To all whom it may concern:

Be it known that GEORGE W. ROBERTSON and WILLIAM T. HOGG, citizens of the United States, residing in Danville, Pittsylvania County, Virginia; EDWARD T. GARSED, a citizen of the United States, residing in Charlotte, Mecklenburg County, North Carolina, did, in connection with WILLIAM G. BENEFIELD, formerly a citizen of the United States, residing in Danville, Pittsylvania Co., Virginia, but now deceased, during his lifetime, invent certain improvements in Warp-Dyeing Machines, of which the following is a specification.

This invention relates to warp dyeing machines and particularly to those employed in indigo-dyeing, and the object of the invention is to provide means whereby the warps may be passed directly from one machine to another without the necessity for an intermediate balling.

The common system of warp dyeing comprises a series of distinct and entirely independent operations. In each operation the warps are taken from their balls, passed through the washing or indigo tank, as the case may be, and then reballed. The usual process consists of a washing operation, a dyeing operation, a second dyeing or a series of dyeings, and a final washing operation, in the order named, and as has been already indicated each operation entails the unballing and reballing of the warps, while the whole process entails the transfer of the balled warps from one machine to another for each successive operation.

We have discovered a means whereby the warps may be passed directly from one machine to another, which eliminates the necessity for intermediate re-ball and transfer of the balls from one machine to another, and creates a saving in time and labor and increases the general efficiency of the entire process.

In the attached drawings:

Figure 1 is a diagrammatic view indicating in side elevation a machine for boiling and cooling the warps and the warps passing therethrough in the primary washing or boiling and cooling operation;

Fig. 2 is a diagrammatic view and a continuation of Fig. 1 indicating in side elevation an indigo vat with the warps passing therethrough from the boiling and cooling machine in the primary dyeing operation, and also the compensator through which the warps pass intermediate the two machines; Fig. 3 is a perspective of the compensator; Fig. 4 is a vertical section of the compensator carriage; and Fig. 5 is a perspective showing certain of the details of the carriage.

With reference to the drawings, 1 represents a tank having two compartments 5 and 6 containing in the present instance hot and cold water respectively; 2 is an indigo tank; and 3 and 4 are sets of balling attachments located opposite the tanks 1 and 2 respectively. In the usual system, the grey warps are taken from the balls, 5, upon the attachments, 3, and passed through the two compartments, 1 and 2, of the boiling and cooling tank 1, after which they are re-balled upon a set of balling attachments, not shown, which are located upon the side of the tank 1, which is opposite the attachments 3. These balls of boiled and cooled warps are then transferred to a set of balling attachments, also not shown, which are located near the indigo tank, 2, and the warps are unwound from these balls, passed through the tank, 2, and again re-balled upon the attachments, 4. These two operations represent one-half of the normal process, the remaining two operations being identical with the first two, only in reverse order. This process is readily understood by those acquainted with the art.

In the present instance, we have shown the warps, after passing from the balls, 5, through the two-compartment boiling and cooling tank, 1, passing directly to the indigo tank, 2, through which they pass to be re-balled upon the attachments, 4. The warps in passing between the tanks, 1 and 2, are preferably supported upon and guided by overhead racks, 6, of suitable construction.

It will be understood that each tank, together with the sets of balling attachments belonging thereto, constitutes a complete and independent machine, the rollers upon the balling attachments and those located
upon the tank which carry the warps there-through being operated from a single and usually independent source of power. It is impossible, because of belt slippage and various other ungovernable factors, to operate these separate machines at the same and constant rate of speed which would be necessary, were the warps passed direct from one machine to another, to avoid breaking or straining the warps or developing undue slack.

We have discovered a means whereby the variance in the operating speeds of these machines may be compensated, so that the warps may be passed direct from one machine to another without fear of breakage or of the development of undue slack. This compensating means takes the form in the present instance of the compensator, 7, shown in Figs. 2 and 3, through which the warps pass in their journey from one of the tanks or machines to another. In the present instance the compensator is located between the boiling and cooling tank, 1, and the indigo tank, 2, and the warps pass through the combined machines in the direction indicated by the arrows.

The embodiment of the compensator illustrated herein, comprises a frame consisting of two uprights, 8, connected at their tops by a cross brace, 9. At each end of the brace, 9, is a laterally extending beam, 10, and journaled in the extremities of these beams, 10, and extending therebetween are rollers, 11 and 12. Adapted to travel vertically between the uprights, 8, is a carriage 13, said carriage comprising wheels or spools, 14, at each side, which rest against the uprights, 8, and rollers 15 and 16, one at each side of the carriage body as clearly shown in Figs. 3 and 4. There are also upon the carriage guide niches, 17, located above the roll, 15, and apertures, 18, in the carriage body between the two rolls. Cords, 19, attached to the carriage body at each side, extend over pulleys 20 upon the top of the frame, and have counter balance weights 21 attached to the other extremities thereof.

The warps in passing through the compensator, pass over the rollers, 11 and 12, under the rollers, 15 and 16, and through the guides, 17, and apertures, 18. The carriage is supported by the warps and the weights, 21, counter balance the weight of the carriage so that the strain on the warps is not excessive.

The operation of this device is as follows:

For illustrative purposes we will say that the boiling and cooling tank operates at a generally faster rate of speed than the indigo vat, this being usually the case, and the warps as a consequence pass more rapidly through the tank, 1, than through the tank, 2. Since the warps, in the present instance, are shown passing from the tank, 1, to the vat, 2, it is obvious that between the two there will be a constant development of slack, which, were it allowed to continue, would soon necessitate the halting of the operations. In starting the machines, however, the warps are stretched tight between the tank, 1, and vat, 2, and through the compensator, 7, the carriage, 13, being carried to the top of the frame. As the machines now operate, the slack developing between the two is taken up by the dropping of the carriage, 13, which keeps the warps always taut. When, now, the carriage, 13, reaches a point close to the floor, the machinery operating the tank, 1, is shut down, the warps, however, still being carried through the vat, 2, by the machinery operating the same, and the result is the tautening of the warps between the machines and the re-lifting of the carriage 13 to the elevated position. When the carriage reaches the top of the frame the machinery of tank 1, is again started and the cycle repeated. The boiling and cooling machine may be shut down by hand of the operator, or by any other means, as for example automatically by use of electricity or mechanically. Should the same tanks, 1 and 2, be employed for the second and succeeding operations of the process which, as has already been described, involves the passing of the warps first through the indigo vat and thence to the tank 1, it is apparent that since the warps are pulled through the tank, 1, more rapidly than through the indigo vat, 2, there will be a tendency to stretch and break them. In overcoming this tendency the carriage 13, at the start is left in the low position, instead of elevated as in the other case, and as this slack in the warps is taken up by the more rapidly operating washing machine, the carriage, 13, will be lifted, until when it reaches the top of the frame the machinery of tank 1, is shut down. The carriage will then return to the bottom of the frame as the warps continue to pass through the vat, 2, and when the low position is reached the machinery of the tank, 1, again is started and this cycle repeated.

Thus, it is possible with the use of this device to combine any two machines to form one continuous operation of what heretofore was two separate operations, and the saving in time and labor is obvious. It is also apparent that the invention, without departure from the essential features thereof, is capable of numerous embodiments and modifications.

We claim:

1. The method of feeding warps for dyeing purposes, which consists in passing the warps through a treatment tank, then passing the warps through a compensating mechanism to collect and refeed any slack in the warp, and finally passing the warps
through a second treatment tank operated at a different speed than the first mentioned tank.

2. The method of dyeing warps, which consists in passing the warps through a boiling tank, then through a cooling tank, then through a compensator mechanism to collect and refeed any slack in the warp, and then to a dyeing tank operated at a different speed than the first mentioned tanks.

3. The process of dyeing warp which consists in boiling and cooling the warp, then progressively passing the warps without reballooning a compensator mechanism to regulate the tension of the moving warps, and then progressively feeding said warps from said mechanism to means for imparting a color treatment to the warps.

4. The method of dyeing warps, which consists in progressively passing the warps through a boiling and cooling tank, then through a tensioning compensator, then through a dyeing tank, then through a second tensioning compensator, and finally to a further boiling and cooling tank to effect a continuous feed of the warp during the dyeing operation.

In witness whereof, the said GEORGE W. ROBERTSON, WILLIAM T. HOGG, EDWARD T. GARSED, and J. D. HARRISON, administrator of the estate of WILLIAM G. BENEFIELD, deceased, have hereunto set their hands.

GEORGE W. ROBERTSON.
WILLIAM T. HOGG.
EDW. T. GARSED.
J. D. HARRISON,
Administrator of the estate of William G. Benefield, deceased.