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PHOTOELECTRIC SELECTING SYSTEM

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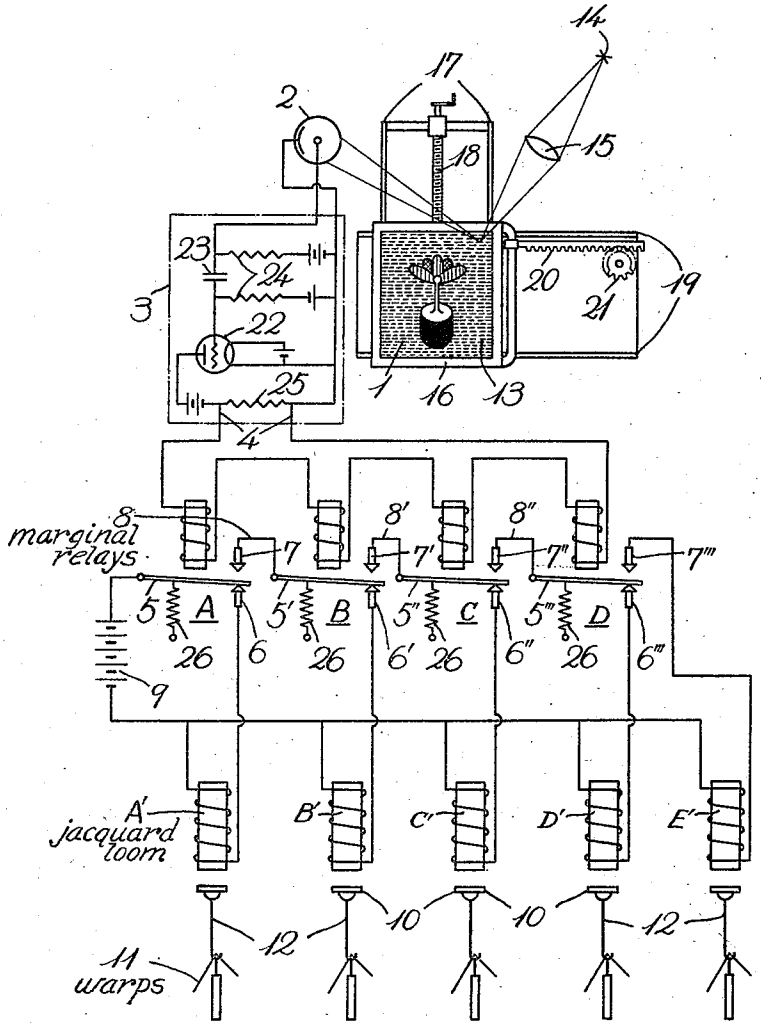

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PHOTOELECTRIC SELECTING SYSTEM

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My invention relates to a system for photoelectric selection and has for its object to provide a system for selectively operating a desired electromagnet of a group of electromagnets through the cooperation of a series of relays having successively varying current ratings determined in accordance with the photoelectric current corresponding to the differences in colour or shade value of objects or parts thereof.

The accompanying drawing illustrates an embodiment of the invention in which the figure is a diagrammatic view thereof applied to a special loom, such as an electric brocade weaving machine, for illustrating the manner of photoelectrically selecting colour threads corresponding to a desired design to be woven into cloth.

Referring in detail to the drawing, in order to obtain a coloured figure to be woven in a cloth a standard picture 1 may be drawn with black ink of different shade values corresponding to different colours. For example, the standard picture 1 may be so prepared that the portions thereof corresponding to red, violet, brown, blue and other colours are represented by deepest black, dull black and successively weaker shade values of black. 14 and 15 are a light source and a focusing lens respectively and these elements are arranged to focus the light from the former on the standard picture 1. 2 is a photoelectric tube arranged adjacent the standard picture 1 at a suitable distance therefrom, and the light reflected from every scanning point on the picture 1 is reflected upon the photoelectric tube 2. For this purpose, the standard picture 1 may be carried on a frame 16 which is moved back and forth along a pair of rails 17 by a leading screw 18, and the rails 17 are moved to-and-fro on the rails 19 by means of a suitable mechanism such as a rack 20 and a pinion 21. 3 represents generally a suitable amplifier for amplifying the photoelectric current produced in the photoelectric tube 2. That is, 22 is an amplifying vacuum valve the input circuit of which is connected across the terminals of the photoelectric tube 2 through a condenser 23. 24 designates high resistances in the input side, while 25 is a load resistance connected in the output side of the amplifying vacuum valve 22. It will be noted that the amplifier 3 used in connection with the photoelectric tube 2 does not constitute the main part of this invention, since it is known as disclosed, for an instance in the United States Patent No. 1,822,306, and well known by those skilled in the art.

A desired number of relays A, B, C, and D are connected to the output circuit of the amplifier. The coils of these relays are shown as connected successively in series, but it will be understood that they may be connected in parallel to attain the object of my invention. These relays have successively increasing or decreasing ratings of operating current, that is to say they are operated at successively varying predetermined current values by inserting, for instance, different resistances in the circuit of each of these relay coils or by changing the number of turns of the coil, or by varying the weight of the moving parts, carrying the tension of the spring 26 and also the effective air gap and the like. The relays are provided with armatures 5, 5', 5'', and 5''' which are normally closed on the contacts 6, 6', 6'', 6''', and are engageable with the normally open contacts 7, 7', 7'' and 7'''. The contacts 7, 7', 7'', and 7''' are connected to the succeeding armatures 5', 5'', and 5''' through leads 8, 8', and 8'' respectively. The normally closed contacts 6, 6', 6'', and 6''' and the open contact 7''' of the last relay D are connected respectively to one end of the coils of electromagnets A', B', C', D', and E' which are arranged to operate coloured threads, and the other ends of these magnet coils are connected in common to one pole of a battery 9, the other pole of which latter is connected with the armature 5 of the first relay. The movable armatures 10 of the electromagnets used for operating coloured threads are arranged to operate the hooks 12 which lift up necessary warps 11 to have colour threads woven in a cloth.

The operation of the above described arrangement is as follows:—The points on a horizontal dotted line 13 of the original picture 1 are successively scanned by reciprocating the picture itself along the line 13 by the operation of the leading screw 18 and the rack 20 and the light from each point on the picture 1 is reflected onto the photoelectric tube 2, the photoelectric current of the latter varying in accordance with the colour value of the point on the picture which is being scanned. Since the current is amplified by amplifying vacuum valve 22, the current corresponding to the colour or shade value of every spot on the original picture 1 flows through the output circuit 4 of the amplifying vacuum valve 22. As stated the relays A, B, C, D, are so chosen as to operate at successively larger predetermined current values.

Assuming that the current intensity corresponding to red, for example, operates the relay

A only, then the armature 5 is moved to close the contact 7 so that the circuit including the electromagnet B' will be completed through the normally closed contact 6' of the next relay B. Thus the electro-magnet B' will be energized to pull up its armature controlling the red thread which is to be woven in the cloth. At this moment the normally closed contact 6 of the relay A is opened so that no current flows in the circuit including the electromagnet A', thus it does not operate.

Next, if a stronger current corresponding to brown, for example, flows in the output circuit of the amplifying vacuum valve 22, the relays A and B will be operated simultaneously so that the armatures 5 and 5' contact with the fixed contacts 7 and 7' respectively, thereby the circuit of the electromagnet C' is energized to operate the brown thread. Since in this case the normally closed contacts 6 and 6' of the relays A and B are opened no current flows through the circuit including the electromagnets A' and B' so that these magnets are not operated. As long as the photoelectric current is less than the predetermined value, it is obvious that the contact 6 of the first relay A remains closed to maintain the electromagnet A' energized so that it is conveniently used to operate the thread 11 corresponding to the back-ground of the cloth. The other coloured threads may also be similarly controlled by the relays corresponding to the different current ratings in such a manner that only the relay having the maximum current rating of those operated is effective to operate the electromagnet for a desired colour thread, thus coloured figures corresponding to the original picture 1 may be automatically woven into the cloth.

If in the above example the electromagnets are arranged to act upon punching rods of a card cutting machine for a Jacquard loom, a card necessary to provide a coloured figure corresponding to the original picture 1 can be produced automatically and selectively in a manner similar to that above described.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. In a system for photoelectric selection, the combination of means for moving a plurality of articles having different colours in the scanning direction, means for projecting the scanning light on said articles, a photoelectric tube arranged to receive light from said articles, a plurality of relays having successively different current ratings connected in series with each other and in the output circuit of said photoelectric tube, an armature of each of said relays being connected to a normally open contact of the adjacent relay of lower current rating, and a plurality of electromagnets, one terminal of every operating coil of which being connected to a normally closed contact of said relay with the exception that one terminal of the last electromagnet coil is connected to a normally open contact of the last relay, and the other terminals of all the electromagnet coils being connected to one terminal of an electric source, the other terminal of which being connected to the armature of the first relay so as to connect said electromagnet coils in parallel with each other in the circuit of said electric source, the armature of said electromagnet being associated with an operating mechanism which picks up the desired article so that the photoelectric current produced corresponding to the colour of said article may be utilized to selectively operate the electro-magnet corresponding to the relay of maximum rating at the predetermined photoelectric current by the cooperation of contacts of said relay of lower rating, thereby picking up the armature with the desired article.

2. In a system for photoelectric selection, the combination of a standard picture drawn in different depth of basic colour to correspond with colours of objects to be selected according to the quality thereof, means for projecting the scanning light on said standard picture, means for moving said standard picture in the scanning direction, a plurality of relays of different current ratings connected in series with each other and in the output circuit of a photosensitive electrical device which is arranged to receive the ray reflected from the scanning surface of said standard picture, an armature of each of said relays being connected to a normally open contact of the adjacent relay of lower current rating, and a plurality of electromagnets, one terminal of every operating coil of which being connected to a normally closed contact of said relay with the exception that one terminal of the last electromagnet coil is connected to a normally open contact of the last relay, and the other terminals of all the electromagnet coils being connected to one terminal of an electric source, the other terminals of which being connected to the armature of the first relay so as to connect said electromagnet coils in parallel with each other in the circuit of said electric source, the armature of said electromagnet being associated with an operating mechanism which picks up the desired object so that the photoelectric current produced corresponding to the brightness of every scanning part of said standard picture may be utilized to selectively operate the electromagnet corresponding to the relay of the maximum rating at the predetermined photoelectric current by the co-operation of contacts of said relays of lower rating, thereby picking up the required object corresponding to the scanning part of said standard picture.

3. In a system for photoelectric selection, the combination of a standard picture drawn in different depth of basic color to correspond with a colorful design to be put on a cloth, a light projecting means consisting of a light source and a lens for projecting the scanning light on said picture, a photoelectric tube arranged to receive light from every point of said standard picture, means for moving said standard picture to one direction at the constant speed and cross-wise thereto by one pitch in the plane of said standard picture after the first mentioned movement is over, an amplifier of the photoelectric current connected to the output circuit of said photoelectric tube, a plurality of relays having successively varying current ratings connected in series with each other and in the output circuit of said amplifier, an armature of each of said relays being connected to a normally open contact of the adjacent relay of lower current rating, and a plurality of electromagnets, one terminal of every operating coil of which being connected to a normally closed contact of said relay with the exception that one terminal of the last electromagnet coil is connected to a normally open contact of the last relay, and the other terminals of all the electromagnet coils being connected to one terminal of an electric source, the other terminals of which being connected to the armature of the first relay so as to connect said electromagnet coils in parallel with each other in the circuit of said electric source, the armature of said electromagnet having a hook which holds a

warp arranged in a brocade loom to be woven into a cloth so that the photoelectric current produced corresponding to the brightness of every scanning point of said standard picture may be utilized to selectively operate the electromagnet corresponding to the relay of the maximum rating at the predetermined photoelectric current by the cooperation of contacts of said relays of lower rating, thereby picking up the armature with the required warp to be woven into the cloth corresponding to the scanning point of said standard picture.

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