AUTOMATION OF THE BOLLER & CHIVENS SPECTROGRAPH LIGHTING SYSTEM.

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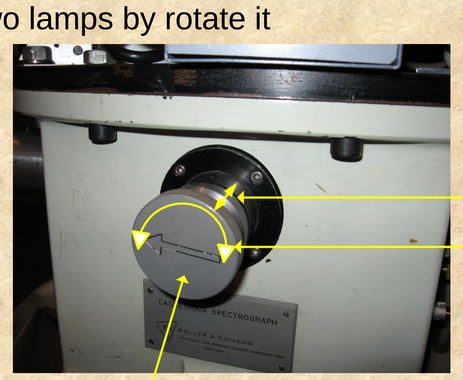
SUMMARY

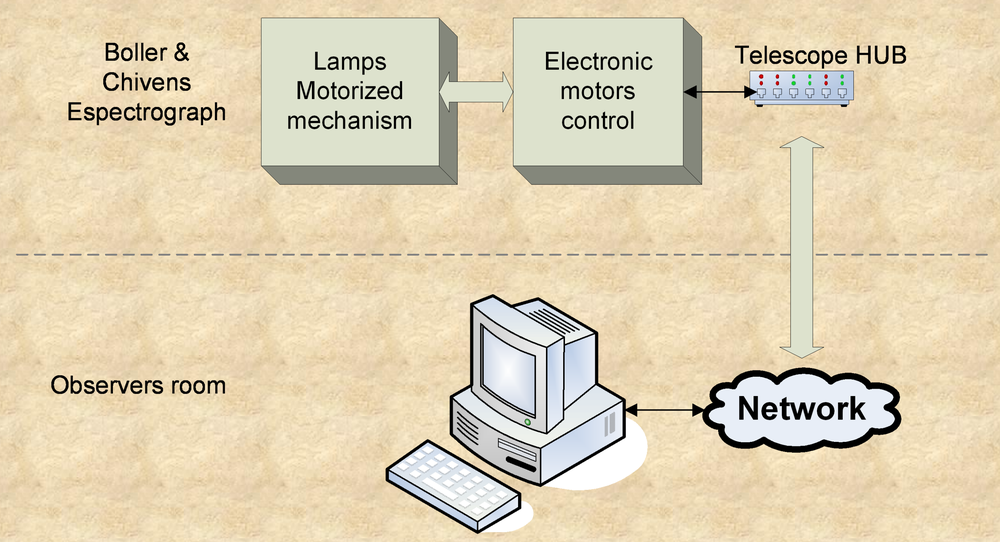
This paper presents **the design and implementation of a system that allows remote operation of all Boller & Chivens spectrograph lamps**. This describes the mechanical and electronic design and the user program. The implementation of this **system results in increased efficiency during the observations with this instrument**, because, previous to this automation, the assistant dome had to climb up to telescope floor to manually operate it every time a lamp was required for comparison. This activity **used to require 5 minutes**. Currently, with the automation of the Boller & Chivens spectrograph lighting system **it takes about 5 seconds**. This is an important step considering that the Boller & Chivens spectrograph has **a significant demand among users of the OAN.** The automation of the lighting system required the design and construction of a motorized mechanism for the selection of the lamps. As well as the design of an efficient motor controller, capable of receiving commands via the Ethernet network. Also, we developed a program user-friendly interface for operation.

SPECTROGRAPH LICHTING SISTEM.

The lighting system has two lamps, a copper-argon and a neon lamp. **The light source is introduced on the spectrograph optical axis by a pull-push knob** and this knob selects one of two lamps by rotate it



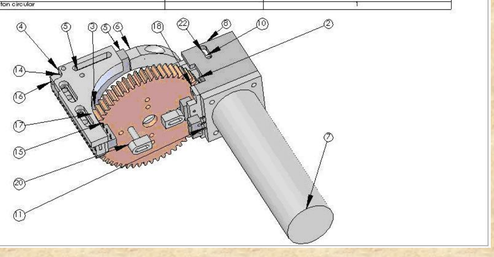
AUTOMATIC SYSTEM CONCEPT



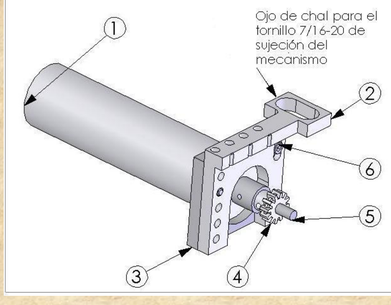
MECHANISM.

The mechanical system consists of two movement mechanisms, the first it's a push-pull mechanism that move the mirror in to the instrument optical axis. The second mechanism rotates the knob in order to select the lamp. The left figure shows the first mechanism which has of a motor with a gear-pinion mechanism fastened to the shaft and to the motor mounting plate assembly to the instrument. The figure on the right shows the second mechanism which has of a rack-pinion mechanism with the pinion assembly to the instrument knob. A second motor is used to rotate the knob.

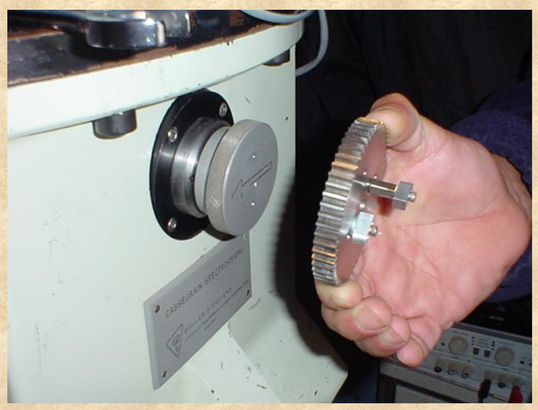
Nº DE ELEMENTO	NÚMERO DE PIEZA	DESCRIPCIÓN	CANT.
1	001_B&Ch_eje Motor1		1
2	PIC Design-G57-20		1
3	PIC Design-G27-56		1
4	006_B&Ch_Abrazadera1		1
5	004_B&Ch_ABRAZADERA2	Abrazadera Izquierda	1
6	005_B&Ch_ABRAZADERA1	Abrazadera Derecha	1
7	HW-12 MOTOR gLOBE MOTORS		1
8	002_B&Ch_base motor&Nic		1
9	HX-SHCS 0.112-40UNC2-5X0.375-S		1
10	0028_B&Ch_ABRAZADERA1		1
11	UNION SWITCH 3/32"		4
12	010_B&Ch_palanca del switch		1
13	UNION B&Ch_SWITCH 3/32"		1
14	011_B&Ch_Abrazadera del Switch		1
15	INVERSUNION SWITCH 3/32"		1
16	PIC Design -AG-31	Rise Pitch Rack - 20 Deg. Pressure Angle	1
17	009-0010_B&Ch_palanca del Switch		1
18	14_B&Ch_Abrazadera del SWITCH GAS		1
19	012_B&Ch Topet1 Switch		1
20	013_B&Ch Topet1 No eje		2
21	0128_B&Ch Topet1 Switch		1
22	15_B&Ch Regulton circular		1

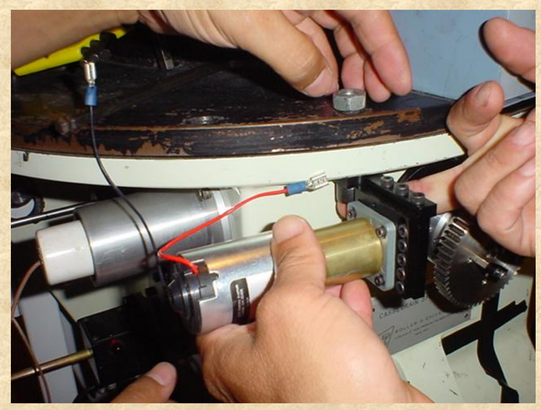


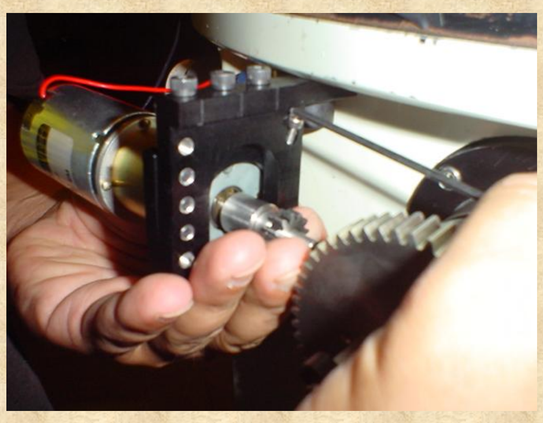
Nº DE ELEMENTO	NÚMERO DE PIEZA	DESCRIPCIÓN	CANT.
1	RSR 13 MOTOR gLOBE MOTORS	Motro globe motor 2030	1
2	001_B&Ch_baseMotor1		1
3	006_B&Ch_base motor		1
4	PIC Design-G57-12	No dinete: 12; P.D: 1/2" SS Spurg Gear-24 pitch	1
5	007_B&Ch_eje Motor2		1
6	HX-SHCS 0.138-32x0.375x0.375-S		2
7	16B_B&Ch CUBIERTAB	No mostrada	1
8	16_B&Ch CUBIERTA	No mostrada	1



COUPLING THE INSTRUMENT MECHANISM.

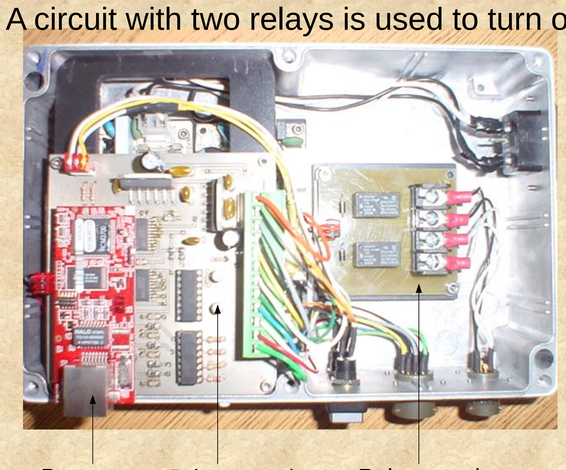






ELECTRONIC MOTORS CONTROL.

The electronic control uses an RCM3700 **microcontroller with ethernet port, which allows the remote movement of the mechanism**. Two engine drivers LMD18200 are used, one for each motor. The speed motor is adjusted with a PWM signal**. Switches limit are used for sensing the mechanism position**. A circuit with two relays is used to turn on the lamp sources.



GRAPHICAL USER INTERFACE

The user interface program was done in TCL-TK language and runs on Linux operating system. The left figure shows the lamps off, right te Cu-Ar lamp On.