Moving head projectors
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The characteristics and performances of these "intelligent" projectors and the reasons of their success in various applications

The so called moving head projectors have been on the market for a few years and they are becoming very popular with many experts of the lighting show sector, thanks to their many applications in places devoted to shows and public entertainment. Today, moving head projectors are placed, in the catalogues of the most qualified manufacturing firms, alongside the now classic "scanners", the appliances that send light beams in the environment through one or more mirrors controlled by micro-stepping motors. Despite offering lighting engineering performances similar to those offered by a scanner (continuous and strobe regulation, colouring, shaping, variations of the width of the beam and other effects) they have the prerogative of a greater rotation of the beam, as well as being silent. What moves, in fact, to make the light beam dynamic, is not a hinged mirror but the whole body of the appliance containing the light source and all the optic and mechanic components. The possible rotation of most recent models amounts to 540°pan (rotary movements around the vertical axis) and 306°tilt (rotary movements around the horizontal axis), with very small steps, 0.013° and 0.007° respectively, values that make us understand that an extremely accurate and precise orientation is possible. It is clear that these illuminators, thanks to the power of the fitted lamp, send light to considerable distances and thus even a small fraction of a degree has its own relevance when training the beam. These values, related to the rotation, allow to send the beam in practically every direction. We must then consider that there is maximum freedom in positioning the base of the projectors (with the moving head pointed downwards, upwards or diagonally), on an horizontal or oblique anchorage level. It is important to notice, with regard to noise, that, unlike scanners, the moving head type does not contain a cooling fan; for this reason this appliance is more silent, a feature that is highly appreciated in theatres and on television and film sets. In order to disperse the heat generated by the lamp (voltages are generally high, from 500W to 1200W) the body of the projector is equipped with special cooling components (bodies in special materials, fins, perforations, fissures, etc.) which give some models an original shape.

But let us see what are the main reasons at the basis of the market success of this type of appliance which form part of the family of "intelligent" projectors. Let's begin by analysing why they differ from the common projecting devices. In the show and entertainment world light is used to create settings, effects, atmospheres, and sceneries suitable for specific places, for specific events, for the character on the stage, the audience, which is often the protagonist of the show. There are infinite variables that contribute together to define the role of light. In general, the lighting plant must provide a multiplicity of performances and even the single illuminating body must be multifunctional. The projector becomes an instrument in the hands of the lighting designer who must be able to produce a wide range of effects. Let us deal then with the more diffused lighting engineering performances of

moving head projectors. Obviously, the most sophisticated and expensive models are those that offer the complete series of performances. Each action of the moving head projector performed by its internal devices, to which correspond a specific light effects, is controlled by an electronic board, a small electronic mind (hence the definition of "intelligent" projectors), which permits to order such actions in a sequence, then to link one effect to the other at certain intervals, according to a programme established by the operator. More evolved projectors have several available "channels" (up to 18 channels), that are used independently from each other, to make the control signals reach as many acting devices as possible. Therefore, for instance, it is possible to change the colouring of a light beam and at the same time to reduce or widen its opening angle. The programme comprises a series of controls that the lighting designer transmits to the projector through a console connected by cable. The projector receives and elaborates some signals codified according to standard protocols (the better known are described by the acronyms DMX512 and RS232). Once programmed, the appliance can perform its sequence of effects without any variation, in a perfectly identical way, for the desired number of cycles. The "intelligence" of the projector is based on the fact that it perceives the instructions and that it performs them faithfully. Instructions are memorized, this means that at every replica of the show the sequences are reproduced in an absolutely identical way, without any intervention on behalf of the operator.

Let us see now what are the ordinary light "manipulations". The quantity of light that comes out of the appliance is graduated by a device called "dimmer". It is a mechanic device, that is operated by a stepping motor, comprising a system of metal plates that act as a barrier more or less penetrable by the light rays. In this way it is possible to regulate the light in a continuous way, ensuring a good uniformity of the flux inside the beam, from 0% to 100%, of the quantity of light that is distributed by the lamp which consequently remains constantly switched on. The light sources that are used are high pressure metal halide discharge lamps. It is the only small-sized lamp, with an emission near to the punctiform model, that today can provide big quantities of luminous flux with a residual production of infrared radiations (thermal emissions) that is quite contained. It is important to remember that heat in a completely sealed body is the factor that must be kept under control to maintain the integrity and the good functioning of optical, electronic and mechanic parts. The rapid movement of the plates produces the strobe effect. In general the effect is also adjustable in terms of number of light flashes per each second. These usually range 1 to 7 flashes per second.

Colour is the soul of any scenographic effect. Moving head projectors adopt the colour creation system based on subtractive synthesis, that is by placing three dichroic filters one in front of the other, each filter with a fundamental colour: cyan, magenta and Yellow. By superposing the filters in a sequence it is possible to obtain a great variety of colours, but it is also possible to increase it by adding other coloured filters in a linear sequence.

From a strictly optical point of view the intelligent projector works like the classic slide projector. The light emitted by the light source is reflected by a spherical or ellipsoidal mirror cap towards a system of lens, which acts as an optic condenser, and subsequently focused by a lens. The optic characteristic of the lens determines the width of the light beam. The optic train comprehends all the optic accessories that control the effects: mechanic dimmer, fixed and interchangeable filters, interchangeable and rotating gobos, interchangeable and rotating prisms. The gobos are small semi-shielding plates that serve to project figures (images, silhouettes, shapes, brands, legends) on the focalized plans that intercept the light beam. The most elementary gobo comprises a simple engraved metal template: the projected shape plays upon the contrast between light and dark areas. More refined models are realized with dichroic glass (monochrome and multicolour gobos), or with photographic plates (shaded gobos and with a high degree of image definition). The

range offered today is very wide and the main manufacturers have at their disposal a service for the creation of personalized gobos. Gobos are used to realize the so called "graphic" system of the projector. Other elements that can be inserted in the optic train are prisms. They are built by combining together optic glasses or by processing a glass plate. They are used to alter the image produced in the light halo projected with its subdivision in parts or by multiplying the structural elements. Both gobos and prisms, as already mentioned, are interchangeable (always with the remote control system described above and the programming of sequences) and rotating in order to amplify the range of effects. Some models are equipped with the automatic change of the lens. In this way it is possible to modify rapidly the width of the beam. Another element permits the delimitation of such width. This element is called "iris" and works like the diaphragm of the camera, it is very useful especially in projectors that do not include the change of lens. Finally it is possible to use "frost" filters that have the task of shading the outline of the beam by increasing its width. They are used when ample areas need to be hit by the light.