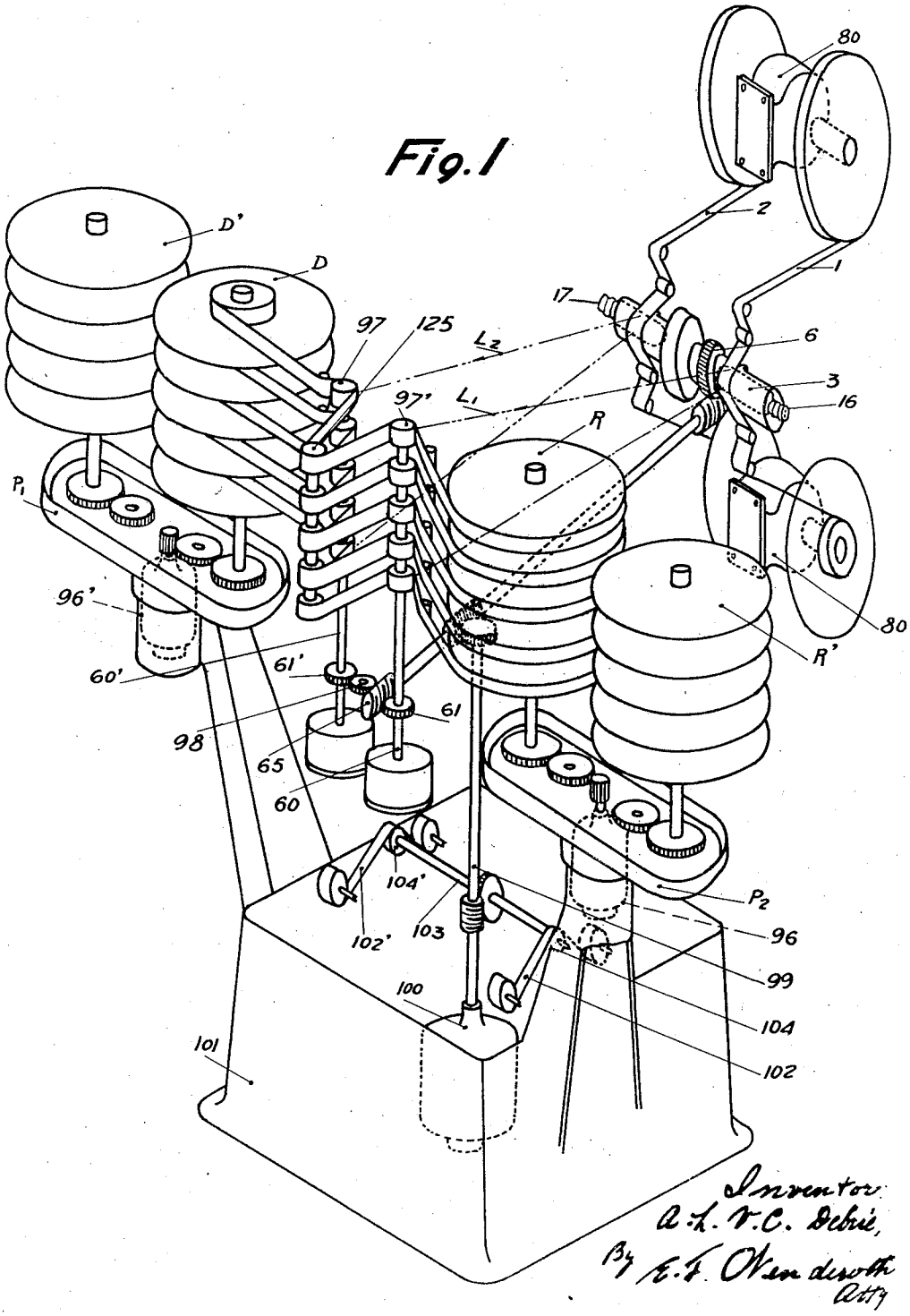
April 28, 1936. A. L. V. C. DEBRIE 2,039,213

MULTIPLE PRINTING MACHINE

Filed Feb. 28, 1935 7 Sheets-Sheet 1

Fig. 1



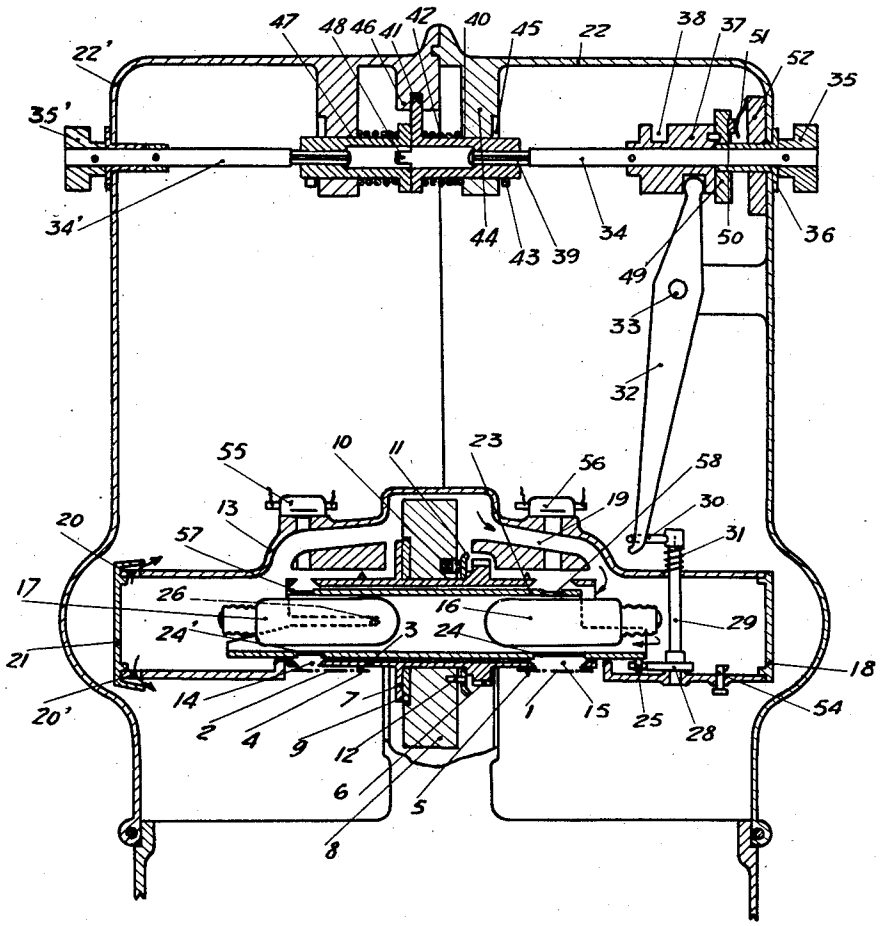
Inventor
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MULTIPLE PRINTING MACHINE

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Fig. 2



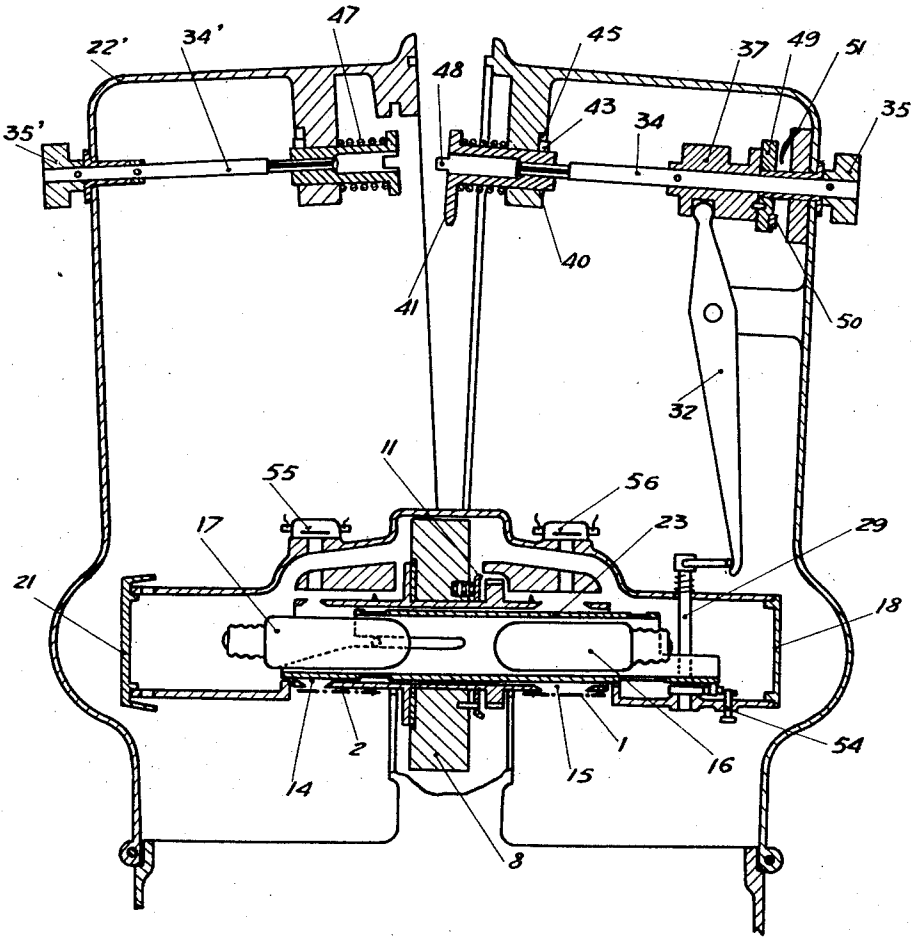
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MULTIPLE PRINTING MACHINE

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Fig. 3



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MULTIPLE PRINTING MACHINE

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Fig. 5

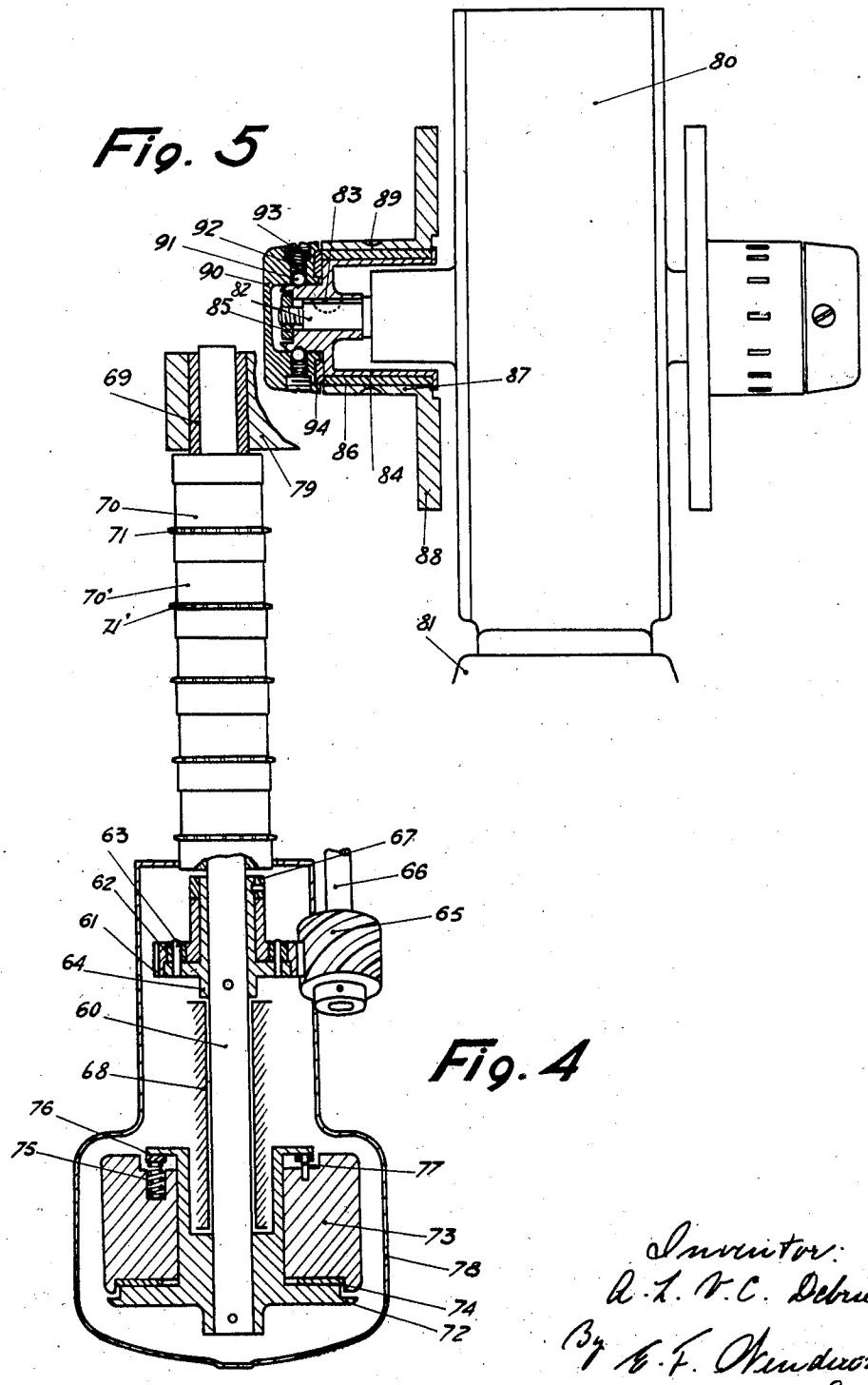


Fig. 4

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MULTIPLE PRINTING MACHINE

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Fig. 6

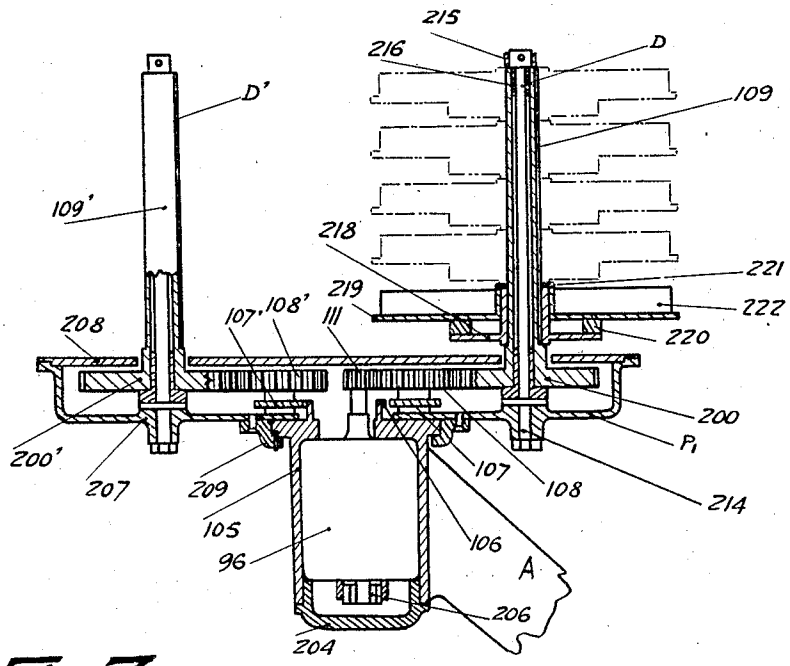
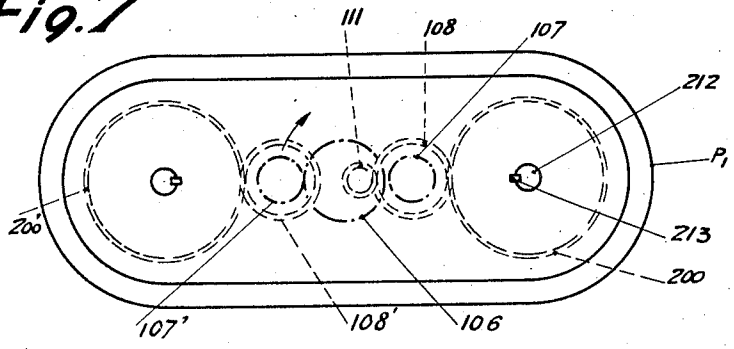


Fig. 7



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MULTIPLE PRINTING MACHINE

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Fig. 8

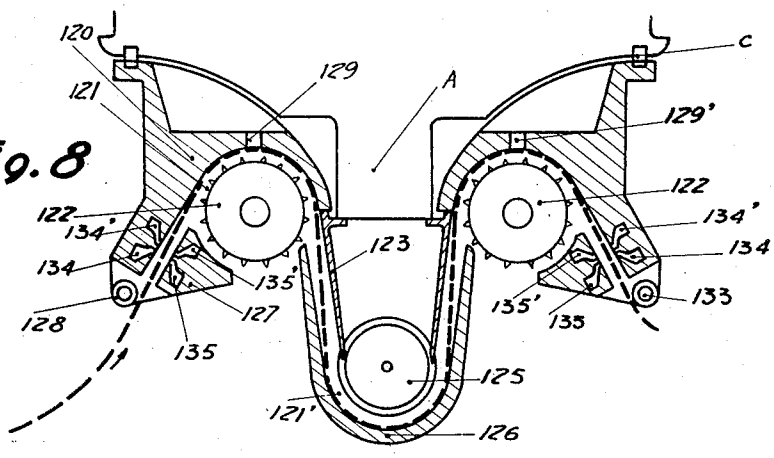


Fig. 9

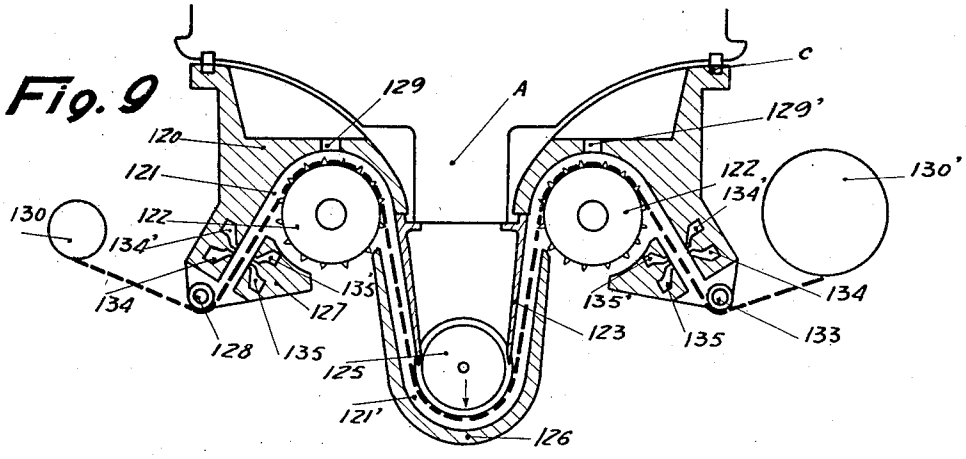
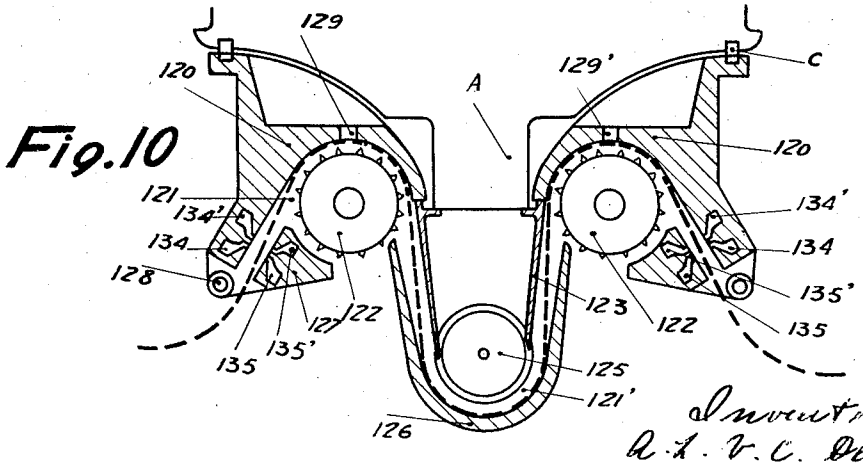


Fig. 10



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MULTIPLE PRINTING MACHINE

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Fig. 11

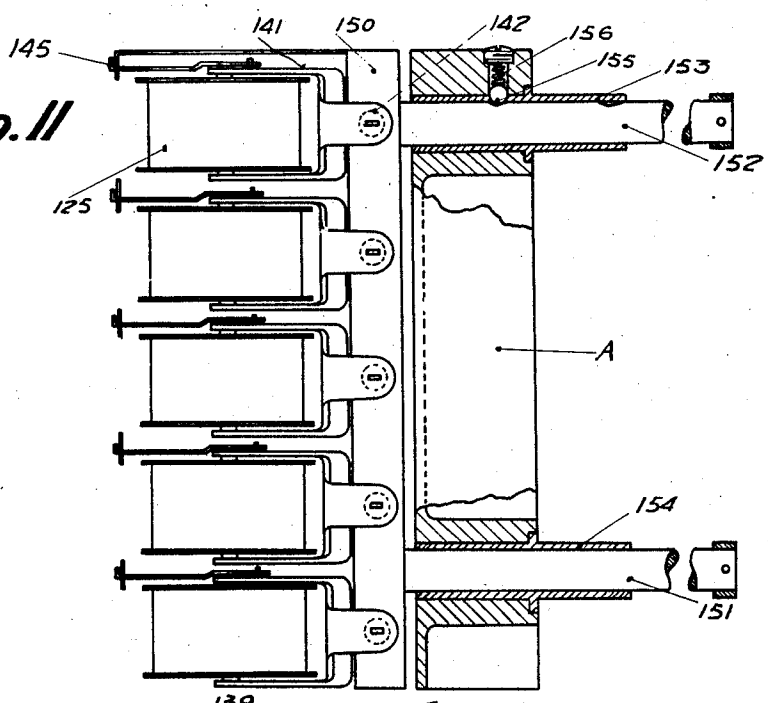


Fig. 12

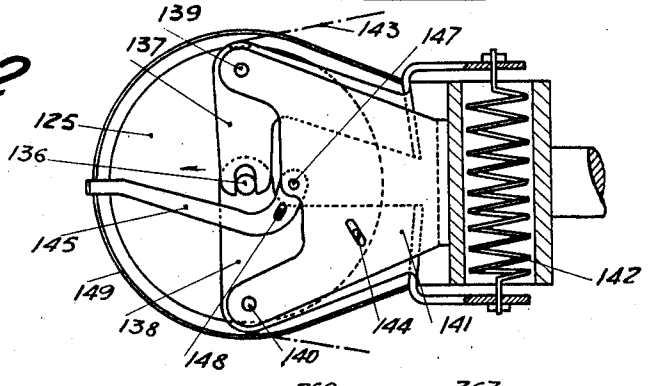
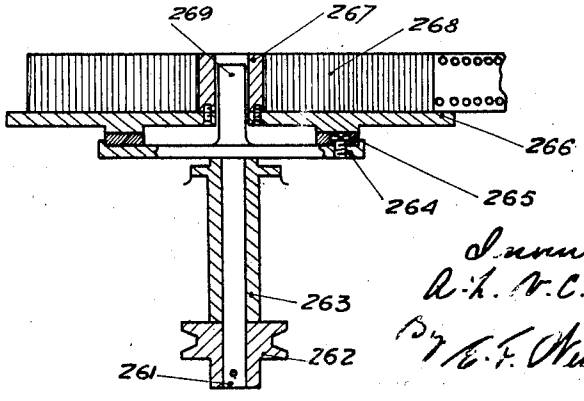


Fig. 13



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Patented Apr. 28, 1936

2,039,213

UNITED STATES PATENT OFFICE

2,039,213

MULTIPLE PRINTING MACHINE

André Léon Victor Clément Debrie, Paris, France

Application February 28, 1935, Serial No. 8,735
In France March 6, 1934

19 Claims. (Cl. 88—24)

My copending application Ser. No. 753,051 filed on November 14, 1934, describes a printing machine for the simultaneous printing of a plurality of positives from a negative passing over a cylindrical drum along the axis of which is arranged the single projecting lamp, the luminous beams issuing from the latter passing through successive images on the negative so as to impinge respectively through the superposed printing gates on the positives driven by drums keyed to a common axis and arranged behind said gates. Two such machines or more may be associated for the simultaneous printing on the different positives of two or more negatives and more particularly of a sound and an image negative.

My invention has for its object an improved control mechanism for a multiple machine of the last disclosed type, said mechanism including independent control means for the common frictional winding and unwinding of the different positives, for the common frictional winding and unwinding of the negatives and for the drive through an independent motor and a common control shaft of the series of superposed drums providing the progress of the positives in front of their printing gates and of the negative driving drums, whereby the usual feed drums may be omitted. Moreover means are also provided for disengaging the positive films with reference to their drive, which completes the independent drives provided in the machine and allows the same scene to be printed several times on one or more positives without disconnecting the positive drive with reference to the negative drive.

I will disclose my invention with reference to a form of execution of a multiple printing machine provided with independent control means as specified together with certain other novel and interesting features.

In accompanying drawings:

Fig. 1 is a general perspective view of a multiple printing machine.

Figs. 2 and 3 are longitudinal cross-sections of the negative driving means and of part of the casing of the apparatus respectively for the opened and closed positions thereof.

Fig. 4 shows the shaft carrying a series of positive driving drums.

Fig. 5 shows the motor ensuring the frictional drive of both negatives.

Figs. 6 and 7 are partly sectional front and plan views of one of the frictional positive winding means.

Figs. 8, 9 and 10 are sectional views of the guiding channel enclosing the two successive driving drums of a positive for three different positions of the latter.

Figs. 11 and 12 are plan and side views of a system ensuring regularity of tension on the positive films in their guiding channel.

Fig. 13 is a detail relating to the frictional winding of a positive.

Fig. 1 shows diagrammatically the whole of the double printing machine with the omission however of the optic devices shown merely in a diagrammatic manner at L_1 and L_2 between each negative and the corresponding printing gates, said devices being preferably as described in my abovementioned copending application. In Fig. 1 the picture negative **1** and the sound negative **2** are unwound off their feed reels and wind on their take-up reels frictionally driven by a common motor **80**. The parts played by the feed and take-up reels may be interchanged by stopping and disconnecting the motor driving the take-up reels used as feed reels and starting and reconnecting the motor **80'** adapted to drive the feed reels used now as take-up reels.

The negative drive is performed by the drum **3** serving also as an apertured cylinder containing along its axis the projecting lamps. The negatives are led on to said drum by rollers mounted on stationary pivots, the elasticity of the negatives being sufficient for maintaining them in contact with the driving drum. To ensure the projection of the two negatives, two lamps **16** and **17** are provided in front of the two series of gates **14—15** (Figs. 2 and 3) corresponding to pictures and sounds. The drum **3** is driven independently of all the frictional drives through the general control system of the machine comprising the motor **100** secured to the base **101**, the shaft thereof **99** and the connecting shaft **66** controlled thereby which carries at one end the driving pinion for the drum **3**. To the other end of the connecting shaft **66** is keyed a pinion **65** driving the shaft **60—60'** carrying the driving drums **97—97'** of the positives **5** arranged in front of the gates for printing on the latter respectively sounds and pictures. An auxiliary pinion **98** is interposed between the end pinion of the shaft **66** and the shaft **60'** for instance so as to make the shafts **60—60'** rotate in the same direction. The positives are fed by the pile of feed reels D and are wound on the pile of take-up reels R frictionally driven by the motor **96** after they have passed over the sound printing drums **97**, the tension compensating rollers **125** and the picture printing drums **97'**. After the plates P_1 and P_2 car-

rying each two piles of reels have rotated round their pivots as explained hereinafter with more detail, the positives wound on the reserve reels of the third pile D' (carried by plate P_1) are unwound and rewound on the fourth pile R' (on plate P_2) which has taken the place of R and is frictionally driven by the motor **96'**. The drive can be of course effected from R to D or from R' to D', if the motor **96'** is set operating in place of motor **96**. More generally any of the reels of one plate may be used as a feed reel with either of the reels on the other plate as a take-up reel.

The general control through the shaft **99** of the motor **100** also provides the continuous drive of the light control bands **102** and **102'** for sound and picture printing respectively, through the agency of the secondary shaft **103**. This shaft **103** is controlled by the shaft **99** through a suitable reducing gear and carries at its ends the driving drums **104—104'** for the strips **102—102'**.

I will now describe with greater detail the different parts of the machine.

Figs. 2 and 3 are horizontal cross-sections through the axis of the driving drum for the negative picture film **1** and the negative sound film **2**. This single drum or hollow shaft **3** is provided at each end with a toothwork **4—5** for driving the corresponding negative through a single row of perforations and with projecting gates **14—15** in front of the location of the two negatives. The shaft or drum **3** is also provided with a part **6** cut with a toothwork adapted to be driven by the shaft **66** (Fig. 1) and has a flange **7** adapted to drive through a frictional ring **9** a speed regulating fly wheel **8**. The latter rotates in unison with a washer **11** to which it is connected by the spigot **12** and the transverse movements of the fly-wheel are damped by the springs **10** arranged between the fly-wheel and its washer. The fly-wheel **8** has for its object the absorption of the vibrations produced by the play in the gearwork and the like.

A casing **13** surrounds the drum **3** except at its front where are provided the projection slots or gates **14—15**. The light sources **16** and **17** arranged axially of the drum for projecting pictures and sounds are removable. The cover **18** of the casing allows their speedy dismantling. The cooling is effected by a circulation of air from the pipes **19—19'** passing through the casing; this air after it has passed round the lamps **16—17** escapes through the apertures **20—20'** in front of which the flange of the cover **21** forms a light-tight joint.

The general casing of the machine may be opened by means of the doors **22—22'** and it is necessary to shut off the light from the sources **16—17** when these doors are open so as not to allow any intense illumination of the printing room. To this end I use a cylindrical sliding shutter **23** with two apertures **24—24'** protected by glass panes ensuring the rigidity of the films in spite of the pressure of the air inside the shutter, said apertures corresponding normally with the projection gates **14—15**. The shutter **23** which is locked against rotation by a spigot **26** is connected through a projection **25** with the system for locking the doors **22—22'**. The projection **25** is engaged in the forked end of a lever **28** carried by a spindle **29**, the other end of which carried an arm **30**. A spiral spring **31** urges this arm into contact with a double lever **32** pivotally secured at **33** to the door **22**. When the doors **22—22'** are closed (Fig. 2), the shutter **23** does not come into the way of the projection operation but as soon as they open (Fig. 3) the shutter **23** closes the slots **14** and **15** as explained hereinafter.

The door-locking system which controls the sliding movements of the shutter **23** comprises a spindle **34** controlled by the knob **35** and rotatably carried by the guiding bearing **36** secured to the door **22**. A cam **37** keyed to the spindle **34** has a helical groove **38** engaged by the end of the double lever **32**. The square **39** forming the end of the spindle **34** engages a sleeve **40** carrying a bolting projection **41**. A spring **42** is arranged round the sleeve **40** between said projection **41** and a projection **44** on the door **22**, in which latter projection the sleeve may slide. A spigot **43** on the sleeve abutting against projection **44** prevents said sleeve from moving outwardly towards the door **22'** and enters the recess **45** in the projection **44** when the sleeve has rotated through 180° away from the position shown in Fig. 2. The doors being closed, the bolting projection **41** is held in a jaw **46** of the door **22'**. In order to allow a control of the bolting from the side of door **22'**, the latter is provided with the same control means as the door **22** including chiefly a sleeve **47** carried by a spindle **34'** and adapted to engage the sleeve **40** through the catches **48** whereby the knob **35'** is adapted to control the rotation of the bolting projection **41**. Moreover an insulating plate **49** drivingly connected with the cam **37** carries a contact strip **50** adapted to close, over a blade **51** secured to the insulating plate **52** on the door **22**, the circuit of a signalling lamp, not shown, as soon as the doors are locked in their closed position.

The working of the locking system is as follows: when the doors are to be opened, the operator turns the knob **35**; the cam **37** rotates then whereby it shifts the double lever **32** the movement of which is accompanied by the arm **30** urged by its spring **30**, which brings the shutter **23** in front of the projection slots **14** and **15** so as to close the latter. At the same time the bolting projection **41** rotates and passes out of the jaw **46** whereby it allows the opening of the doors **22—22'**. Moreover the spigot **43** which has entered the recess **45** is held therein by reason of the pressure of the spring **42** and consequently the sleeve **40** is held in place and so is the lever **32** whereby the sliding shutter **23** can no longer move and the sliding shutter **23** is locked against displacement. When it is desired to dismantle said shutter, for instance with a view to cleaning the glass panes, a releasable stop **54** allows the lever **28** to be held away from the projection **25** on the shutter.

On the other hand, there are provided for controlling the illumination of the printing lamps **16** and **17** photo-electric cells **55—56** carried by the casing **13** for receiving part of the illumination from the lamps through the slots **57—58** in the shutter **23** registering with cooperating slots in the drum **3**. This allows a supervision of the intensity of the lights emitted at any moment by means of galvanometers, not shown, electrically connected with these cells.

Fig. 4 is a cross-section along the longitudinal axis of one of the vertical shafts carrying the driving drums of the positive films, said films being adapted to receive on said drums the parallel projecting beams from the optic system in front of the corresponding negative.

The shaft **60** illustrated is controlled by the pinion **61** meshing with the pinion **65** keyed to the end of the shaft **66**. This pinion **61** is yieldingly

mounted on the shaft 60 and is provided to this effect with a recess 62 filled with rubber or the like yielding material. The driving teeth 63 secured to the hub 64 keyed to the shaft 60 and passing through this yielding material transmit the rotation of the pinion 64 to the shaft 60 without transmitting any vibrations from the pinions 61 and 65. A stop ring 67 holds the pinion 61 in contact with the hub 64.

The shaft 60 is rotatably held in the bearings 68 and 69 and carries different drums 70—70' provided with the toothworks 71—71' driving the positive through a single row of perforations. These drums are arranged just above the yieldingly secured pinion 61. To the lower end of the shaft 60, a flanged hub 72 is rigidly secured; said hub is adapted to receive a fly-wheel 73 frictionally driven by the friction wheel 74. Compensating springs such as 75 bear against the washer 76 which rotates together with the fly-wheel under the action of the spigot 77. The casing 78 contains the different parts 61 to 68 and 72 to 77 and a projection 79 on the general frame of the machine serves to carry the upper bearing 69.

Fig. 5 shows one of the two frictional drives used in alternation for taking up the negatives as stated hereinabove. This drive comprises a motor 80 secured to the support 81 and the shaft of which projects on either side for frictionally driving the corresponding negatives. This motor carries on each elementary shaft such as 82 a key 83 for securing the hub 84. A nut 85 holds this hub in place, which hub carries the frictional ring 86 driving through adherence the sleeve 87 provided with a flange 88. The sleeve 87 is provided at its periphery with grooves 89 ensuring the drive of the hub of the take-up reel of the negative considered.

For keeping the sleeve 87 longitudinally in place I use an easily removable stop system comprising a plug 90 held in place by balls 91 engaging an annular groove on the hub and submitted to the action of springs 92 compressed by screws 93. A friction ring 94 is interposed between the plug 90 and the hub 84.

The driving system 80', as shown, serves exclusively for the frictional unwinding of the two negatives, with their two sleeves 87' rotating over their hub 84', stationary at the moment considered, against the frictional resistance of the ring 86'. When the unwinding is performed in the opposed direction, the motor 80' is started for frictionally rewinding the negatives whereas the motor 80 being stopped, the unwinding is performed against the action of friction off the sleeves 87 carried by the shaft ends 82. The elements controlled by 80' such as 84', 87', 86' being exactly similar to the corresponding elements 84, 87, 86 are not shown.

Figs. 6 and 7 are a sectional side view and a plan view of one of the double friction drives for positives comprising a plate P_1 and two piles of reels D and D'. The motor 96 is secured inside a casing 105 to the frame A of the machine. A plug 204 allows removal of the motor. The motorshaft is provided at its upper end with a small pinion 111 and at its lower end with a ratchet wheel 206 the part played by which is described hereinafter.

The pivoting plate P_1 encloses a gearwork under the cover 208. This plate is adapted to rotate round the casing 105, over a securing ring 209. However the rotation of the plate is eccentric with reference to the pinion 111 of the motor 3. The plate P_1 carries two intermediary pinions 108—108' the position of which is such that one of them meshes with the pinion 111 on the motorshaft while the other is spaced with reference thereto. These pinions are in permanent mesh with the large diameter pinions 200—200' which carry the elongated hubs 109—109' for the piles of reels D and D'. A key 213 is laid in a longitudinal groove of each hub 109—109'.

For increasing the rigidity of the hub, a vertical spindle 214 passes through the plate and hub and ends with a ring 215 held over the top of the hub with bearings 216—217 of material having a very low coefficient of friction and requiring no lubrication interposed between the hub and the spindle.

The hub removably carries friction plates 218 and the film-carrier plates 219, the former of which are secured to the hub 109 through the key 213. The film-carrier plates 219 are frictionally driven by the plates through the interposed friction rings 220. A nut 221 holds the plates 219—218 in place but of course, without locking them together and the film reel 222 is wound in the usual manner over the carrier plate 219. I may thus superpose round each hub 109—109' a number of friction plates, each provided with an independent friction plate forming with it a removable unit, the friction plate and the corresponding carrier plate being permanently coupled together.

As stated the printing machine comprises a double system P_1 P_2 of two reels to either side of the printing shafts 60, 60'. The positives may be wound say from P_1 on to P_2 for a first series of copies and the next set may be wound from P_2 on to P_1 for the a second series of copies. When the reels on plates 219 are feed reels, the motor 96 is at a standstill as the traction on the film is ensured by the driving drums such as 97. However it is of interest to lock the hub 109 so that the film may be rigid as it passes off the reel towards the printing drums.

This is obtained, the gearwork 111—200 remaining in mesh, by the sprocket wheel 206 on the motor shaft which is prevented by a catch from rotating independently of the motor in the direction corresponding to the direction of the traction exerted by the unwinding film. The hub 109 being thus held stationary by the motor, the positive reels 222 unwind tautly against the friction exerted by the friction plates 218—220.

When the first series of copies is made, the operator causes the plate P_1 to rotate so as to reengage pinion 108' previously disengaged whereby the pile of reels D' may form the take-up reels. As soon as the positive films have begun winding round hub 109' and the motor 96 has been started, the different reels driven by the friction plates 218—220 continue winding. For this direction of winding, the free wheel 206 does not interfere with the connection of the motor 96.

For the printing of successive series of positives and for each plate P_1 P_2 the motor is in alternation operative in a given direction for winding the films on their take-up reels or locked with a frictional brake impressed on the unwinding of the films.

I may provide non-actinic witness lamps at the upper part of the machine frame for allowing supervision of the operation of the motors 96 and the like.

It will be noted that the pile of reels D' temporarily out of mesh with reference to the motor 96 is adapted to receive a reserve pile, rap-

idly set in place, of unimpressed positives which are submitted to printing in the above described manner after a half revolution of the plate P_1 (or P_2) carrying it. It is of interest to lock the spindle **109'** of the reserve pile against rotation in order to prevent an untimely unwinding of the reserve films before use. This locking is provided through the pivotal motion of the plate P_1 which causes the pinion **111** on the motor-shaft to mesh with the intermediary wheel **108** controlling the friction drive of the other pile D. To this end, the casing **105** of the motor **96** is provided at its upper end with a toothwork **106** the axis of which is eccentric with reference to the pair of secondary pinions **107—107'** carried by the shafts of the intermediary wheels **108—108'**. According to the angular position given to the plate P_1 carrying the two piles of reels, one or the other of the secondary pinions **107** or **107'** (for the position shown) meshes with the stationary toothwork **106**. Thus the pile toothwork meshing with **106** and which is obviously the one which is not in mesh with the motor-controlled pinion **111** is held against rotation. When the plate P_1 is revolved through 180°, the secondary pinion **107'** ceases, with a slight pivotal motion round its own axis, being in mesh with the stationary toothwork **106** while the pinion **108'** engages the pinion **111** so as to allow the unwinding of the reserve reels D', the motor **96** remaining stationary during this unwinding by reason of the presence of the free wheel **206** interposed between the motor and **111** or else the motor may be caused to rotate in the direction required for tensioning the film during unwinding or for furthering said unwinding. At the same time the secondary pinion **107** is locked in its turn to prevent unwinding of any further reserve reels carried by hub **109**.

Returning to the arrangement of the friction drive of the reel carrier plates **219**, it should be noted that this arrangement prevents any undesirable loop from forming between the printing drum and the take-up reel, by reason of the tension of the film being effected automatically without any jerk; as soon as the motor **96** is set in operation the film is tensioned and when the motor **100** is started in its turn the tensioned film remains taut by reason of the resistance afforded by the friction. Fig. 13 is a detail view of a modification of the friction drive for one or more films to be wound or unwound in the machine. In this figure somewhat similar to Fig. 6 **261** is a spindle carrying a pulley **262** and rotatably mounted in the bearing **263**. A plate **264** keyed to the spindle **261** is provided with a friction ring **265**. Said ring is in contact with a plate **266** the diameter of which is sufficient for carrying the desired film length. The plate is provided with a hub **267** round which the film **268** is wound. The spindle **261**, ends as a part **269** serving solely as a centering for the plate **266**. The rotation of the spindle **261** controlled mechanically, is thus frictionally transmitted as in the case of Fig. 6 to the film carrying plate **266**. The pressure on the friction ring **265** depends on the weight of the film and is thus proportional to the torque to be exerted for winding or unwinding.

In a general manner the frictional drive for the take-up reels of the negatives and positives should be such that the tension of the film on the feed side is greater than on the take-up side. To this end, I may advantageously make the feed reel friction spindles rotate in a direction opposed to the unwinding whereby the difference between the speeds of the friction drives on the feed and take-up sides is always greater than the absolute speed of the take-up friction drive.

Figs. 8 to 12 show the channel guiding a positive in front of its printing drums and relate to an improved manner of feeding the film into said channel. Heretofore films were inserted in front of the gates of the machine sidewise, generally after opening part of the passage. As illustrated, the incurved shape and the breadth of the passage or channel passing round one or both driving sprockets or drums constrains the film, simply loaded or engaged through one end to follow under the action of its elasticity the smooth wall of the channel opposed to the sprocket teeth and to pass out through the other end of the passage. The meshing with the driving sprocket or drum for operation in either direction is provided through a traction on the ends of the film inserted in the channel while any subsequent desired disengagement of the film may be simply obtained by giving it slack.

The passage illustrated in Figs. 8 to 10 comprises two parts **120** passing at **121** through a half-circle round the corresponding driving drums **122** (which are those referred to as **97, 97'** on Fig. 1) at a small distance thereof. Between these two parts the concavity of which is directed along parallel lines is arranged a U-shaped part **126** of opposite concavity surrounding at **121'** the compensating roller **125** at a small distance thereof. Two small plates **123** secured to the frame A of which parts **120** form an extension arrive tangentially against the roller **125**. Lastly beyond the drums and in front of the outer ends of the parts **120** ending each with a roller **128**, are arranged uprights **127** forming part of the general frame A.

The films moving in either direction in the channel bounded on one side by the elements **128—120—123—125—123—120—128** and on the other by the elements **127—122—126—122—127** receive the impressions of sounds and pictures through the gates **129—129'** provided in the parts **120**.

The setting of the film in place is performed simply by pushing it into either end of the above-defined channel. The film moves forwards under the action of its elasticity in contact with the concave portions of parts **120** and **126** between which parts it passes across the channel (see Fig. 8 illustrating the loading of the film). Thus the film is prevented from any contact with the sprocket teeth from which it is spaced through part of the width of the channel.

The engagement of the film with the sprocket teeth through perforations on one side only or on both sides of said film is performed automatically as shown in Fig. 9 by drawing out the ends of the film. Such a traction may be exerted by causing the rotation in the desired direction of friction rollers **130—130'** over which the film passes on either side of the channel.

A particularly advantageous application of this arrangement is that of repeated and successive printings of the same scene on the positive. I avoid thus any disconnection between the driving drums of the negatives and of the positives which are positively driven as described hereinabove by common control means. It is sufficient to slacken the ends **131—132** of the positive film (Fig. 10) for instance by unwinding slightly the friction drives. Thus the film disengages the drum toothwork and comes under the action of

its elasticity against the concave parts of the channel. This disengages temporarily the positive with reference to the drums and allows the negatives to be unwound or rewound during this time, together if required with the light control strips such as 102—102' or the like, without the positive continuing to be driven. I may thus after a first printing on the positives, rewind the negatives without moving the positives considered so that it becomes possible to make a second impression following a first impression and identical therewith and so on.

The parts 120 also form doors for opening the corresponding ends of the passage, said doors being preferably mounted on the pivots 133 of the rollers 128. The gates being opened, it is possible to have access to the inside of the channel for its upkeep.

A film air-cleaning means is constituted by a system of ducts provided in these doors and the opposite uprights 127—127'. To this end air is blown in at the entrance and outlet of the channel through ducts 134—135, the air passing out of the channel through the symmetrical ducts 134'—135'. A contact *c* may be provided for signalling when the doors are closed.

I have shown in Figs. 11 and 12 how the superposed compensating rollers 125 are mounted so as to move yieldingly in the direction XY of Fig. 10 for ensuring uniformity in the tension of the corresponding film between its two driving sprockets.

The pivot 136 of the compensating roller 25 is held (Fig. 12) between the levers 137—138 of which one, 137, is notched. These levers which provide compensation for the film tension rotate respectively round pivots 139—140 carried by a stationary strap 141. On the other hand the rear ends of the levers are connected through a return spring 142 urging the roller 125 to move in the direction of the arrow K of Fig. 12 so as to provide a uniform tension for the film 143 as it passes round the roller. A spigot 144 carried by the lever 138 and engaging a slot in the strap 141 determines the ends of the path allowed for the roller 125. Lastly an amplifying hand 145 preferably with an illuminated pointer shows the amount of tension of the film by following the to and fro motions of the roller 125. This hand is carried by a spindle 147 mounted on the strap 141 and is connected with the lever 138 through its projection 148 engaging an aperture in the latter. A protecting ring 149 surrounds the parts above roller 125 controlling the position of same.

Fig. 11 shows a common support 150 carrying the superposed straps 141 housing in their turn the springs 142 in a transversal recess. Two parallel horizontal rods 151—152 are secured in bearings 153—154 carried by the frame A. A stop system comprising a ball 155 submitted to the action of a spring 156 compressed by a set screw presses, through a slot in the bearing 153, on the rod 152 at any chosen point of its length, whereby it is possible to place correctly and at will the unit constituted by the rollers 125 and their compensating means with reference to the frame A and consequently to give the proper length to the film loop between the picture printing gate and the sound printing gate.

What I claim is:.

1. A multiple projection printing machine for printing a plurality of negative impressions simultaneously on a plurality of positives, comprising a hollow printing drum provided with longitudinally spaced peripheral series of apertures, toothworks adapted to engage the negatives and to drive them past the printing drum, illuminating means arranged inside the hollow drum and adapted to project beams of light through the apertures in the drum, a set of parallel shafts, sprocket wheels keyed thereto and adapted to engage the positives, optic means adapted to lead the beams of light passing out of the apertures towards the sprocket wheels on the shaft corresponding to series to which the aperture considered belongs a common positive control for the two shafts adapted to drive the toothworks and friction drives independent of one another and independent of the said common control adapted to take up and to feed the negatives on one hand and the positives on the other.

2. A multiple projection printing machine for printing a plurality of negative impressions simultaneously on a plurality of positives comprising a frame, a common rotary hollow printing drum, provided with longitudinally spaced series of apertures, toothworks carried by said drum and adapted to positively drive the negatives past the printing drum, illuminating means arranged inside the hollow drum and adapted to project beams of light through the apertures in the drum, a set of parallel shafts, sprocket wheels keyed thereto and adapted to positively drive the positives, optic means adapted to lead the beams of light passing out of the apertures towards the sprocket wheels on the shaft corresponding to the series to which the aperture considered belongs, a common positive control for the two shafts adapted to drive the hollow drum and friction drives independent of one another and independent of the said common control adapted to take up and to feed the negative on one hand and the positives on the other.

3. A multiple projection printing machine for printing a plurality of negative impressions simultaneously on a plurality of positives, comprising a common rotary hollow printing drum, provided with longitudinally spaced series of apertures, toothworks carried by the drum adapted to drive the negatives past the printing drum, illuminating means arranged inside the hollow drum and adapted to project beams of light through the apertures in the drum, a fly wheel frictionally driven by the rotary drum, a cold-air circuit for the illuminating means, photoelectric means adapted to control the intensity given out by the illuminating means, a set of parallel shafts, sprocket wheels keyed thereto adapted to positively drive the positives, optic means adapted to lead the beams of light passing out of the apertures towards the sprocket wheels on the shaft corresponding to the series to which the aperture considered belongs, a common positive control for the two shafts adapted to drive the hollow drum and friction drives independent of one another and independent of the said common control adapted to take up and to feed the negatives on one hand and the positives on the other.

4. A multiple projection printing machine for printing a plurality of negative impressions simultaneously on a plurality of positives, comprising a casing, doors for said casing, locking means for the casing doors, a common rotary hollow printing drum, provided with longitudinally spaced series of apertures inside the casing, toothworks carried by the drum adapted to drive the negatives past the printing drum, illuminating means arranged inside the hollow drum and adapted to project beams of light through the apertures in the drum, a cylindrical shutter slidingly

mounted on the drum, means whereby operativeness of the door locking means causes the shutter to obscure the apertures in the drum, a set of parallel shafts, sprocket wheels keyed thereto adapted to positively drive the positives, optic means adapted to lead the beams of light passing out of the apertures towards the sprocket wheels on the shaft corresponding to the series to which the aperture considered belongs, a common positive control for the two shafts adapted to control the hollow drum and friction drives independent of one another and independent of the said common control adapted to take up and to feed the negatives on one hand and the positives on the other.

5. A multiple projection printing machine for printing a plurality of negative impressions simultaneously on a plurality of positives, comprising a hollow printing drum provided with longitudinally spaced series of apertures, toothworks adapted to drive the negatives past the printing drum, illuminating means arranged inside the hollow drum and adapted to project beams of light through the apertures in the drum, a set of parallel shafts, sprocket wheels keyed thereto adapted to drive the positives, optic means adapted to lead the beam of light passing out of the apertures towards the sprocket wheels on the shaft corresponding to the series to which the aperture considered belongs, a motor, a common shaft driven by the motor, gearworks connecting said common shaft with both parallel shafts on one hand and the toothworks on the other and friction drives independent of one another and independent of the said common motor and shaft arrangement adapted to take up the negatives on one hand and the positives on the other.

6. A multiple projection printing machine for printing a plurality of negative impressions simultaneously on a plurality of positives, comprising a hollow printing drum provided with longitudinally spaced series of apertures, toothworks adapted to drive the negatives past the printing drum, illuminating means arranged inside the hollow drum and adapted to project beams of light through the apertures in the drum, a set of parallel shafts, sprocket wheels keyed thereto adapted to drive the positives, optic means adapted to lead the beams of light passing out of an aperture towards the sprocket wheels on the shaft corresponding to the series to which the aperture considered belongs, a motor, a common shaft driven by the motor adapted to positively control the toothworks, a pinion on the common shaft, pinions mounted yieldingly on each parallel shaft and controlled positively by last mentioned pinion, and friction drives independent of one another and independent of the said common motor and shaft arrangement adapted to take up the negatives on one hand and the positives on the other.

7. A multiple projection printing machine for printing a plurality of negative impressions simultaneously on a plurality of positives, comprising a hollow printing drum provided with longitudinally spaced series of apertures, toothworks adapted to drive the negatives past the printing drum, illuminating means arranged inside the hollow drum and adapted to project beams of light through the apertures in the drum, a set of parallel shafts, sprocket wheels keyed thereto and adapted to drive the positives, optic means adapted to lead the beams of light passing out of the apertures towards the sprocket wheels on the shaft corresponding to the series to which the aperture considered belongs, a motor, a common shaft driven by the motor, gearworks connecting said common shaft with both parallel shafts on one hand and the toothwork on the other, light controlling strips controlled by the said common shaft and adapted to provide respectively the changes in light intensity required by the corresponding negatives and friction drives independent of one another and independent of the said common motor and shaft arrangement adapted to take up the negatives on one hand and the positives on the other.

8. A multiple projection printing machine for printing a plurality of negatives simultaneously on a plurality of positives comprising a common rotary hollow printing drum provided with longitudinally spaced series of apertures, toothworks carried by the drum and adapted to drive the different negatives past the printing drum, illuminating means arranged inside the hollow drum and adapted to project beams of light through the apertures in the drum, a set of parallel shafts, sprocket wheels keyed thereto adapted to drive the positives, optic means adapted to lead the beams of light passing out of the apertures towards the sprocket wheels on the shaft corresponding to the series to which the aperture considered belongs, a common positive control for the two shafts and for the hollow drum, a friction drive independent of said common control adapted to take up the positives, a motor independent of the said positive control and friction drive and friction drives adapted to take up the corresponding negatives controlled by last mentioned motor on either side thereof.

9. A multiple projection printing machine for printing a plurality of negative impressions simultaneously on a plurality of positives comprising a common rotary hollow printing drum provided with longitudinally spaced series of apertures, toothworks carried by the drum and adapted to drive the negatives past the printing drum, illuminating means arranged inside the hollow drum and adapted to project beams of light through the apertures in the drum, a set of parallel shafts, sprocket wheels keyed thereto adapted to drive the positives, optic means adapted to lead the beams of light passing out of the apertures towards the sprocket wheels on the shaft corresponding to the series to which the aperture considered belongs, a common positive control for the two shafts and for the hollow drum, two friction drives including each a motor independent of said common control, a pile of superposed coaxial rotary plates controlled thereby and positive reel carriers lying on each plate in frictional cooperation therewith and a friction drive independent of said common control and two last mentioned friction drives adapted to take up the negatives.

10. A multiple projection printing machine for printing a plurality of negative impressions simultaneously on a plurality of positives comprising a common rotary hollow printing drum provided with longitudinally spaced series of apertures, toothworks carried by the drum and adapted to drive the negatives past the printing drum, illuminating means arranged inside the hollow drum and adapted to project beams of light through the apertures in the drum, a set of parallel shafts, sprocket wheels keyed thereto adapted to drive the positives, optic means adapted to lead the beams of light passing out of

the apertures towards the sprocket wheels on the shaft corresponding to the series to which the aperture considered belongs, a common positive control for the two shafts and for the hollow drum, two friction drives including each a motor independent of said common control, the motorshaft thereof, a support eccentrically rotatable round the axis of rotation of the motorshaft, two piles of superposed coaxial rotary plates carried by the support, a gearwork controlling each of them and adapted to be operatively driven by the motor in alternation according to the angular position occupied by the rotatable support, and the positive reel carriers lying on each plate in frictional cooperation therewith and a friction drive independent of said common control and two lastmentioned friction drives adapted to take up the negatives.

11. A multiple projection printing machine for printing a plurality of negative impressions simultaneously on a plurality of positives comprising a common rotary hollow printing drum provided with longitudinally spaced series of apertures, toothworks carried by the drum and adapted to drive the negatives past the printing drum, illuminating means arranged inside the hollow drum and adapted to project beams of light through the apertures in the drum, a set of parallel shafts, sprocket wheels keyed thereto adapted to drive the positives, optic means adapted to lead the beams of light passing out of the apertures towards the sprocket wheels on the shaft corresponding to the series to which the aperture considered belongs, a common positive control for the two shafts and for the hollow drum, two friction drives including each a motor independent of said common control, a pile of superposed coaxial rotary plates controlled thereby, positive reel carriers lying on each plate in frictional cooperation therewith and a free wheel carried by the motorshaft for preventing its rotation in the direction corresponding to the unwinding of the positives, and a friction drive independent of said common control and two last mentioned friction drives adapted to take up the negatives.

12. A multiple projection printing machine for printing a plurality of negative impressions simultaneously on a plurality of positives comprising a common rotary hollow printing drum provided with longitudinally spaced series of apertures, toothworks carried by the drum and adapted to drive the negatives past the said drum, illuminating means arranged inside the hollow drum and adapted to project beams of light through the apertures in the drum, a set of parallel shafts, sprocket wheels keyed thereto adapted to drive the positives, optic means adapted to lead the beams of light passing out of the apertures towards the sprocket wheels on the shaft corresponding to the series to which the aperture considered belongs, a common positive control for the two shafts and for the hollow drum, two friction drives including each a motor independent of said common control, a pile of superposed coaxial rotary plates controlled thereby and positive reel carriers lying on each plate in frictional cooperation therewith, and forming a removable unit with the said underlying plate and a friction drive independent of said common control and two last mentioned friction drives adapted to take up the negatives.

13. A multiple projection printing machine for printing a plurality of negative impressions simultaneously on a plurality of positives comprising a common rotary hollow printing drum provided with longitudinally spaced series of apertures, toothworks carried by the drum adapted to drive the negatives past said drum, illuminating means arranged inside the hollow drum and adapted to project beams of light through the apertures in the drum, a set of parallel shafts, sprocket wheels keyed thereto adapted to drive the positives, optic means adapted to lead the beams of light passing out of the apertures towards the sprocket wheels on the shaft corresponding to the series to which the aperture considered belongs, a common positive control for the two shafts and for the hollow drum, two friction drives including each a motor independent of said common control, the motorshaft thereof, a support eccentrically rotatable round the axis of rotation of the motorshaft, two piles of superposed coaxial rotary plates carried by the support, a gearwork controlling each of them and adapted to be operatively driven by the motor in alternation according to the angular position occupied by the rotatable support, carriers for the positive reels lying on each plate in frictional cooperation therewith and a stationary toothwork adapted to engage the gearwork of the pile which is not operatively connected with the motor and a friction drive independent of said common control adapted to take up the negatives.

14. In a machine as claimed in claim 2 a passageway for each positive film in front of its sprocket wheels, said passageway passing over a half circumference round the sprocket wheel and adapted to constrain the film urged into one end of the passageway to follow under the action of its elasticity the wall opposed to the wheel.

15. In a machine as claimed in claim 2 a passageway for each positive film in front of its sprocket wheels, said passageway passing over a half circumference round each sprocket wheel with a concavity directed in the same direction for the different wheels, said cavities being connected through a concavity of opposite direction merging tangentially into the first concavities, a roller between the successive sprocket wheels arranged in said oppositely directed concavity of the passageway, the passageway being adapted to constrain the film urged into one end thereof to follow under the action of its elasticity the wall portions opposed to the wheels and to the roller respectively.

16. In a machine as claimed in claim 2 a passageway for each positive film in front of its sprocket wheels, said passageway passing over a half circumference round each sprocket wheel with a concavity directed in the same direction for the different wheels, said concavities being connected through a concavity of opposite direction merging tangentially into the first concavities, a roller between the successive sprocket wheels arranged in said oppositely directed concavity of the passageway, a yielding support for the roller for uniformizing the tension of the film, the passageway being adapted to constrain the film urged into one end thereof to follow under the action of its elasticity the wall portions opposed to the wheels and to the roller respectively.

17. In a machine as claimed in claim 2 a passageway for each positive film in front of its sprocket wheels, said passageway passing over a half circumference round each sprocket wheel with a concavity directed in the same direction for the different wheels, said concavities being connected through a concavity of opposite direc-

tion merging tangentially into the first concavities, a roller between the successive sprocket wheels arranged in said oppositely directed concavity of the passageway, the passageway being adapted to constrain the film urged into one end thereof to follow under the action of its elasticity the wall portions opposed to the wheels and to the roller respectively, the passageway including parts adapted to be opened for allowing access inside same.

18. In a machine as claimed in claim 2 a passageway for each positive film in front of its sprocket wheels, said passageway passing over a half circumference round each sprocket wheel with a concavity directed in the same direction for the different wheels, said concavities being connected through a concavity of opposite direction merging tangentially into the first concavities, a roller between the successive sprocket wheels arranged in said oppositely directed concavity of the passageway, the passageway being adapted to constrain the film urged into one end thereof to follow under the action of its elasticity the wall portions opposed to the wheels and to the roller respectively, the passageway including air circulating means for cleaning same.

19. In a machine as claimed in claim 2 a passageway for each positive film in front of its sprocket wheels, said passageway passing over a half circumference round each sprocket wheel with a concavity directed in the same direction for the different wheels, said concavities being connected through a concavity of opposite direction merging tangentially into the first concavities, a roller between the successive sprocket wheels arranged in said oppositely directed concavity of the passageway, a yielding support for the roller for uniformizing the tension of the film, the passageway being adapted to constrain the film urged into one end thereof to follow under the action of its elasticity the wall portions opposed to the wheels and to the roller respectively and a common holder for the yielding supports of the rollers adapted to be adjustably secured to the machine frame.

ANDRÉ LÉON VICTOR CLÉMENT DEBRIE.