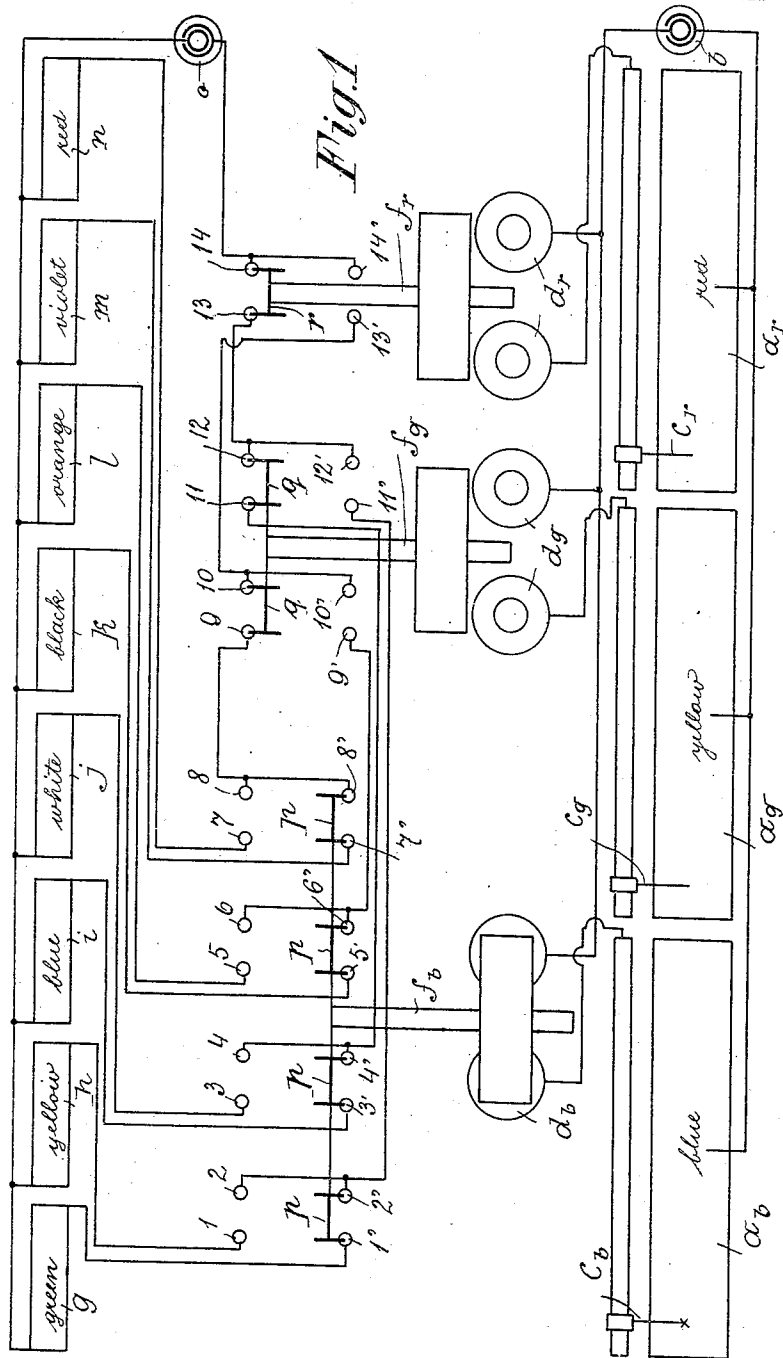


A. REGAL.
 MECHANISM FOR ELECTRICALLY OPERATING JACQUARDS WITHOUT PATTERN CARDS.
 APPLICATION FILED FEB. 1, 1909.

935,818.

Patented Oct. 5, 1909.

4 SHEETS—SHEET 1.



WITNESSES

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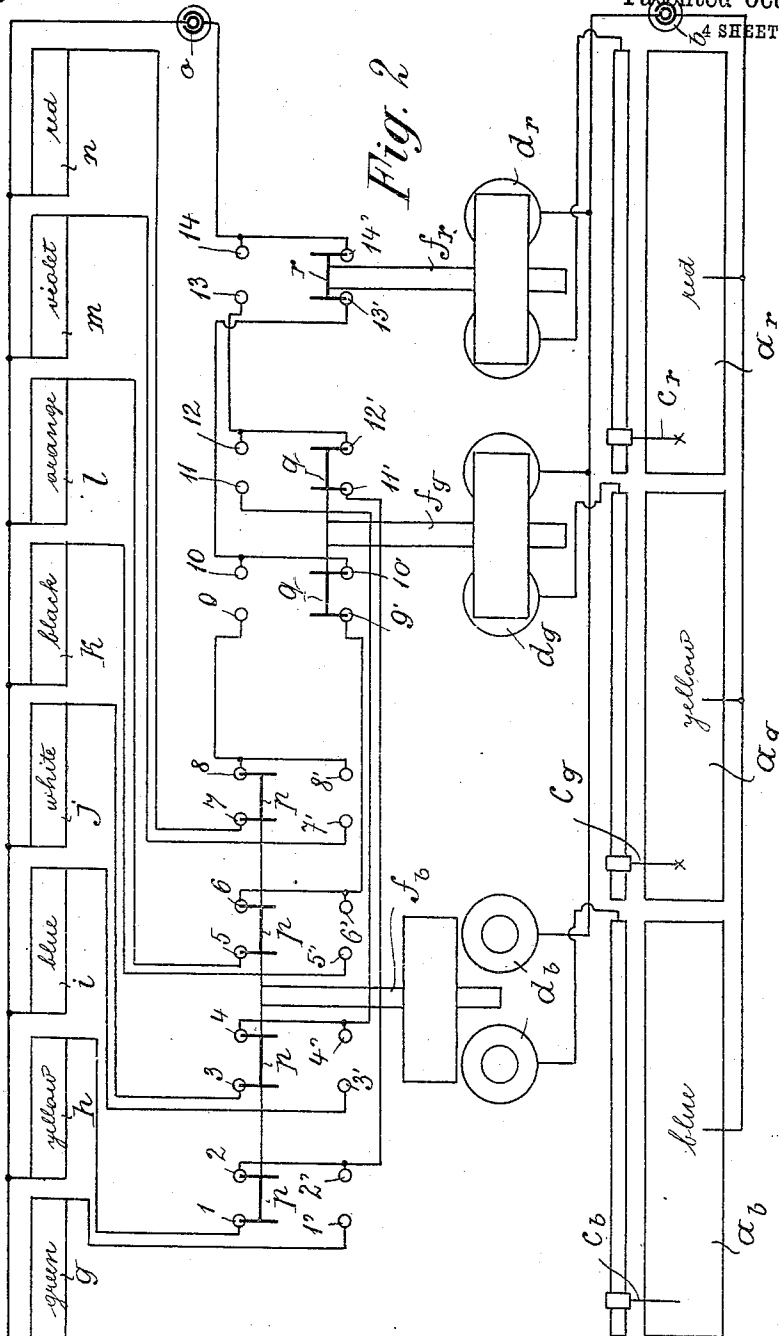
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4 SHEETS—SHEET 2.



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4 SHEETS—SHEET 3.

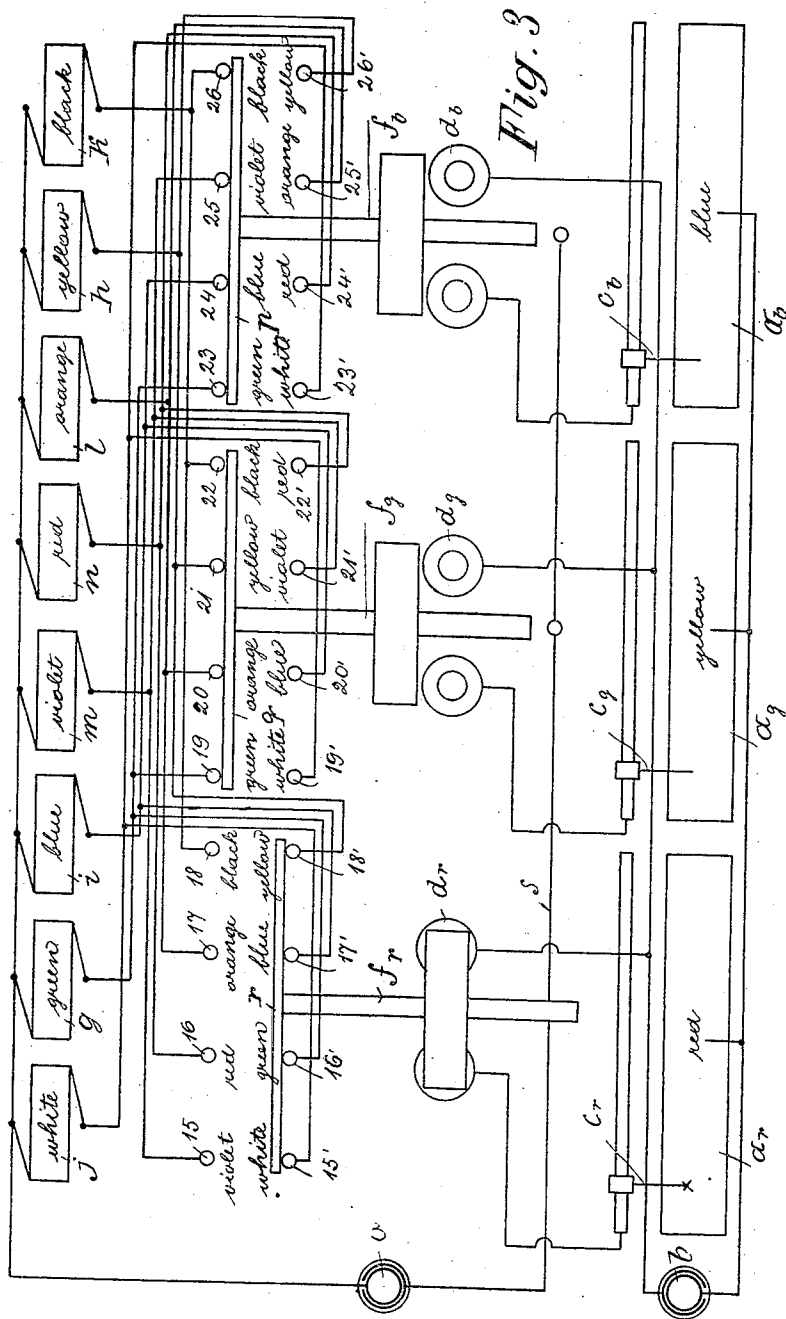


Fig. 3

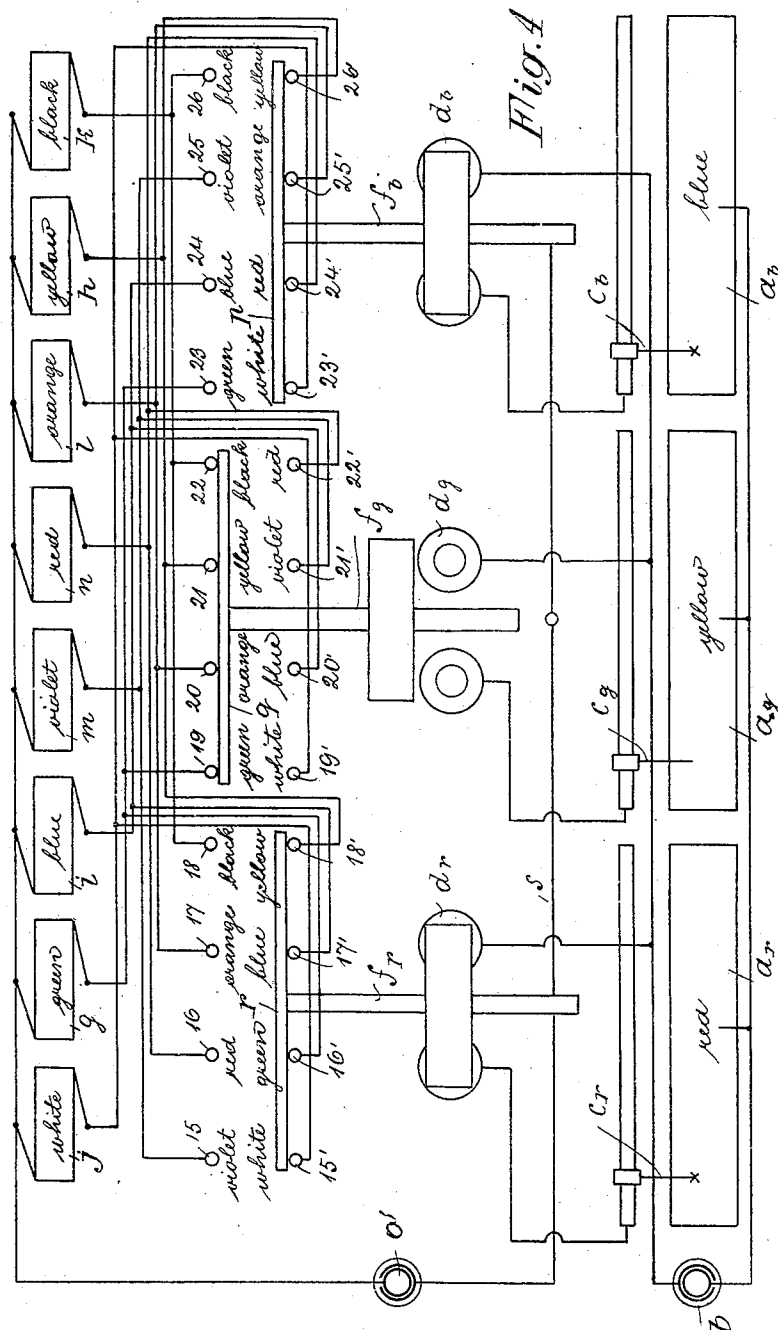
WITNESSES. ITZVETZTOR,
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4 SHEETS—SHEET 4.



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UNITED STATES PATENT OFFICE.

AUGUST REGAL, OF JÄGERNDORF, AUSTRIA-HUNGARY.

MECHANISM FOR ELECTRICALLY OPERATING JACQUARDS WITHOUT PATTERN-CARDS.

935,818.

Specification of Letters Patent.

Patented Oct. 5, 1909.

Application filed February 1, 1909. Serial No. 475,364.

To all whom it may concern:

Be it known that I, AUGUST REGAL, professor, a subject of the Emperor of Austria-Hungary, and resident of Jägerndorf, in the crownland of Silesia, Empire of Austria-Hungary, have invented new and useful Improvements in and Relating to Mechanism for Electrically Operating Jacquards Without Pattern-Cards, of which the following is a specification.

This invention relates to mechanism for electrically operating jacquard machines and it consists in certain improvements appertaining to the subjects-matter of my Letters Patent of the United States Nos. 873,683 and 874,370.

For producing the partial color negatives, partial negatives of the article to be reproduced are obtained by the process used in three-color printing, by a photographic process, in the three single colors red, yellow and blue, by the use of light filters, and from the said negatives single color partial positives are printed by the well-known chromate process on three plates of insulating material covered with metal by an electrolytic process. The dark or non-exposed portions of the partial pictures, after the plates are washed and slightly etched, are electrically conducting, while the light or exposed portions remain covered with chromium oxid gelatin, that is to say, are not conducting. From the said plates are produced patterns on drums for the partial pictures, the said patterns being used simultaneously in the device in question. As already stated, in addition to the warp threads of the three primary colors, red, yellow and blue, there are also provided warp threads in orange, violet, green (each being a combination of two colors) black and white (combinations of all the three colors) so that there are eight warp threads for weaving the pattern. The lifting wires of each longitudinal series of the jacquard machine used for carrying out the process, are connected to one of the eight warps, thus for instance, the first longitudinal row to the red, the second to the yellow and the third to the blue warp threads. The fourth longitudinal row supports the orange, the fifth the violet, the sixth the green, the seventh the black and the eighth the white warp threads.

This invention relates to a relay by means of which the electric jacquard machine can

be controlled in the manner required for carrying out the process.

To that end, the electric patterns or cards are connected to a source of current, into the circuit of which are switched contact pins or studs in contact with the patterns, the said contact studs, according as they are in contact with the conducting or non-conducting portions of the pattern card, closing or opening the circuit of the source of current. Into the said circuit are also switched electromagnets of the jacquard machine, the number of which corresponds to the number of lifting wires to be controlled. The electromagnets act on armatures which are attracted on the electromagnets being excited. To the armatures are secured tension cord connected to the needles controlling the hooked wires. The said tension cords could also be connected directly to the heddles of the warp threads, so that the electromagnets, on being excited would act directly on the warp threads.

The relay is shown in two different positions in Figures 1 and 2 of the accompanying drawing, it being assumed for this construction that the electromagnets control the heddles or leashes of the warp threads directly. Figs. 3 and 4 show another construction of the relay in the case in which the electromagnets control the needles of the lifting wires only.

In the construction of the relay shown in Figs. 1 and 2, the electromagnets of the jacquard machine control the leashes or heddles of the warp threads, so that those electromagnets must be excited which are to raise the warp threads. The pattern cards for the partial picture, negatives a^b for the blue, a^y for the yellow and a^r for the red partial picture, are switched into the same circuit with the source of current b , the contact studs c^b c^y and c^r , as well as with the electromagnets d^b d^y d^r . The electromagnets d^b d^y d^r are provided with armatures f^b f^y or f^r which carry at the ends contact bridges for connecting together the contacts provided. The series of electromagnets for the single warp threads are diagrammatically indicated in the connection diagrams of Figs. 1 and 2, each by one electromagnet g , h , to n . Opposite the electromagnet armature f^b there are 16 contacts 1—8 and 1'—8' arranged in two superposed rows of eight contacts each. Opposite the electro-

magnet armature f^s there are eight contacts arranged in two rows of four contacts each, 9—12 and 9'—12'. Four contacts in two rows of two contacts each 13 14 and 13' 14' are arranged opposite the electromagnet armatures f^r . The electromagnets g of the green warp threads are connected to the contact 1', the electromagnets h of the yellow warp threads to the contact 1. The electromagnets i of the blue warp threads are connected to the contact 3', the electromagnets j of the white warp threads to the contact 3, the electromagnets k of the black warp threads are connected to the contact 5', and the electromagnets l of the orange color warp threads to the contact 5. The electromagnets m of the violet warp threads are connected to the contact 7', and the electromagnets n of the red warp threads to the contact 7. The contact 2 is connected to the contact 2' below it and to the contact 11' of the second electromagnet. From the contact 4 a conductor leads to the contact 4' and further to the contact 11. The contact 6 is connected to the contact 6' and to the contact 9', and the contact 8 is connected to the contact 8' and to the contact 9. The contact 10' is connected to the contact 10 and to the contact 13', and the contact 12' to the contact 12 and further to the contact 13 by means of a wire. In the same way the contacts 14' and 14 are connected to each other and to the source of current o .

Fig. 1 shows the position of the single parts when the contact stud c^b of the pattern card a^b for the blue partial picture, touches a conducting point, while the remaining contact pins c^s and c^r touch non-conducting points of their pattern cards. This is the case when the corresponding point of the original to be reproduced in the woven fabric, is a blue point. Accordingly a blue point must appear in the fabric at the point corresponding to the same point in the original, that is to say, a thread of the blue series or group of warp threads must be raised. In that case only the electromagnet d^b is switched into the circuit of the source of current b , and the armature f^b of the said electromagnet is attracted. In that way the contact bridge p arranged on the armature f^b is brought from its position of rest in which the contact pins of the bridge were touching the contacts of the upper contact row 1, into the lowest position in which the contact pins of the bridge p connect together the single contact pairs of the lowest contact row 1'—8'. The armatures f^s and f^r of the electromagnets d^s and d^r remain in their position of rest in which the contact pins of the contact bridges q and r touch the contacts of the upper contact rows. In that case, as shown in the connection diagram in Fig. 1, only the electromagnets i for the blue warp threads are switched into the circuit

of the source of current o , so that only a blue warp thread can be lifted out. All the other electromagnets for the other warps are on the contrary switched out of the circuit.

In Fig. 2 it is assumed that the contact pin c^b of the pattern a^b of the blue partial picture strikes a non-conducting point, while the contact pins or studs c^s and c^r of the patterns a^s and a^r of the yellow or red partial picture, are in contact with conducting points. That will be the case when the point of the original, corresponding to the conducting points of the partial pictures, is of an orange color. Accordingly it is necessary to lift out in the fabric an orange colored warp thread, so that the electromagnets for the orange colored group of warp threads must be excited. As the studs c^s and c^r are in contact with conducting points of the pattern, that is to say, are switched into the circuit of the source of current o , the electromagnets d^s and d^r are excited and their armatures f^s and f^r attracted. The bridges q and r thus move from their upper position into the lowest position, in which the contact studs of the bridges connect each two adjoining contacts: 9' and 10', 11' and 12', 13' and 14'. The bridge p of the electromagnet armature f^b remains in its normal position, in which the contact pins of the bridge touch the contacts of the upper row of contacts and connect the single pairs of contacts together. On the operation of the relay the electromagnets l for the orange colored warp threads are switched into the circuit of the source of current o , while the electromagnets of all other warps are switched out from the circuit, as clearly shown in the connection diagram. For that reason, only the electromagnets for the orange colored warp threads are excited, and only such a thread can be lifted.

When none of the contact studs engage a conducting point of the partial picture patterns a^b a^s a^r , which is the case when in the original picture there is a white point, all the contact bridges p , q and r of the armatures of the magnets remain in their upper position, and all the electromagnets except those for the white warp threads, are switched out of the circuit, so that the electromagnetic lifting device lifts a white thread. If, on the contrary, all the three studs touch conducting points of the patterns for the partial pictures, which is the case when in the original of the partial pictures, there is a black point, all the three contact bridges p , q , r will be brought into their lowest position, as all the three electromagnets d^b d^s d^r are switched into the circuit of the source of current o , and consequently their armatures are attracted. All the electromagnets except those for the black warp threads are then switched out of the

circuit of the source of current o , so that a black warp thread must be lifted out.

The connection of the relay shown in Figs. 1 and 2, correspond as already stated, to the case in which the electromagnets of the jacquard machine act directly on the heddles or leashes of the warp threads. If, however, the electromagnets act on the needles of the hooked wires, it will be necessary to use the connection shown in Figs. 3 and 4. In that case the electromagnet of the thread to be lifted, must not be excited in order that the hooked wire should not be drawn away from its knife or griff, but should remain on the same, so that it may be raised when the latter is moved upward. On the contrary, all the electromagnets of the threads which must not be lifted out, must be excited, in order that the needles of the corresponding hooked wires should be shifted and the said wires drawn away from the knives or griffs, that is to say, not raised. The process in this case must, therefore, be exactly the reverse of that for the electromagnet connection hereinbefore described. If, for instance, a red point is to appear in the woven fabric, that is to say, a red warp thread must be lifted, then, although the contact pin for the red partial picture touches a conducting point, the electromagnets of the red series of warp threads must not be switched into the circuit, while the electromagnets of all other warps must be switched into the circuit. The patterns a^b a^s and a^r for the partial pictures, in this case as well, are switched into one and the same circuit with the source of current b , the contact pins c^b c^s and c^r and the electromagnets d^b d^s and d^r of the relay, the armatures f^b f^s and f^r of the electromagnets d^b d^s and d^r carry contact bridges p q r and slide with their free ends on a contact bar s switched into the circuit of the source of current o together with the electromagnets g n for the single series of colored warp threads. Opposite each of the electromagnet armatures are arranged contacts in two rows of four contacts each. The contacts 15-18 and 15'-18' correspond to the electromagnet armature f^r , the contacts 19-22 and 19'-22' to the electromagnet armature f^s and the contacts 23-26 and 23'-26' to the electromagnet armature f^b . When the electromagnets d^b d^s and d^r are not excited, the contact bridges p q r are in their upper position in which the contacts of the upper row of contact points are electrically connected together. If, however, the electromagnets d^b d^s and d^r are excited and the armatures f^b f^s and f^r attracted, the bridges p q r will be brought into their lowest position in which the contacts of the lowest contact rows are electrically connected together. At the same time the ends of the armatures f^b f^s and f^r slide on the contact bar s , so that the contact bridges p q r are switched into the circuit of

the source of current. The electromagnets j for the white warp threads are connected to each first contact of the lowest contact rows, that is to say, to the contacts 15' 19' 23', and the electromagnets g of the green warp threads—to the contacts 16' 19 and 23. The electromagnets i of the blue warp threads are connected to the contacts 17' 20' and 24, and the electromagnets m of the violet warp threads to the contacts 15, 21' and 25. The electromagnets n of the red warp threads are connected to the contacts 16' 22' and 24', and the electromagnets l of the orange colored warp threads to the electromagnets 17, 20 and 25'. From the electromagnets h of the yellow warp threads, wires lead to the contacts 18' 21 and 26', and from the electromagnets k of the black warp threads, wires lead to the contacts 18, 22 and 26. All the eight contacts of each of the electromagnets, d^b d^s and d^r are therefore connected to all the electromagnets of the single series of warp threads, the sequence of the connections being a different one in each group of contacts.

The connection diagram shown in Fig. 3 is used in the case in which there is a red point in the original of the picture to be woven in natural colors. In that case the contact pin c^r strikes a conducting point of its pattern a^r , while the contact pins c^b and c^s do not touch any conducting points of the partial picture patterns. The electromagnet d^r is, therefore, excited, and its armature f^r with the ridge r attracted, so that the bridge connects together the contacts 15' 16' 17 and 18' of the lower row of contacts. The bridges p and q remain in their normal position in which they connect together the contacts of the corresponding upper contact rows. In that position of the contact bridges p q r all the electromagnets for the single series of warp threads are switched into the circuit of the source of current o , only the electromagnets n of the red warp threads being switched out. All the electromagnets except those of the red warp threads are, therefore, excited and move the lifting wires out of the path of the knives or griffs so that they are not raised. Only the lifting wire for a red warp thread is not affected and is therefore, carried by the knife or griff, whereby the raising of a red warp thread is brought about.

Fig. 4 shows the position of the single portions of the relay when the contact pins c^r c^b of the patterns for the red and blue partial picture, strike conducting points, which is the case when the point in the original to which correspond the points in the partial picture patterns, is of violet color. By switching the contact pins c^r and c^b into the circuit of the source of current b , the electromagnets d^b and d^r are excited, and their armatures with the contact bridges p and r attracted, while the contact bridge

5 *q* remains in its normal position. In that way all the electromagnets for the single groups of warp threads with the exception of the electromagnets *m* for the violet warp,
 10 are switched into the circuit of the source of current *o*, so that all the electromagnets, except those for the violet warp threads, are excited, and therefore only a violet thread is raised. If none of the contact pins *c^r* *c^s*
 15 and *c^b* strikes a conducting point of the partial picture pattern, all the contact bridges remain in their upper position, and all the electromagnets except the electromagnets *j* for the white warp, are switched into the circuit. A white warp thread is accord-
 20 ingly raised by the electromagnetic raising device into the upper shed. If, on the contrary, all the three contact pins *c^r* *c^s* and *c^b* strike conducting points of their partial picture patterns, all the electromagnets *d^b* *d^s* and *d^r*
 25 of the relay are excited, and the contact bridges *p q r* moved downward and thus the contacts of the lower contact rows connected. In that way all the electromagnets, except
 30 those *k* for the black warp threads, are switched into the circuit of the source of current, and accordingly a black warp thread is raised into the upper shed. With the assistance of the relay described, which is distinguished by great simplicity and reliability of action, as it only has three elec-

tromagnets, it is, therefore possible to produce woven pictures in natural colors.

Having now particularly described and ascertained the nature of my said invention 35 and in what manner the same is to be performed, I declare that what I claim is:

In an electro-magnetic jacquard mechanism, the combination of devices having portions of their surfaces electro-conductive and 40 other portions electro-non-conductive, contacts respectively engaging said devices, each device and contact being movable the one relatively to the other, an electro-magnetic switch corresponding to each device and its 45 contact, a series of electro-magnets, a branched circuit connection having one of said devices, its contact and switch in each branch thereof, another branched circuit connection having one of the electro-magnets 50 in each branch thereof and having its branches controlled by said switches, and means for energizing said circuit connections, substantially as described.

In testimony whereof I have signed my 55 name to this specification in the presence of two subscribing witnesses.

AUGUST REGAL.

Witnesses:

GERON WOLFE,

ROBERT W. HEINGARTNER.