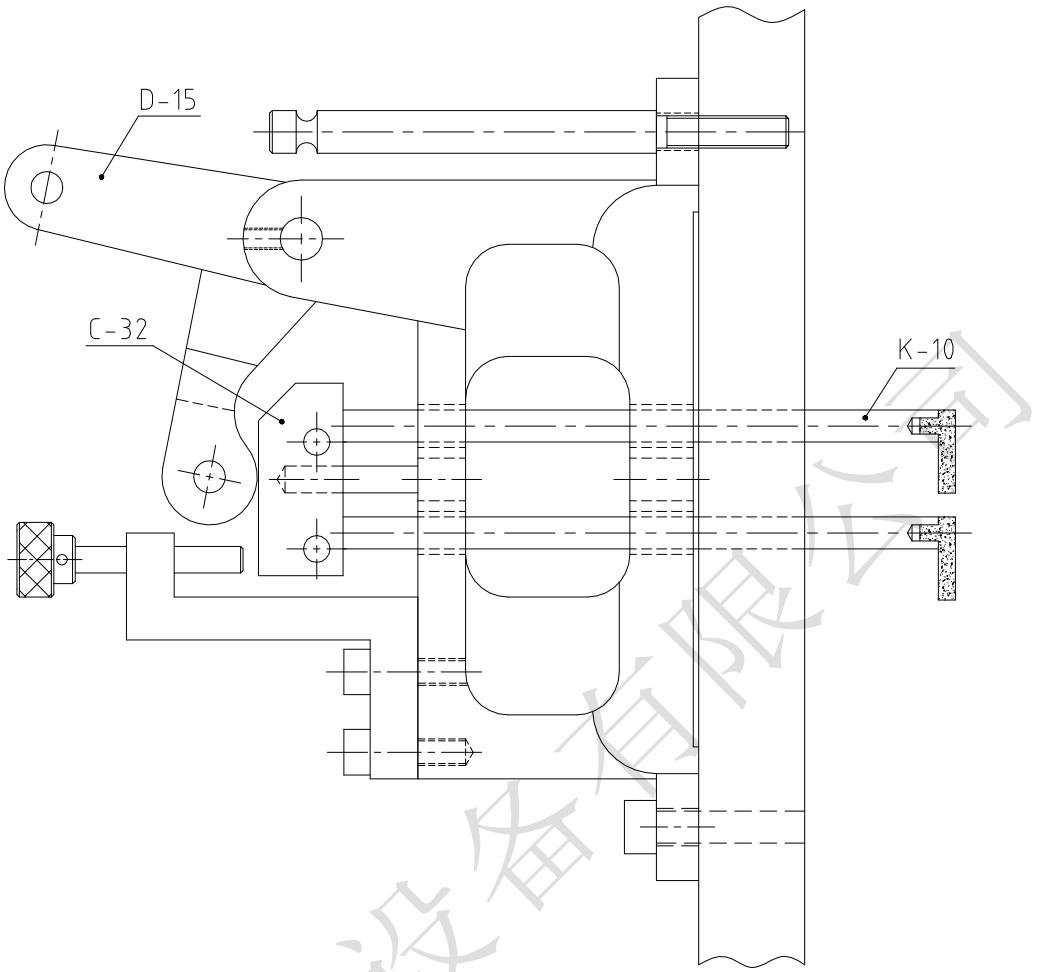
When coiling springs with coarse pitch, it is advisable to be in conjunction with the adjustment of the pitch along the parallel direction of spring shaft.

The two pitch tools (K-10) as shown in Fig. 10 are fixed on the pitch

driving shaft ejector (C-32), and driven by driving the feeding and cutting pitch lever (D-12), the rocker shaft pitch fine adjustment lever (D-13) as shown in Fig. 9 and the pitch driving shaft lever (D-15) as shown in Fig. 10 through the pitch cam. Be sure that the lever driving pin (H-16) is fixed at the center of (D-12)) to disengage from the adjustment of the pitch along the vertical direction of spring shaft.

The position for the pitch tool to go forward is adjusted by the pitch lever adjusting nut (H-29).

Note: It must be remembered that this pitch tool should be located at the rear position during cutting off to prevent the cutting tool from bumping against this tool.



(Fig. 10)

XIII. Cut-off:

The springs coiled must be cut off at the end of each operation cycle. The cutting-off operation is controlled by the cam. The return stroke of the cutting tool depends on the cam instead of the tension spring. Therefore, the possibility of cutting tool return failure is avoided.

The cut-off operation is jointly completed by the mandrel (K-07) as shown in Fig. 3 and the movable cutting tool (K-08) as shown in Fig. 3. The mandrel is slightly smaller than the inside diameter of the spring, in order to generate equivalent stress. Based on previous experience, the spring can be cut off when

its outside diameter is five times larger than the wire diameter, but such five times is the limit for cutting off the spring.

The mandrel is located in a mandrel tool holder (C-27) and a mandrel tool holder pressure plate (C-28) as shown in Fig. 11 and is fastened by universal screws (H-38). The position for the mandrel tool holder to go forward can be adjusted by the mandrel lever adjusting screw (H-41) as shown in Fig. 12, and it goes back under the action of the spring force. The mandrel adjusting slider (C-25) together with the mandrel tool holder and the mandrel can be adjusted in the vertical direction by turning the upper and lower adjusting nuts (H-22) of the mandrel.

The cutting tool (K-08) as shown in Fig. 3 is located in the cutting slider (C-03) as shown in Fig. 8 and can be adjusted by turning the cutting tool adjusting pad (H-11) and the two fastening screws. When stopping feeding, the cutting-off operation is controlled by the cutting cam (F-01) as shown in figure 9 through the cam lever (D-9) of the feeding and cutting shaft and the rocker shaft cam lever (D-10). The shorter the stroke of the cutting tool, the better. And the stroke can be adjusted by changing the positions of the cam lever link (D-11) and the cam lever link pin (F-08). The front and rear positions of the cutting tool can be adjusted by turning the adjusting nut (H-03). The extreme position for the cutting tool to go forward is preferably a small distance for the cutting tool that goes beyond the mandrel.

The upper slider or the lower slider can be driven by moving the lever

driving pin (H-16) on the cam lever (D-9) of the feeding and cutting shaft. When coiling a right-handed spring, the spring is cut off from above, and the lever driving pin is inserted backward into the combined lever driving pin (H-16) on the left of Fig. 8. When coiling a left-handed spring, the lever driving pin is inserted forward into the left-and-right-handed lever (D-07) of the feeding and cutting shaft, and the spring is cut off from below.

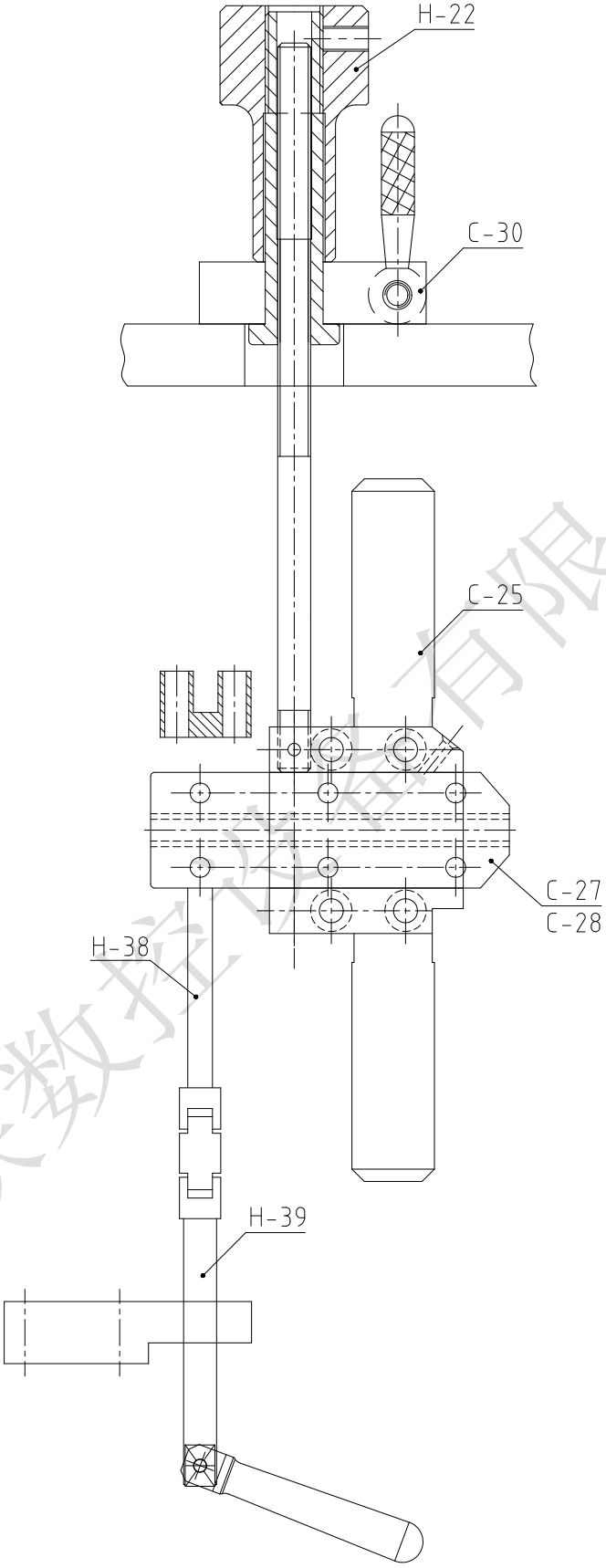


Fig. 11

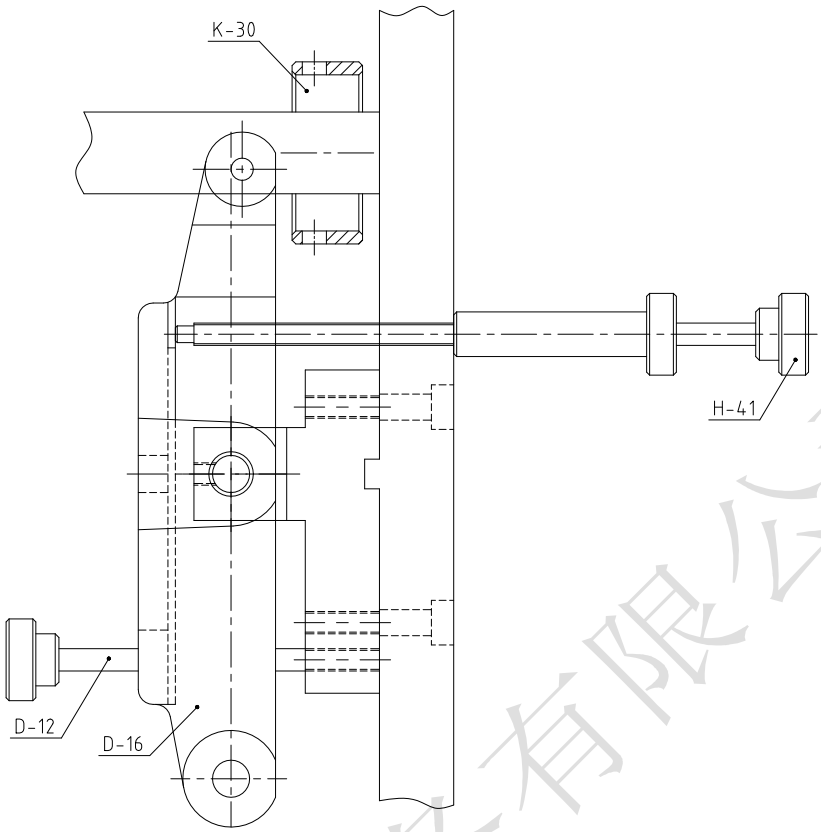


Fig. 12

XIV. Mandrel shifter:

In the manufacture of double-cone springs, central-cone springs and barrel-shaped springs, the mandrel must be shifted.

When coiling the springs, the cutting-off mandrel fixed to the mandrel tool holder (C-27) and the mandrel tool holder pressure plate (C-28) as shown in Fig. 11 is shifted out of the coiling plane by operating the mandrel adjusting lever (D-16) through the mandrel cam piece (K-30) as shown in Fig. 12. When cutting off the springs, the mandrel is transitorily pushed forward. Note: When this mandrel shifter is adopted, the mandrel lever adjusting screw (H-41) should rotate backward and be no longer in contact with the lower portion of the mandrel adjusting lever (D-16).

XV. Left-handed spring coiling device:

A left-handed spring is coiled downward during coiling; the left-handed curve gauge holder should be installed to replace the right-handed curve gauge holder, the cutting tool is installed in the lower slider and the pitch cutting tool is installed in the upper slider.

The double-cone spring auxiliary device is selected for right-left-handed coil springs. The reducing fine adjustment rocker (D-02) and the short reducing rocker (D-04) as shown in Fig. 7 must be shifted on the small shaft (H-12) and the universal joint screw (H-39) of the reducing fine adjustment rocker located below the camshaft.

XVI. Adjustment:

When the feed roller, the wire board guide plate, the coiling ejector pin and the mandrel are installed in place according to the requirements of the wire diameter or spring outside diameter, the machine can start to coil the springs. In order to coil the first ring of spring effectively, the coiling ejector pin tip should be adjusted to a position where the spring outside diameter is larger. After passing through the straightening device, the feed roller and the right-handed wire guide plate, the wire should be formed into a ring from its end with a ring wrench and put in the groove at the coiling ejector pin tip, and then compressed tightly by the feed roller hold-down gear, but the stress imposed is sufficient to smoothly introduce the wire into the machine.

The hand wheel is rotated to introduce the wire and adjust the coiling

ejector pin to the outside diameter of spring desired at the same time. If necessary, the reducing tool seat (C-24) as shown in Fig. 6 and the short reducing rocker (D-04) of the coiling ejector pin should be rotated at the same time to properly position and adjust the position of the coiling ejector pin tip.

XVII. Compression spring:

In the manufacture of compression springs with tightly coiled ends, the coiling ejector pin tip should be properly adjusted so that the rings of the spring are aligned without tension. The pitch of the spring is obtained by using the pitch tool.

1. Adjustment of cylindrical spring:

a. Install the feed rollers as required, and adjust the pair of feed rollers for mutual contact (the wire cannot be inserted into the feed rollers).

b. Install the wire guide plate with a cover plate and make it move towards the direction of the feed rollers until the wire guide plate is in contact with the feed rollers; then make it go back about 0.5-1 mm (to avoid contact with the feed rollers during operation).

c. Install a mandrel tool of which the size should be determined according to the spring diameter, and the projection, with the polished length being about twice that of the corresponding wire diameter, should be 0.5 mm smaller than the inside diameter of spring.

d. Adjust the right-handed wire guide plate between the feed roller and the mandrel tool. The clearance cannot exceed 0.2 mm to 0.3 mm during coiling the

thin wires. The other end of the wire guide plate is made into a straight edge. In case of machining small springs, the right angle of the wire guide plate near to the mandrel tool should be cut into an angle of about 45 degrees (cut the upper portion during coiling the right-handed springs, and cut the lower portion during coiling the left-handed springs).

e. Install the cover plate of the wire guide plate, and be careful not to make the cover plate in contact with the moving components.

f. Adjust the mandrel tool holder by the mandrel lever adjusting screw (H-41) as shown in Fig. 12, allowing it to go about 1 mm beyond the tool holder slide rest; lock the fixture block (C-30) as shown in Fig. 11 after aligning the mandrel tool with the wire guide plate.

g. Insert the pitch tool. A tool with a chamfer of 45 degrees is usually adopted (A pointed tool with a chamfer of 30 degrees is adopted during coiling the thin wires). Move the pitch cutting tool to allow it to go 5 mm beyond the upper edge of the wire guide plate. Adjust the compression screws to allow the pitch cutting tool to be in contact with the wire guide plate, but it should move freely. During installation of the cut-off tool, it should be noted that the tool edge of the cut-off tool should be consistent with that of the mandrel. Adjust the stroke of the cutting tool so that its stroke above the mandrel tool will not exceed twice the wire diameter.

h. Check the technical requirements of the spring to be coiled before installing the coiling ejector pin. In case of coiling the thin wire, the surplus part

at the front end of the coiling ejector pin and that near to the groove shall be ground off, and the edges on both sides of the groove shall be arc-shaped. If the outside diameter of the spring is less than 4 mm, the front end of the coiling ejector pin is required to be pointed.

i. Approximately adjust the feed length and check the number of turns. Adjust the exact feed length.

j. Install the pitch cam and adjust it until an ideal tail ring is obtained.

2. Adjustment of single-cone spring:

In the manufacture of a single-cone spring, the spring should be coiled from its minimum outside diameter. The roller located on the short reducing rocker (D-04) as shown on Fig. 7 is located at the highest point of the cam plate. The roller coils the spring according to the lowest point (outside diameter of large spring) of the lower arc between the cam plates.

The next spring is coiled from a half-turn of the two coiling ejector pins, so the cam plate has a sharp change arc, which enables the ejector pin to quickly reach the minimum outside diameter of the spring and stops feeding the wire at the same time. The spring is cut off at the turning point from the completion of the large outside diameter to the beginning of the small outside diameter.

3. Double-cone spring

In the manufacture of a double-cone spring with both conical ends, the roller located on the short reducing rocker (D-04) as shown in Fig. 7 goes to the lowest point from the highest point of the deformed cam and then goes back

during the coiling process. If the midsection of the spring is cylindrical, the deformed cam should be provided with a concentric circle between the changes in arc.

4. Barrel-shaped spring

In the manufacture of a barrel-shaped spring with double cones toward the midsection, the mandrel is required to shift away from the coiling plane during coiling. Therefore, the mandrel shifter is required to be connected to the machine.

XVII. Electrical operation and maintenance:

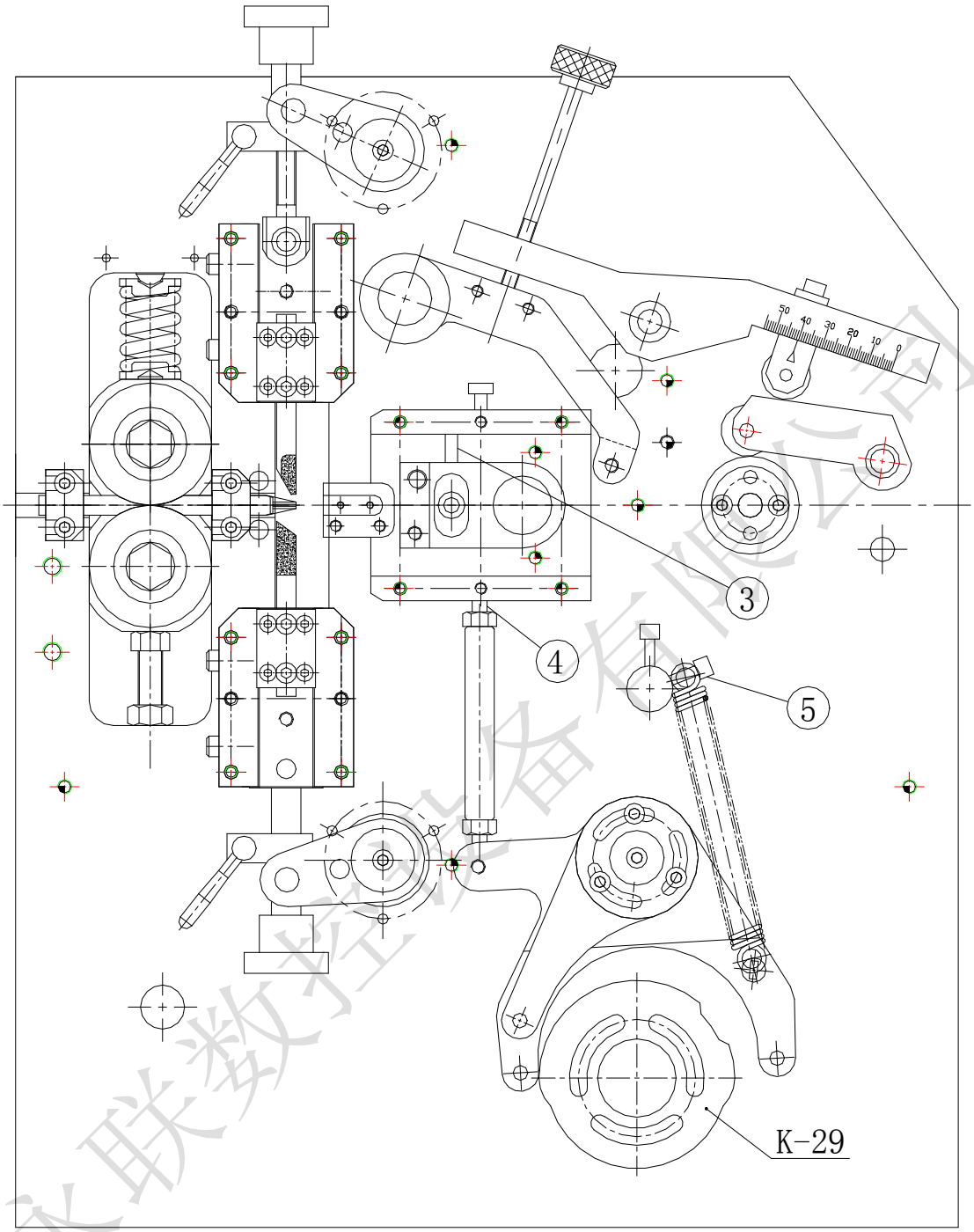
1. Fault switch: The CNC machine will be shut down automatically when a fault occurs in the wire feed support.

2. Continue to feed wire and continuous wire feeding (quick compensation).

A toggle switch arranged on the wire guide bracket of the wire feed support is configured to control the motor of the wire feed support to continuously rotate or continue to rotate. When the switch is turned to the continuing position, the micro switch is pulled by a wire being coiled by the machine so that the wire feed motor can continue to rotate. When the switch is turned to the continuous position, the wire feed support will continuously rotate to pay off the wire at a set speed, and can automatically continue to pay off at an accelerated speed when the wire is not paid off timely, and the pay-off speed is controlled by the speed control knob beside the switch.

XIX. Torsion spring forming device: Optional

In addition to being able to form various springs mentioned above, this machine is also specially designed with a set of torsion spring forming device for users, i.e., pin springs. Fig. 13 shows all the transmission components of the torsion spring mechanism. A tool holder, with a cutting tool arranged thereon and a tool apron arranged on a right side thereof, is installed on the tool rest slider, and can be used as a pin holding element by moving the link up and down. The specific installation method is shown in the five instructions in Fig. 14, and a torsion spring cam piece (K-29) should be installed on the torsion spring cam bushing (E-20).



(Fig. 13)

Replacement of the standard spring slide device with a right-handed torsion spring slide device:

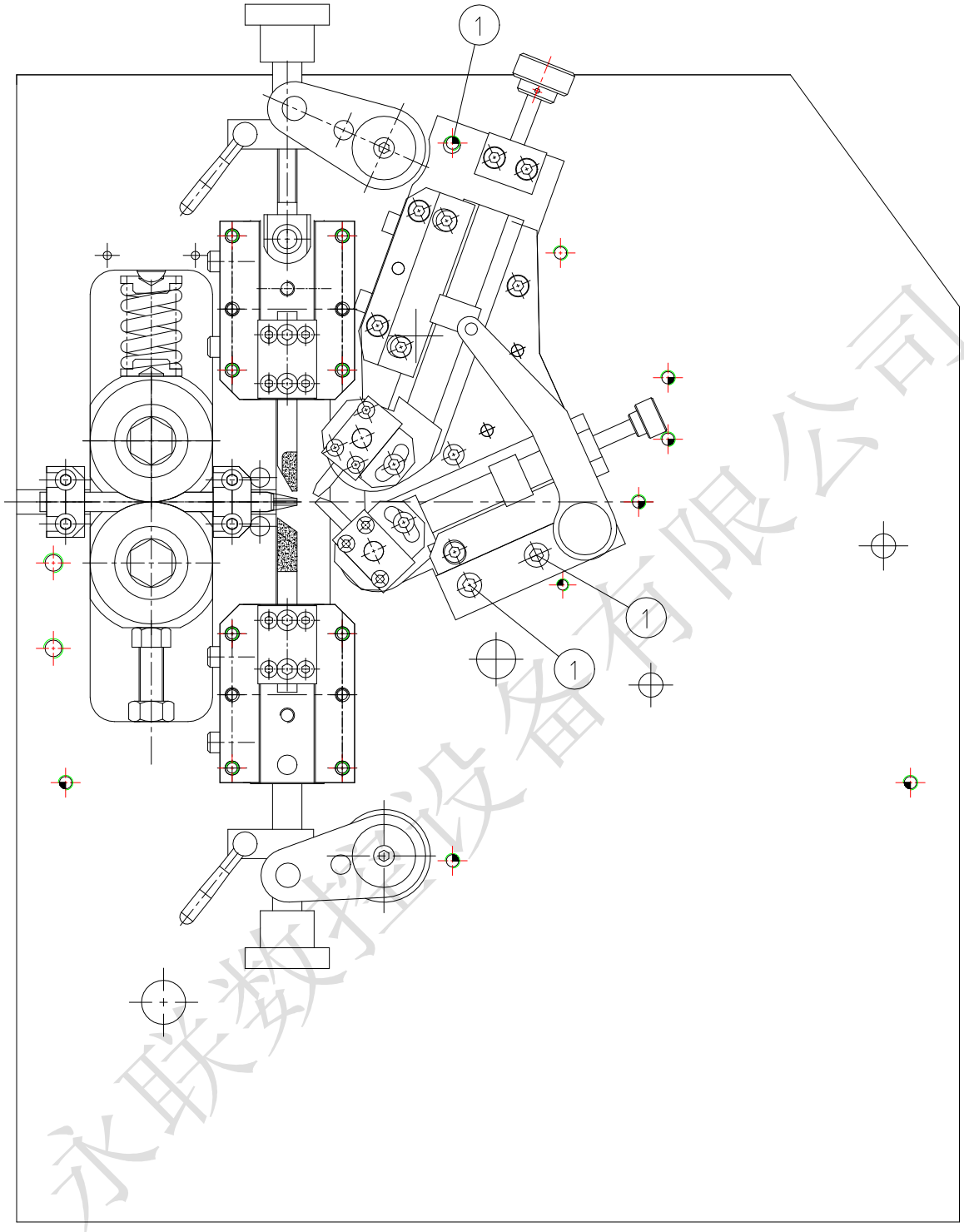
1. Remove the three fastening screws (1#) from the standard spring slide

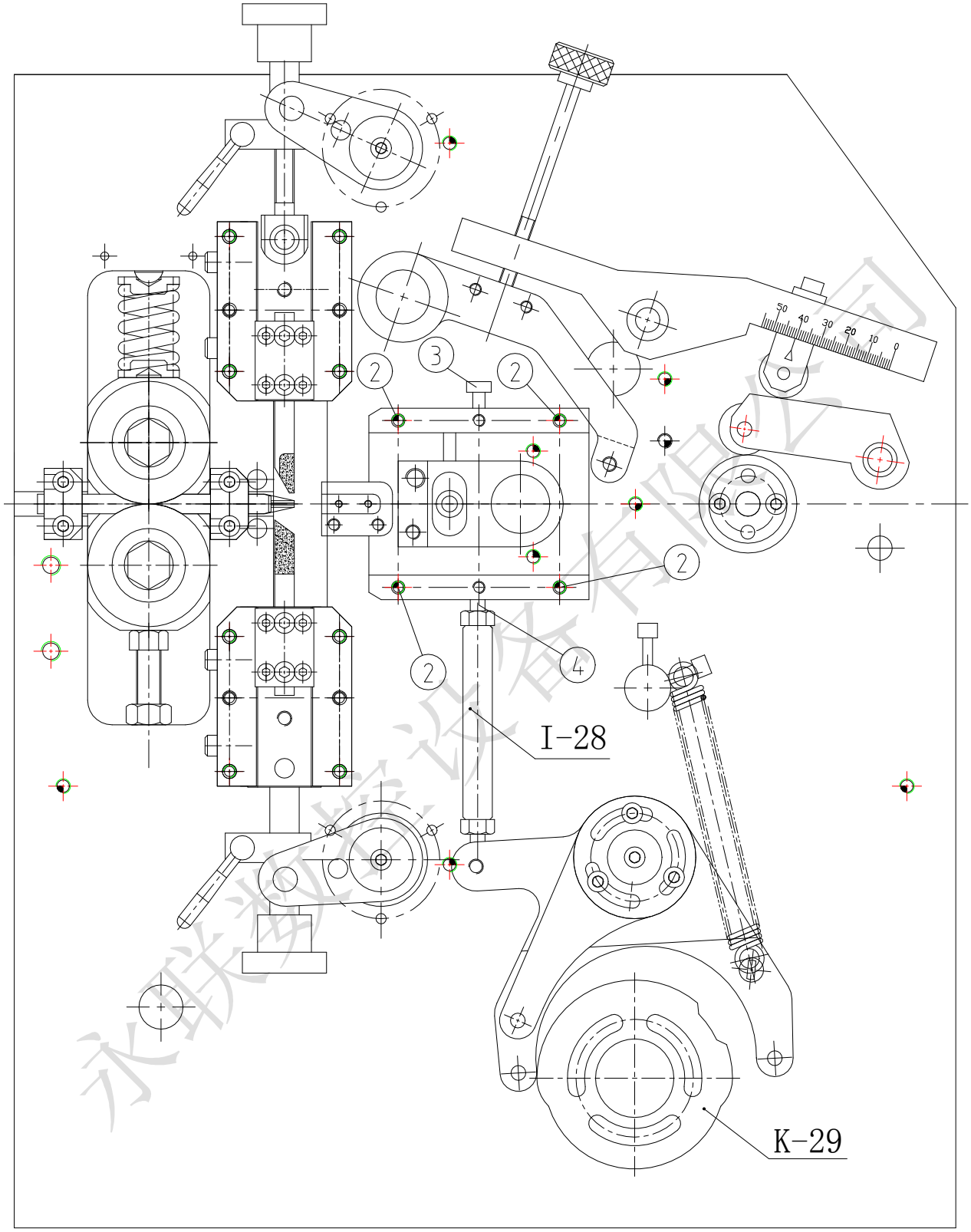
2. Install a torsion spring slide and tighten four screws (2#)

3. Install reversing hexagon couplings (I-28) and main torsion spring cam pieces (K-29) for torsion spring

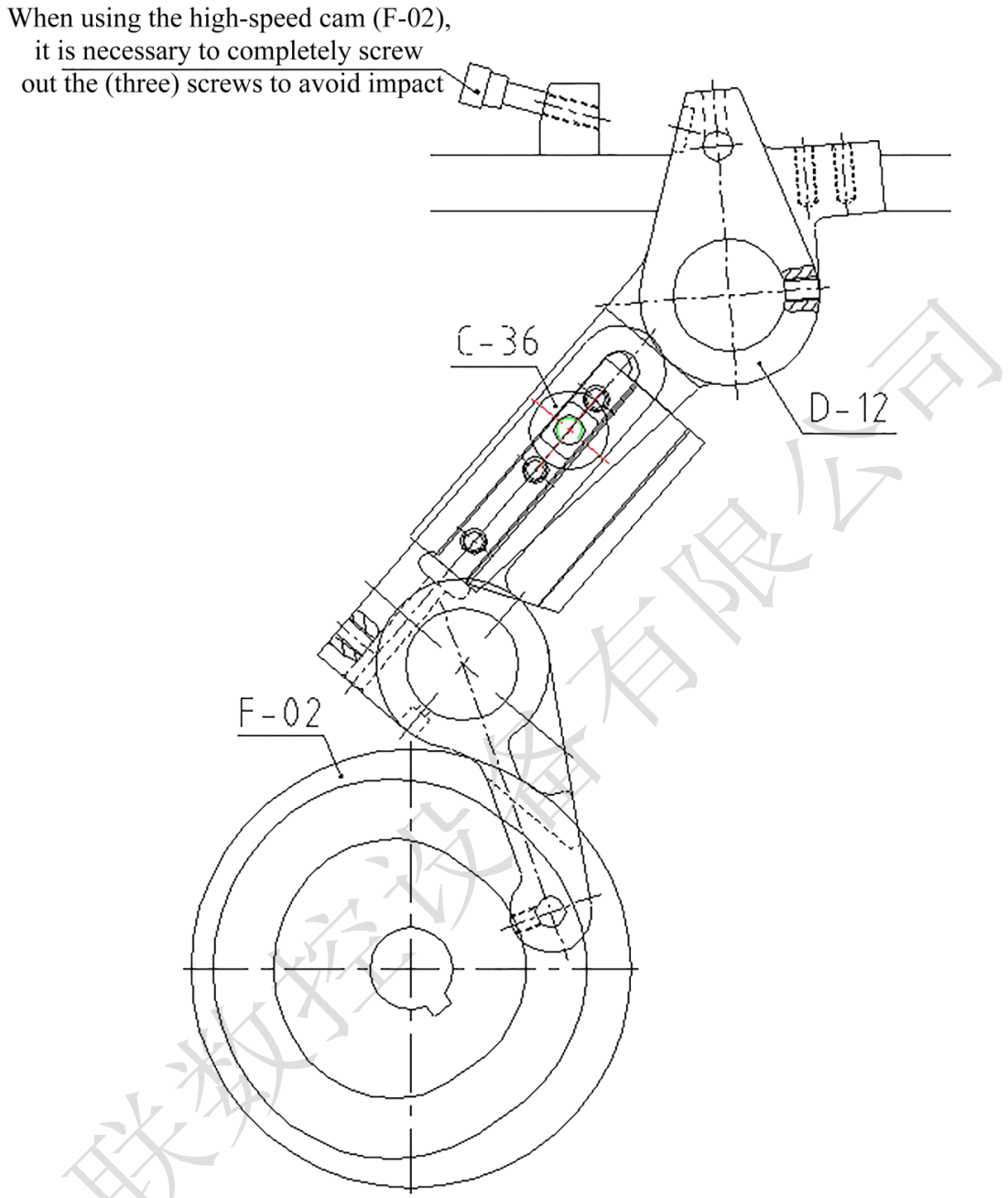
4. Unscrew the screw 3# based on the principle that (the highest point of the cam) is not allowed to bump against this screw during removal of the bent tool rest.

5. Unscrew the screw 4# based on the principle that (the lowest point of the cam) is not allowed to bump against the gap tool during reinstallation of the removed bent tool rest.





(Fig. 14)



(Fig. 18)

XX. Usage of high-speed cam

This high-speed cam is mainly used for spring pitch. when it is used as the pitch of various compression springs, a circular shaft pitch cutting tool should be adopted to adjust pitch of various springs with the pitch lever small slider (C-36) in coordination with the cam ((F-02) in the groove. In the manufacture

of pitch springs, attention should be paid to decide whether to use left-handed tool or right-handed tool, and the customer can make the springs by only making a slight modification to the left-handed and right-handed pitch cutting tool bits as the case may be.

XXI. Safety, maintenance and service

1. The machine is required to be maintained during use so as to maintain stable accuracy and service life for a long time, and the operator is required to grease the lever bearings once every 3 days and spray the slide rails and chutes on the base panel with lubricating oil once or twice a day when starting up the machine, and remove dirt from the surface and surroundings after the work is completed.

2. The springs are required to be coiled according to the specified wire diameter without increasing the diameter at will, so as not to damage the machine. In the manufacture of the profile, its diameter is calculated according to the equivalent area of the maximum wire diameter.

3. During operation, neither the operators is allowed to put their hands into the machine, nor is it allowed to put iron wares into the machine to clean up the springs and other objects. As the machine is running very fast, be sure there is no accident. If any problem is found during operation, the machine may be shut down immediately for trouble disposal.

4. In addition to keeping clean and sanitary in the workshops (computer facilities), keep the machine away from direct sunlight and keep the indoor

normal working temperature (between 16 degrees centigrade and 26 degrees centigrade) at optimum level. Do not allow heating any articles indoors, and do not allow any dust.

Note: The Company reserves the right of final interpretation