

螺旋焊管机组钢带自动对中装置

魏海翔¹, 刘翠华²

(1 广东中山市华骏钢管有限公司, 广东 中山 528441;

2 广东中山市黄圃镇科委, 广东 中山 528429)

摘 要: 介绍了一种螺旋焊管机组钢带自动对中装置, 简述了该装置的工作原理、机械和电路设计方案。经使用测试, 各项数据及控制功能均达到或超过设计要求, 满足了生产需要。

关键词: 螺旋焊管; 成型; 钢带中心线; 自动对中

中图分类号: TP271⁺.4 **文献标识码:** B **文章编号:** 1001-3938(2005)05-0069-03

0 引 言

螺旋焊缝钢管在焊接成型时因钢带行进过程中受阻力不均匀, 且钢带宽度有误差, 常常会引起钢带中心线偏移。这不仅会造成两边铣刀损坏, 还会使钢带成型出现偏差, 内外焊的质量也就无法保证, 直接影响到产品的合格率。如果手动调节机架进行钢带对中, 不仅要专人负责, 而且为保证及时校正钢带中心线还要降低轧速, 这种对中方式的效果降低了生产效率。

针对这一现状, 我公司研制了一套简单实用的钢带自动对中装置, 该装置实测精度达到 0.5 mm/min, 响应时间为 1 s。实际使用表明, 钢带自动对中装置设计完全可满足生产技术要求。该装置先后在我公司三条生产线上投入使用, 节省了人力, 提高了主驱动速度 (最高可达 1.3 m/min), 充分发挥了设备的生产潜能, 提高了生产效率和产品质量。

1 工作原理

1.1 机械部分

钢带自动对中装置机械部分的作用是将钢带中心线偏移信号转换成电信号, 为电气控制提供校正依据, 钢带中心线偏移可通过带边偏移体现出来。

钢带自动对中装置机构示意图见图 1。当螺旋焊管机组调型成功、钢带中心线确定后, 只要调

节钢带对中装置固定定位支架的位置, 使上下连接臂和左右转辊垂直放置在钢带边缘, 然后把上连接臂固定在活动连杆上就确定了钢带的中心线。无论何种原因引起钢带中心线偏移必然会使钢带边偏移, 从而导致转辊偏移。例如, 钢带中心线右偏移, 带边也跟着右偏移, 右辊右移并拉动弹簧, 弹簧通过上连接臂带动活动连杆向左移动, 固定在活动连杆一端的衔铁通过传感器中间也向左移动。传感器和衔铁上都有个通光孔, 当衔铁在传感器中间移动时, 这两个通光孔的重叠面积也会随之改变, 通光量就产生了变化, 通过通光量的变化来驱动电气系统, 从而驱动钢带支架移动来纠正钢带中心线。

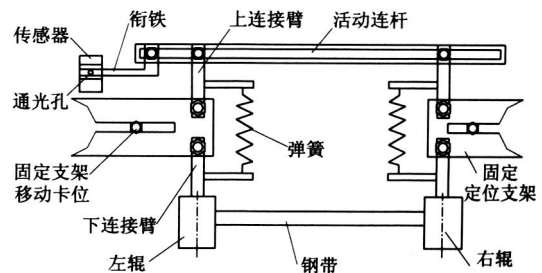


图 1 钢带自动对中装置机械构造示意图

传感器构造如图 2 所示, 左侧为固定点光源, 右侧为固定的光敏管, 点光源与光敏管之间有一个直径 40 mm 的通光孔, 中间是活动衔铁, 衔铁中间有一个直径 40 mm 的通光孔。

当螺旋焊管机组调型成功、钢带中心线确定

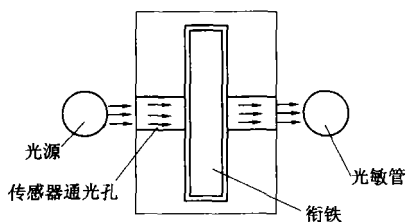


图 2 传感器结构示意图

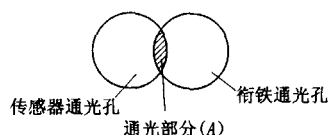


图 3 传感器和衔铁通光孔互相重叠的原始位置

后,只需移动传感器的位置,使传感器的一端与衔铁的一端对齐(如图1所示),就形成了如图3所示的传感器通光孔与衔铁通光孔相互重叠的原始位置,通光面积为两个通光孔重叠部分,该重叠部分定义为通光量 A 。当钢带中心线右偏移 $+S$ 时(为叙述方便,该钢带中心线右偏移量定义为 $+S$,钢带中心线左偏移量为 $-S$),则右转辊通过弹簧带动活动连杆向左偏移 $+L$,活动连杆带动衔铁的偏移量也为 $+L$,于是通光部分面积增大,通光量也增大,将该通光量定义为 A_1 , $A_1 > A$ 。同理,钢带中心线左偏移,通光部分面积减小,通光量减少,将该通光量定义为 A_2 , $A_2 < A$ 。

1.2 电气控制部分

钢带自动对中装置电气控制如图4所示。其控制原理是:当钢带中心线发生偏差、通光量 A 发生改变时,导致接收通光量的光敏电阻 RA 变化,从而由电阻 RA 驱动电气控制电路进行钢带自动对中。其电气控制系统具有以下功能:处理传感器输入的信号,输出可调的方波信号用于驱动钢带机架液压电磁阀,使机架间歇移动以校正中心线;提供超时校正报警信号,当中心线偏离太大时,表示板宽已经超出允许偏差,或由于机械故障,校正失效,电路系统可发出报警信号,提示操作人员作出应变措施;自由操作功能,设置了手动操作功能,方便上料拨接钢带时手动调整中心线。

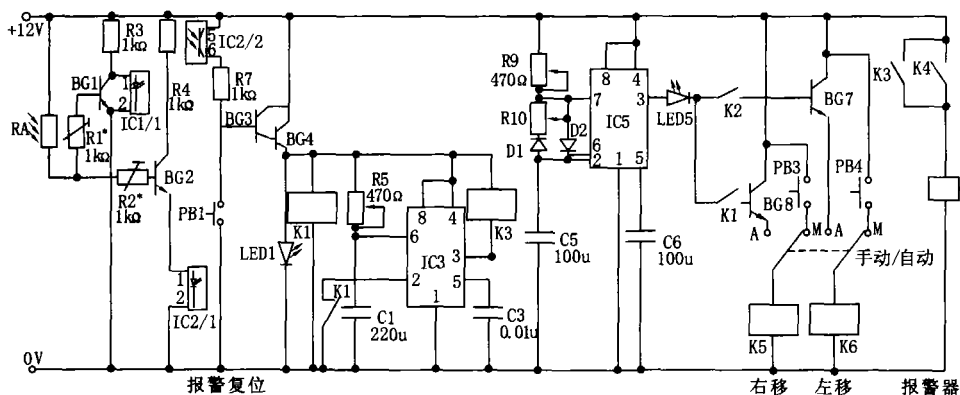


图 4 自动对中装置电路简图

初次使用钢带自动对中装置时要进行初始值的设定,即当钢带中心线不发生偏差时,也即传感器、衔铁在原始位置,此时的通光量 A 、光敏电阻 RA 阻值即为钢带自动对中装置传感器的钢带中心线标准值,调整可调电阻 $R1$ 、 $R2$,使 $BG1$ 保持导通, $BG2$ 保持截止, $IC1$ 、 $IC2$ 均无激发信号, $K1$ 、 $K2$ (由于篇幅有限,图4中没有画出左偏时 $K2$ 的控制部分)不动作,电路不输出驱动信号,不发生对中动作,初始值的设置调整完成。

当钢带中心线向右偏移、传感器通光面积增大即通光量增大($A_1 > A$)时, RA 接收光量增大, RA 阻值减小, $BG1$ 、 $BG2$ 的 B 极电流 I_b 增大, $BG1$ 、 $BG2$ 均导通。由于 $BG1$ 的 C 、 E 极和光耦 $IC1$ 输入端接成并联线路, $BG2$ 的 C 、 E 极和 $IC2$ 输入端接成串联线路。所以, $BG1$ 导通 $IC1$ 的1脚无信号输入, $IC1$ 不工作; $BG2$ 导通 $IC2$ 的1脚有信号输入, $IC2$ 工作,致使 $IC2$ 的5、6脚导通。 $+12V$ 电源从 $IC2$ 的5、6脚,经 $BG3$ 、 $BG4$ 放大后

驱动 K1。由 IC5、D1、D2、R9、R10、C5、C6 等组成多谐振荡线路产生方波序列,调整 R9、R11,可改变方波的幅度,信号由 IC5 的 3 脚输出,该信号由 K1、K2 转换,决定是否输出或向哪一路输出。K1 吸合,K2 断开时,且手动/自动转换开关置于自动位置,BG8 饱和导通,驱动 K5 动作,钢带机架右移。K1 吸合意味着 IC3 导通,同时 K1 的 NC 触点打开,IC3 和 R5、C1、C3 组成的定时电路开始计时,定时器时间 T 由 R5、C1 时间常数决定,如校正时间超过 T ,则 IC3 的 3 脚输出一个信号驱动 K3,蜂鸣器报警线路工作。

同理,可分析当钢带中心线向左偏移即通光量减小 ($A_2 < A$),RA 增大时电路的工作原理,这里就不再叙述。

2 结 语

该螺旋焊管机组钢带自动对中装置是光、电、机械等知识的综合运用。电气控制线路并不复

杂,但解决了生产过程中的实际问题,与国外同类设备相比有结构简单、造价低廉、维修方便等特点。经过试生产,各项控制功能均达到了设计要求,满足了生产需要。

参考文献:

- [1] 清华大学编写组. 数字电路 [M]. 北京:高等教育出版社,1992
- [2] 清华大学编写组. 模拟电路 [M]. 北京:高等教育出版社,1992

作者简介:魏海翔(1974-),男,毕业于华南理工大学,工程师,主要从事技术开发工作,(地址)广东省中山市石岐区城市花园怡景阁 14 幢 1 座 601 (电话) 0760 - 5571208 (Email) Lea wei98@163.com。

收稿日期:2005 - 02 - 21

修改稿收稿日期:2005 - 05 - 08

编辑:谢淑霞

欢迎订阅 2006 年《特种油气藏》

《特种油气藏》是经国家科学技术部和新闻出版总署批准,由中国石油天然气集团公司主管,辽河油田分公司主办,面向国内外公开发行的国家级科技期刊,是全国唯一一份全面报道“特种油气藏”勘探开发新技术、新理论、新进展的科技期刊。全文收入《中国期刊全文数据库》、《中国期刊网》及《中国科技期刊(光盘版)》,入选《中国核心期刊数据库》和《中国学术期刊综合评价数据库》统计源期刊,并被《中国石油文摘》收录,被美国化学文摘(CA)索引。荣获《CAI-CJ 规范》执行优秀奖,辽宁省优秀期刊一等奖及中国石油、石化行业优秀期刊二等奖。

“特种油气藏”即“非常规油气藏”,系指稠油、高凝油、低渗透、岩浆岩、变质岩、裂缝、古潜山及其它一切特殊油气藏。目前,全国大部分油田的勘探、开发程度已经较高,常规油气藏的潜力越来越小,且工作难度越来越大,而特种油气藏的勘探开发程度相对较低,是各油气田下一步工作的重点。《特种油气藏》为特种油气藏勘探、开发、工艺、实验、信息交流提供了园地。

《特种油气藏》设综述、地质勘探、油藏工程、钻采工艺、试验研究、环境保护、科技信息、综合等栏目。欢迎关心我刊的国内外同行积极订阅我刊。《特种油气藏》(双月刊)全年 6 期,逢双月 25 日出版,大 16 开本,每期 112 页,每册定价 12 元,全年定价 72 元,国外定价 12 美元/册,72 美元/年。可通过邮局订阅(邮发代号 8 - 173),或直接寄款到编辑部订阅。

地址:辽宁省盘锦市兴隆台区辽河油田分公司勘探开发研究院《特种油气藏》编辑部

邮编:124010 电话:0427 - 7823579; 7820262 Email: tzyqc@etang.com

开户银行:辽宁盘锦工行辽河油田支行

帐户:中油辽河油田分公司结算部兴隆台结算科 帐号:0714000209221026913

Key words: STT control principle; CO₂ gas protect automatic welding; welding current; welding speed; feeding wire speed

Application of Big Character Stenciling Unit on Pipe Production

WEI Jing, WANG Qian-hua, ZHU Wei

Abstract D: 1001-3938 (2005) 05-0045-EA

Key words: big character stenciling unit; principle; property; technical parameter; application effect

Application on Pipe Quality of Certification with Visual FoxPro6.0 Software

ZHU Da-quan, WANG Shu-ren

Abstract D: 1001-3938 (2005) 05-0047-EA

Abstract: Pipe quality of certificate is an important document of enterpriser to issue product quality certification to end user. It introduces to apply Visual FoxPro6.0 software and carry out program design to quality control information system to realize system-ization of product quality control information as per the requirement of pipe quality of certificate of spiral submerged arc welded pipe for West-to-East gas transmission project

Key words: quality of certificate; system design; Visual FoxPro6.0 software; application

Application of Plasma Welding System on Stainless Steel Welded Pipe

CHEN Guo-yu, LI Yi, WANG Lin-lin, CHEN Chun-yang

Abstract D: 1001-3938 (2005) 05-0051-EA

Abstract: It is described the advantage of plasma welding principle and welding process and analyzed the properties of key component among plasma welding system. It is introduced some welding process parameter of plasma welding system and its effect on practice application during stainless steel welded pipe

Key words: stainless steel welded pipe; plasma welding; equipment; application

Structure Principle Analysis to Inside Burr Removing Unit for Longitudinal Welded Pipe

KANG Xia-ming

Abstract D: 1001-3938 (2005) 05-0054-EA

Key words: longitudinal welded pipe; inside burr; inside burr removing unit; knife profile; structure; analysis

Study on Hot-rolling Process of X70 Thick Coils

GUO Bin, SONG Ping, ZHENG Lin, WEI Gang-cheng, KONG Jun-hua,
WEN Dun, ZHANG Chao, LI Chang-ming

Abstract D: 1001-3938 (2005) 05-0056-EA

Abstract: Hot-rolling process of X70 thick coils was studied in this paper, and it was concluded that increasing the cooling rate, fine reduction and finish coiling temperature would be helpful to the forming of acicular ferrite and improving of steel strength and toughness, in reverse, extra high or low finish rolling temperature would be harmful to them. By taking reasonable hot-rolling process, the microstructure of X70 production was mainly acicular ferrite, and its strength and toughness were good enough to satisfy the requirement of "Technical Agreement of Hot-rolling Coils for Pipe Manufacturing of West to East Gas Transporting Project".

Key words: X70 steel; hot-rolling process; control rolling and control cooling

Pass Design with Inclined Set for Shuttle Pipe

CAO Guo-fu

Abstract D: 1001-3938 (2005) 05-0061-EA

Abstract: It is introduced that inclined set design method of pass design for shuttle pipe and explains that pass design with inclined set for shuttle pipe has excellence of controlled weld seam position and γ angle of pipe tail as well as not easily tearing burr to the edges of pass to make longer usage life of rollers, etc. It puts forward some fresh design principle. These design principle also has use for reference to design pass of other rectangular pipe

Key words: shuttling pipe; roller pass; inclined angle; design

Improvement on Pipe Expanding Process and Research on Increasing Expanding Head Life

LI Hong

Abstract D: 1001-3938 (2005) 05-0066-EA

Abstract: It puts forward reasonable adjustment to each parameter, improvement to process method, strengthening friction lubrication and rational operation to reach the purpose of increasing usage life of expanding head of expander through analysis to pipe expanding process

Key words: pipe expanding; expanding process; expanding head; usage life

Investigate in the Automatism Aim at Armor Plate Ate Centre

WEI Hai-xiang, LI Cui-hua

Abstract D: 1001-3938 (2005) 05-0069-EA

Abstract: Introduce the automatism aim at armor plate center. Recite the work elements and machine and electrocircuit design

project for the equipment Through running and testing, all of the control and data supporting functions in the equipment have been proved that the primary technical indices are reached or exceeded the project

Key words: spiral steel pipe; armor plate; automatism

Automatic Grinding Unit for Pipe Ends Weld of Spiral Welded Pipe

CHEN Qi-wei, ZHANG Shi-ping, LU Xin-ying

Abstract D: 1001-3938 (2005) 05-0072-EA

Key words: spiral weld seam; automatic grinding unit; sand band; grinding; manufacture

Analysis and Control to Weld Crack of Spiral Welded Pipe with Small Forming Angle

LU Yun, LU Cheng-kun

Abstract D: 1001-3938 (2005) 05-0074-EA

Abstract: Inside weld produced cracks are often faced problem by adopting wide coil with small forming angle to produce small size spiral submerged welded pipe To main reason for produced cracks is analyzed and effective solving measure is raised It has certain direction significance for production of spiral welded pipe with small forming angle

Key words: spiral welded pipe; weld crack; analysis; control; spring stress

Property Appraisal and Improvement of Flattening Test for ERW Pipe

JIE Sheng-qi

Abstract D: 1001-3938 (2005) 05-0077-EA

Abstract: Flattening test cracks for high frequency ERW pipe results from weld micro cracks, rigid and brittle mixed inclusions, thick and big crystal and banded structure, etc. It puts forward a conception of weld inclusions crack index so as to better control quality of weld seam. It puts forward measures by through rational designing chemical composition and reducing inclusions and banded structure as well as optimizing control process parameter to forming, welding and heat treatment, etc to efficiently reduce weld inclusions crack index and improve anti-crack property of weld flattening to high frequency ERW pipe

Key words: ERW pipe; flattening testing clusions; crack index

Noise Control in Hot-dip Galvanization Workshop of Steel Tube Plant

WANG Fu-mao, WANG Chun-dong, CONG Yue-zeng, WANG Fa-zhan

Abstract D: 1001-3938 (2005) 05-0081-EA

Abstract: This paper, through measuring and analyzing the noise sources in the hot-dip galvanization workshop of a steel tube plant, indicated that the operation of inner blowing tube is the major environmental source of noise pollution, studied the mechanism of air current noise for blow pipe, put forward comprehensive administer steps with sealing cap, pressure reduction, noise elimination and noise insulation The noise administer enforcement of first phase project showed as a result: the noise peak value of blowing tube to be reduced 10 ~ 15 dB (A), the noise peak value of factory boundary to be reduced 20 dB (A) more, and a good effect preliminarily to have been received

Key words: noise control; hot-dip galvanization; steel tube; blowing tube

Calculation Method of Hydrostatic Tester with End Seal

WANG Zhi-ming

Abstract D: 1001-3938 (2005) 05-0084-EA

Abstract: It analyses stress sustained by pipe during hydrostatic test and briefly introduces calculation formula deduced process of test pressures It points out that it shall consider compensate the load of pipe ends to working cylinder and first determines rational pressure of working cylinder with hydrostatic tester and determines pressure of hydrostatic tester by adopting ends seal when test pressure is greater than 90% of the minimum yield strength of pipe

Key words: pipe; hydrostatic test; test pressure; stress; end seal; radial seal

Standardization and Relation of Production Management and Scientific Development

LI Yan-feng

Abstract D: 1001-3938 (2005) 05-0086-EA

Abstract: It discusses affinity relations of standardization and production management and scientific development through real example of pipe product and raw material standard It puts forward many practical methods of solving the contradiction between standardization to pipe product and raw material standard as well as production management, scientific and technology development and market competition to better manage relation of standardization between production management, scientific and technology development and market competition to fully exert an important role of standardization among them

Key words: standardization; production management; scientific and technology development; market competition