Capacitive-type height sensor for numerical-controlled flame-cutting machine

Abstract

The utility model discloses a capacitive-type height sensor for a numerical-controlled flame-cutting machine, and the sensor consists of an inductance loop, and a signal detection circuit which is connected with the induction loop. The signal detection circuit consists of a sine wave generating circuit, an operation method capacitance detection circuit, and a phase sensitive detection circuit, wherein the sine wave generating circuit, the operation method capacitor detection circuit and the phase sensitive detection circuit are sequentially connected. The induction loop is connected with the operation method capacitor detection circuit through a capacitor. The induction loop is fixed on a cutting torch, and the cutting torch moves up and down and drives the induction loop to go up and down. The sensor, which employs the above scheme design, is: 1, quick in response, wherein the response of a whole testing process is less than 2 ms; 2, high in detection precision, wherein the output precision reaches +/-5 mV; 3, is stronger in anti-interference, and can be suitable for the severe working environment of the numerical-controlled flame-cutting machine.

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Description

A kind of condenser type height sensor of NC flame cutting machine

Technical field

The utility model relates to NC flame cutting machine, specifically a kind of condenser type height sensor of NC flame cutting machine.

Background technology

NC flame cutting machine, in the process of surface trimming sheet material, for improving precision and the quality of processing, need make the height between cutting torch and sheet material in the numerical control cutting machine course of work, keep to greatest extent extent constant.

At present, in numerical control cutting machine automatic height-adjusting system, there are three kinds of capacitance signal detection techniques:

1, frequency modulation method: simple in structure, affected by extraneous factor less, but the stability of oscillation frequency is not enough, and frequency band is narrower, causes range too small, and inside stray capacitance is larger on the impact of circuit, measuring accuracy is not high;

2, pulse width modulated method: circuit-line is simple, does not need AC signal generator and demodulator circuit, and sensitivity is higher, but the mutual capacitance that capacitive transducer needs is larger;

3, bridge method: highly sensitive, the mutual capacitance of sensor is even below 1pF, and the volume of sensor is little is not enough: sound signal is not too applicable to the electric capacity of low capacity, and nonlinearity erron is larger.

Utility model content

The purpose of this utility model is for improving the precision of current NC flame cutting machine condenser type type automatic height adjusting device, improves the poor problem of its dynamic response characteristic, and a kind of condenser type height sensor of NC flame cutting machine is provided.

The technical scheme that realizes the utility model object is:

A kind of condenser type height sensor of NC flame cutting machine, by inductance loop, formed with the signal detecting circuit being connected with inductance loop, signal detecting circuit is comprised of the sine wave generating circuit being linked in sequence, operation method capacitive detection circuit, phase-sensitive detection circuit, inductance loop is connected with operation method capacitive detection circuit by electric capacity, inductance loop is fixed on cutting torch, along with moving up and down of cutting torch drives its lifting.

The utility model has the advantages that: by design circuits, the relation that the d. c. voltage signal of the last output of sensor and height to be detected form direct ratio, has realized sensor and the height conversion between inductance loop and material to be processed has been become to the object of voltage signal.Adopt the condenser type height sensor of this conceptual design, the one, fast response time, the whole testing process response time is lower than 2ms; The 2nd, accuracy of detection is high, reach ± 5mV of output accuracy; The 3rd, anti-interference is stronger, can adapt to the severe working environment of NC flame cutting machine.

Accompanying drawing explanation

Fig. 1 is the circuit connection diagram of the utility model condenser type height sensor;

Fig. 2 is sine wave generating circuit figure;

Fig. 3 is operation method capacitive detection circuit figure;

Fig. 4 is phase-sensitive detection circuit figure;

Fig. 5 is the connection diagram of the utility model condenser type height sensor and control system.

Embodiment

As shown in Figure 1, a kind of condenser type height sensor of NC flame cutting machine, consists of inductance loop, sine wave generating circuit, operation method capacitive detection circuit and phase-sensitive detection circuit four parts.Between inductance loop and material to be processed, contain capacitor C x(Cx and inductance loop and be inversely proportional to for the height d between rapidoprint); Sine wave generating circuit sine wave output signal V1 (t), Cx, V1 (t) export V2 (t) after operation method capacitive detection circuit is processed, and DC component and the Cx of V2 (t) are inversely proportional to, Phase sensitive detection is exported V3 after processing V2 (t), and its size is directly proportional to the amplitude of V2 (t).By above-mentioned detection and processing, the d. c. voltage signal V3 of sensor output is directly proportional to inductance loop with for the height d between rapidoprint, realizes its height detection function.

Embodiment:

(1) setting parameter

1, set the size of steel inductance loop

Inductance loop structure is an annulus, inner circle radius r=20mm, and exradius R=r+d=40mm, can calculate the useful area of inductance loop accordingly.

$S = \pi(R^2 - r^2) = 3.14\times[(40\times10^{-3})^2-(20\times10^{-3})^2] = 37.68\times10^{-4} m^2$,

Insulating coefficient e=8.85 * 10^{-12}F/M.

2, set sine wave generating circuit

In Fig. 2, selected: R1=R3=5.1K, R2=50K, R4=1K, R5=10K, R7=200K, R8=0.5K, R9=25K, C1=1u, C2=10u, C3=1u, C3 is=103 Frequency f=the 1/(R4+R7 of circuit output signal) * C4], the size of adjusting R7 makes f=100K, adjusts R2 and makes output amplitude Vm equal 3V.So output drive signal in this circuit:

V1 (t)=VmSin ω_c t,vm=3V wherein, ω_c=2 π * 10^5

3, set operation method capacitive detection circuit

In Fig. 3, the expression formula of output signal V2 (t) is:

V 2 (t) = - Cref Cx V 1 (f) = - Cref Cx VmSin ω c t

Set relevant capacitor and resistance value, Cref gets 10p, and the direct current amplitude of V1 (t), e and S substitution above formula can be obtained, and the expression formula of the amplitude V2m of V2 (t) is:

V 2 m = 0.6 dx

The range dx of sensor is 1～25mm, and the scope of V2m is 0.6～15V.

4, phase-sensitive detection circuit

In Fig. 4, set resistance and the electric capacity of phase-sensitive detection circuit, make the output voltage signal of sensor:

V 3 = 3 π V 2 m = 0.573 dx

The unit of V3 is V, and the unit of dx is mm.

(2) test data analyzer

It is as shown in table 1 that test records the real data of dx-V3.

Table 1dx-V3 tables of data

dx(mm) V3(V) dx(mm) V3(V) dx(mm) V3(V) 1 0.0 0.573 7.5 4.298 15.5 8.882 1.2 0.688 8.0 4.584 16.0 9.168 1.4 0.802 8.5 4.871 16.5 9.455 1.6 0.917 9.0 5.157 17.0 9.741 1.8 1.031 9.5 5.444 17.5 10.028 2.0 1.146 10.0 5.730 18.0 10.314 2.5 1.433 10.5 6.017 18.5 10.601 3.0 1.719 11.0 6.303 19.0 10.887 3.5 2.006 11.5 6.590 19.5 11.174 4.0 2.292 12.0 6.876 20.0 11.460 4.5 2.579 12.5 7.163 20.5 11.747 5.0 2.865 13.0 7.449 21.0 12.033 5.5 3.152 13.5 7.736 22.0 12.606 6.0 3.438 14.0 8.022 23.0 13.179 6.5 3.725 14.5 8.309 24.0 13.752 7.0 4.011 15.0 8.595 25.0 14.325

As can be seen from Table 1, at dx in the scope of 1mm～25mm, the output that V3 can be stable.

As shown in Figure 5, Sensor section mainly refers to inductance loop, cutting steel plate, signal detecting circuit and height setting potentiometer, inductance loop is fixed on cutting torch, moving up and down of cutting torch just drives inductance loop lifting, it is exactly Cx that distance between inductance loop and steel plate is reflected on sensor, by the distance ds between signal detecting circuit output voltage signal V2(V2 and cutting torch and steel plate, have functional relation), height setting potentiometer output voltage signal V1. Control system part mainly by signal processing circuit, single chip machine controlling circuit, H bridge direct current motor drive circuit, system power supply module, photoelectric isolation module form, signal processing circuit is processed height voltage signal V1 and the V2 setting, output result voltage signal V1o and V2o, after being correspondingly processed, MCU control circuit reception V1o and V2o control H Qiao Zhi road motor-drive circuit by photoelectric isolation module, drive DC motor positive and negative rotation, thereby control cutting torch lifting.Form the adaptive control system of a closed loop.

Claims (1)

Hide Dependent

1. the condenser type height sensor of a NC flame cutting machine, it is characterized in that: by inductance loop, formed with the signal detecting circuit being connected with inductance loop, signal detecting circuit is comprised of the sine wave generating circuit being linked in sequence, operation method capacitive detection circuit, phase-sensitive detection circuit, inductance loop is connected with operation method capacitive detection circuit by electric capacity, inductance loop is fixed on cutting torch, along with moving up and down of cutting torch drives its lifting.

Similar Documents

Publication	Publication Date	Title
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CN102645631B	2014-06-04	Automobile key switch testing system and testing method
CN102853565B	2015-03-25	Automatic tracking system and method of welding line based on capacitive transducer
CN101718613B	2012-08-22	Experimental modal analysis method of numerical control equipment
CN203479441U	2014-03-12	Switch electric contact head automatic detection device
CN101397907B	2012-12-26	Method and apparatus for eliminating directly coupling signal of induction logging tool
CN102528288B	2014-05-21	Method for digital closed-loop control capacitance raising system
CN100575890C	2009-12-30	Capacitance level transducer and use the liquid level detection device of this sensor
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CN201532310U	2010-07-21	Complete automobile road-test testing device

Priority And Related Applications

Priority Applications (1)

Application	Priority date	Filing date	Title
CN201320512186.XU	2013-08-21	2013-08-21	Capacitive-type height sensor for numerical-controlled flame-cutting machine

Applications Claiming Priority (1)

Application	Filing date	Title
CN201320512186.XU	2013-08-21	Capacitive-type height sensor for numerical-controlled flame-cutting machine

Legal Events

Date	Code	Title	Description
2014-03-05	GR01	Patent grant	
2015-10-14	EXPY	Termination of patent right or utility model	
2015-10-14	CF01	Termination of patent right due to non-payment of annual fee	**Granted publication date**: 20140305 **Termination date**: 20140821

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