The present invention is a machine for the careful removal of excess color media from the coated face of an emulsion having images thereon made by exposure, in an original negative, to selected color waves. In such an emulsion on a picture strip the image lies in a depression below the outer plane of the emulsion, and this depression may be filled by a color coat of the same color as the actinic waves and colored pictures may be projected from the so-colored image if it is carefully defined by removal of any excess on the face of the emulsion beyond the image confines.

If a double emulsion picture strip or film has been produced in two colors and the images are photographically registered the images may be projected as a composite in relative colors if of the same colors as the original subject. It is practical to coat each emulsion all over the frame area and to exclude color coat from the sound track if present.

Therefore this invention has for an object to provide a simple, reliable, efficient, high capacity, high output, high production, and non-injurious film-running machine having provision for the gradual or fractional removal of such part of the color coat on a presented film emulsion as may be desirable. Also an object is to provide means for constantly automatically controlling the coat removing function of relative elements of the machine and which means is itself, under control of the film strip being processed.

The invention consists of certain advancements in this art as set forth in the ensuing disclosure and having, with the above, additional objects and advantages as hereinafter developed, and whose construction, combination and details of features and means, the method of processing, and the general mode of use, operation and/or function will be made manifest in the description of the annexed, illustrative apparatus, it being understood that modifications, variations, and adaptations may be resorted to within the scope, principle and spirit of the invention as it is more directly pointed out in the subjoined claims.

Figs. 1A and 1B, (Sheets 1 and 2) constitute a broken, diagrammatic plan of the machine.

Figs. 2A and 2B (Sheets 3 and 4) constitute a diagrammatic, broken side elevation of the machine; the latter figure on a slightly smaller scale than the former.

Fig. 3 is a fragmentary detail of a part of the first platen wheel and one of a series of processing or sizing wheels, and its sprocket or pilot wheel.

Fig. 4 is a rear face elevation of a swinging bearing frame or box of a processing wheel and its pilot wheel.

Fig. 5 is a sectional detail of one of a series of direction idlers. Fig. 6 is a sectional plan of the assembly mechanism of a processing wheel, and Fig. 7 is an end view of the assembly. Fig. 8 is an elevation of the eccentric trunnion of one of the pilot wheels.

For high speed production the machine includes parallel frame fabrications 2 and 2A carrying respective processing trains 2B and 2B'; the former for treating, say, a red-coated emulsion on a motion picture film strip F having two running bights under constant control of the mechanisms of the trains, as will be explained. The train 2B is for treating, say, the blue coated side of an emulsion on a double emulsion film; that is having an emulsion on each side. The two trains 2B and 2B' are cross-connected, right and left hand, duplexes and operate concurrently, one on one coated side and the other on the other coated side of the film.

The red side of the film passes from a dryer D of any suitable type, to the first platen wheel 4 which is fixed on a frame mounted shaft 5 being driven at a speed of about 200 revolutions per minute by a transmission 6 from a main shaft 7 which is preferably driven for time purposes by a transmission 8 from the dryer D in which the red coated film is dried.

The rim of the wheel 4 is channeled, Fig. 3, to provide spaced, true tracks 4a between beads 4b between which the film is closely guided as it runs onto and is carried around on the platen-forming tracks 4c which lie under only the margins of the film; the red-coated side of which is presented outward. The tracks 4a project beyond intervening wheel face 4d so that the inner face of the film and the image emulsion thereon are protected. Fig. 3 shows a film whose emulsion E leaves uncovered the side margins and also shows a sound track zone at S which is to be protected.

The red-coated emulsion E is thus supported outward on the first wheel 4 and is carried down under the lower portion of the wheel and in such transit is subjected to the action of a plurality of processing wheels 10, Fig. 2B, each having plain rims 11 of a width equal to that of the usual "frame" width of a 35 mm. motion picture film, Fig. 5. These wheels 10 are each included in respective assembly mechanisms A which are suitably attached to the outer wall of an inverted-arch housing H, on its frame 2.

There are several other processing wheel assemblies A, in the duplex trains of this machine,
which are substantially identical and the following description of that shown in Figs. 4, 6, 7 and 8, will suffice for all excepting as later disclosed to differentiate types of process wheels. Each assembly A includes a frame bracket 12 suitably secured to a main frame part, as H, and supporting as in ball bearings 13 a shaft 14 on whose inner end is attached a transmission pulley or wheel 15 having a drive connection 15' to the next assembly A for concurrent drive of the relative series of wheels 10.

Pivoted mounted as on ball bearing 16, on shaft 14, is a swinging box or arm 17 having a medially disposed, cross-shaft 18 in suitable bearings 19 and the respective processing wheel (10 or other type) is fixed on this shaft 18 which is driven by pulley 20 and connection 21 from a pulley 22 fixed on the driven shaft 14.

It is important that the several processing wheels (10 or other) be very accurate and carefully adjustable so that each may do its intended and adjustable amount of coat removing regardless as to such variation of the thickness of the film P as is almost inevitable. For this reason each box arm 17, of the assemblies A, is provided with a gage or pilot pinion 25 having a tracking rim or bead 26 arranged so as to engage and run on the adjacent margin of the film P, Fig. 3. The pinion 25 is suitably and accurately rotative on a trunnion 30, Fig. 8, having an eccentric body 27 as to a stem 28 which is turnably mounted in its bearing part 29 of one side of its box arm 17.

A suitable setting lever 30 is fixed on a screw part 31 of the trunnion 27 and by the lever the trunnion may be turned in its own bearing 29 so that the relation of the pilot pinion 25 as to its box arm 17 may be very carefully set along an index segment 32 fixed on the box arm, Figs. 4, 6 and 7. Since the arm 17 is pivoted on the shaft 14 it will be seen that the outer end of the arm 17 and its processing wheel (10 or other) can be precisely set toward or from the emulsion face being processed. Therefore, each processing wheel may be gaged to remove a minute fraction of the adjacent color coat on the emulsion face. Each assembly box 17 is drawn toward the relative platen wheel (as 4) by suitable means, such as a tension spring 33, only one of which is shown at Fig. 2B.

The several wheels 10 are driven at a speed of about 1100 revolutions per minute and the paint shafts 14 and their train of drive connections 15—15' are motivated by a transmission 14' from main shaft 7.

If desired, a thin layer of a suitable liquid or solution may be applied to the sizing wheels 10 from relative fountains 35, only one of which is here shown at Fig. 2B.

From platen wheel 4 the partially processed film F passes to horizontal-axes, free, guide roller 37 and thence horizontally to a guide roller 38, Fig. 2A, whence it bends down and is marginally supported by a second platen wheel 40 fixed on a shaft 41 mounted on frame 2 and having a drive pulley 42 for connection 43 engaging a drive wheel 44 on a cross-shaft 45, Fig. 1B, which takes power by suitable transmission 46 from main shaft 7. Drive wheel 44 has a suitable slip clutch connection 44' on shaft 45.

Fixed to the frame part, at the platen wheel 40, is a second, inverted-arch housing 46 and on the outer side face of this there is mounted another series of sizing wheel assemblies A (indicated only diagrammatically) each having a smooth-face wheel 10' fixed to its respective shaft 18, each of which has a drive means in the same assembly combination as set forth with respect to Figs. 6—7; the several wheels 10' are 14' mounted in the housing 46 being driven by a transmission train taking power by way of transmission 47, Fig. 1B, from shaft 45. It is understood that the sizing wheels 10' are very carefully adjusted by their pilot pinions 45', in like manner as pinions 25, to each remove the desired amount of red coating presented by the outer face of the continuous film F in transit on the relative platen 40.

The two sets of sizing wheels 18—18' reduce the coat to desired thinness and the film enters to a horizontal axis guide roller 49 and like roller 49' and thence to the lower portion of a third-platen wheel 50 having a shaft 51 mounted on frame 2 and driven by a transmission 52 from a slip clutch wheel 53, Fig. 1A on a shaft 54 having a drive connection 55 to shaft 45, Fig. 1B.

The film F, red side out, is carried to the top of the platen wheel 50 and in this orbit is subjected to the action of a first series of buffing wheels 56 each having an assembly (A) as above described, and which is fixed to an upright 57 on frame 2. Each assembly of the buffing wheels 56 includes a pivot shaft 58 and these have a drive train, as (15—15') concealed in the housing 51 and actuated by a transmission 59 from cross-shaft 45. The effective size of the wheels 56 are preferably provided with a renewable or changeable band 56a of suitable buffing material; felt for instance, whose contact with the red coat face is gaged by the relative pivot wheel of the assembly (A). 35

From the top of the platen wheel 50 the film F passes under a guide roller 60, Fig. 2A, and to roller 61 which is arranged close to platen 40 and just above roller 49. The film is now carried, still red side up or outward, by the top half of the wheel 40 and is subjected to a further dressing or polishing process by action of a series of polishing wheels 62 of appropriate embodiment. These wheels are incorporated in respective assemblies A mounted on the side face of a respective arched housing 63 fixed on frame part 1; the film is carried out or contact of the polishing wheels 62 being regulated by the relative pivot wheels, as set forth for pinions 25. The pivot shafts of the assemblies of wheels 62 are train connected (as 15—15'*, Fig. 6) and take power by a drive connection 64 from shaft 45. The red coated side of the film, now having been subjected to many carefully gaged sizing, buffing and polishing steps is substantially clear of any red coat except that desired to remain to fill the selected-color image pockets to the plane of the polished emulsion face and the film passes to an upper guide roller 65 just above guide 38. Thence the film F, red face outward, passes in a quarter twist Q to vertical-axes turn-out rollers 66—67, Fig. 1B and from the latter passes to a dye machine (not shown) so that a blue or other color coat may be applied to the opposite side of the film from the red coat. 65

After blue coating and drying (if desired) the film is returned to the duplex frame fabrication 22 carrying the duplex processing train TB so that the blue coat may be removed down to the plane of the outer face of the blue coated emulsion and to leave the selected blue image pockets in the emulsion for color projection by the film per se.

Referring to Figs. 1A and 1B it will be seen that the power shafts 7, 45 and 54 are cross-
shafts connecting the duplex processing trains TB and TR and as these shafts transmit positively in time one to the other (as at 600 R. P. M.) the two systems are full control of the threaded, respective film bights running in parallel positions over the two sets of platen wheels; the margin tracks 40 of which are in true alignment in their respective sets. By this duplex system or machine two sides of a very long film may be processed at the same time by connected processing trains cooperative to efficiently process two-emulsion, multicolored film strip at a rate of about 1,900 feet per minute.

The blue coated film enters with the blue face outward, on a platen wheel 18, Fig. 1B, and after passing through the relative processing train is delivered under a guide roller 71, by a quarter twist Q' to turn-out guide rollers 72—73, whence it is passed to a winding reel, not shown.

It will be seen that the red face is treated while the back emulsion of the film is clean and uncoated and is reasonably true for tracking on the platens 40 and 48. Then, later, the polished red face is presented to track on the platens in the blue removing train TB. This method and means is productive of very true-faced, multicolored motion picture strip, with or without sound track, and if there is a sound track it has been in no manner affected by the color diminishing process and machine here disclosed.

The slip drive means of the several platen wheels is a safety for the tensioned film bights on these wheels, whose shafts rotate at about 200 R. P. M., for example, while the buffering and polishing wheels run at about 3,600 R. P. M., say.

It is understood that the several rotating wheels and rollers have suitable bearing on the frames unless otherwise set forth herein.

What is claimed:

1. A machine for removing a color coat media from an emulsion face of a motion picture film, including a suitable frame, a series of rotary driven platen wheels having aligned tracks which receive and advance the film at a given speed, and means cooperative with each wheel for respectively eliminating a portion of the coat; said means including a row of driven, attrition rollers each independently adjustable relative to its adjacent platen track, and independently operative, roller regulating devices engageable with and operative by contiguous film supported on the platen tracks whereby to effect the said radial adjustment of the rollers.

2. A machine as set forth in claim 1, and including independent means normally pressing relative rollers toward the presented face of the film supported on the tracks and including a yieldably mounted bearing for each roller.

3. A machine of the class described, including a platen, means for moving the said platen means for guiding a strip of picture film to the moving platen, and means operative on and controlled by thickness of the strip while supported on the platen to eliminate a portion of a color coat on emulsion of the film strip, said control means including a movably mounted coat reducing roller, means normally moving the said roller toward the film strip on the platen, and a device engageable with the supported film and being movable thereby to automatically repress the roller as to the platen under variation of film thickness.

4. A machine as set forth in claim 3, and means for individually yieldably pressing each roller toward the contiguous film.

5. A machine as set forth in claim 3, and said last named means including a gage means for adjusting each roller as to its bearing.

6. A machine as set forth in claim 3, and in which the drive means includes a friction clutch means in the transmission for the platens.

7. A series of aligned, parallel platen wheels having tracks for receiving and supporting a bight of picture film presenting an outer, color-coated emulsion side, guide means to hold portions of the film to relative film supporting area of the wheels, separate, independently yieldable means cooperative with the wheel to remove portions of the coat from the film emulsion, means continuously driving said wheels and coat removing means, and means engaging and adapted to be actuated by the wheel supported film and operative on and to control the function of the coat removing means.

8. A processing machine having means for continuously advancing a color coated film strip and presenting the coat to be processed outward, and continuously, progressively acting means for removing successive fractions of thickness of the coat and including in order, rough or sizing series of rotary wheels, series of buffing wheels, and series of polishing wheels, and means for driving said wheels, and gage means for independently adjusting said wheels so to face the face of the film stock and including an element for regulating the thickness of the film stock and being actuated by changes in the thickness of the film stock to maintain a gaged wheel adjustment as to the face of the film stock.

9. In a machine of the class described, a platen having a film supporting track area, a driven wheel element for removing an outer color coat from an emulsion face of the interposed film on the platen, a movable bearing for the color removing wheel, and means adjustable mounted on said bearing and engageable with the film stock and adapted to be actuated thereby whereby to automatically compensatively adjust the bearing to move the last named wheel according to thickness variation of the film stock.

10. In a machine of the class described, a platen for supporting a strip of film stock having a color coated emulsion face and for advancing the film, a processing wheel to engage the said coat, a pivoted bearing for the said processing wheel and means acting to press the latter wheel toward the film, and means adjustable mounted on the bearing and operatively engaging the film stock and adapted to be actuated thereby whereby to automatically compensatively move the processing wheel according to variations in the thickness of the film stock.

11. In a coat removing device for reducing a color coat from a continuously traveling film stock having an emulsion face to which such a coat has been applied, a driven shaft, a bearing arm pivotally mounted on said shaft, a processing wheel mounted on said arm and having a member connected to the driven shaft, and means carried by the arm and engageable with the film stock and adapted to be actuated thereby so as to continuously move the arm and maintain uniform contact of the processing wheel with the color coat, according to the thickness of the immediately engaged film.

12. A machine of the class described and including a main frame, parallel trains of platen wheels, the wheels of each train presenting co...
4. Planar tracks for a film strip to be treated, attrition means for operation on the presented face of the strip on each platen, and guide means for twisting the strip as it passes from one train to the other for concurrent treatment of its reverse face in the opposite train; all said means mounted as a unitary assembly on said frame, and in which each train includes a lead-in platen wheel, and an intermediate platen wheel, and a full-return end-bite platen wheel.

13. A machine as in claim 12, and said guide means being arranged between said wheels.

14. In a machine of the class described, a train including a lead-in platen wheel with means for forming a half-circle bend of film strip thereon, a return platen wheel and means to form a full return strip bight thereabout, an intermediate platen wheel and means to form upper and lower, reverse travelling arcs of strip thereon, and independent attrition means for operation on portions of the strip on the lead-in and the return platen wheels and on the arcs of strip on the intermediate wheel.

15. In a machine as in claim 14, and strip twisting, turn-out guide means between the intermediate and the lead-in wheels.

16. In a machine of the class described, a lead-in platen wheel and means to form an arc of film strip about a portion thereof and a series of driven attrition rollers for progressively reducing a color coat on the presented face of the strip in said arc; a return platen wheel and means to form a full reversing bight of the strip thereabout in the plane of said arc and a series of attrition rollers for progressively working on the presented coat on the strip; an intermediate platen wheel in the plane of the said bight wheel and means to form upper and lower arcs of the strip on the intermediate wheel, attrition means for action on the presented coat at said upper and lower arcs, and a power transmitting means including separate drive connections for the several wheels and for the several attrition rollers and means.

17. In a machine as in claim 16, and having a strip twisting, turn-out guide means between the lead-in and the intermediate wheels.

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