Nov. 28, 1967 R. H. NORMANDY ET AL 3,354,777

DOCUMENT FEEDING APPARATUS FOR MICROFILMING MACHINE

Filed Feb. 12, 1965 5 Sheets-Sheet 1

Fig. 1

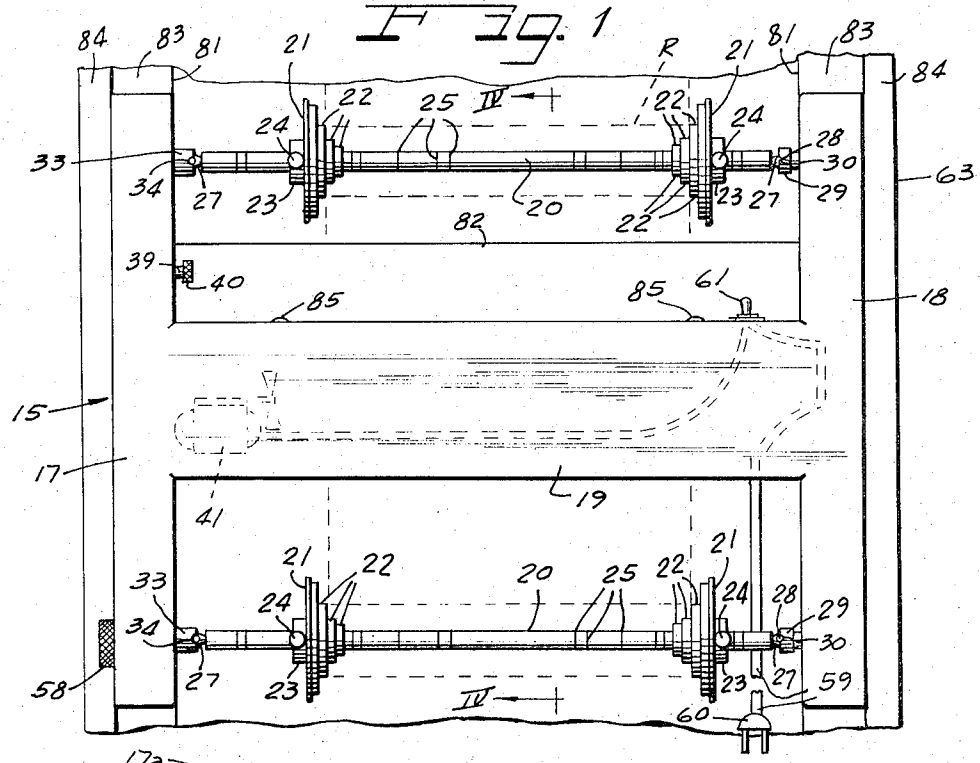


Fig. 2

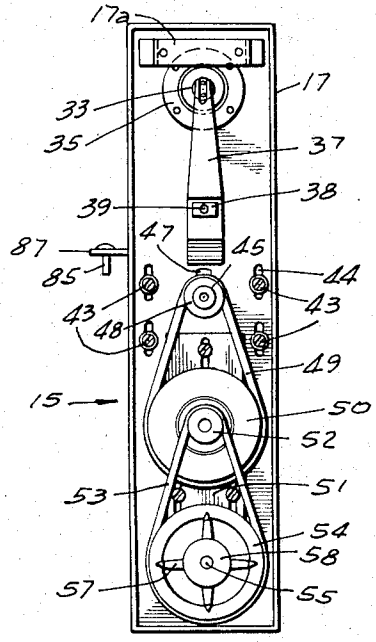
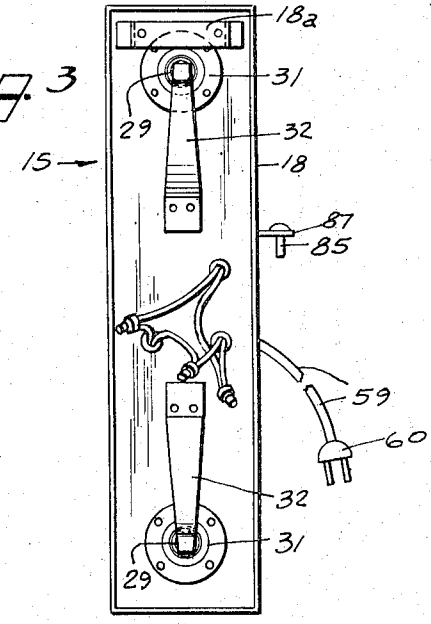


Fig. 3



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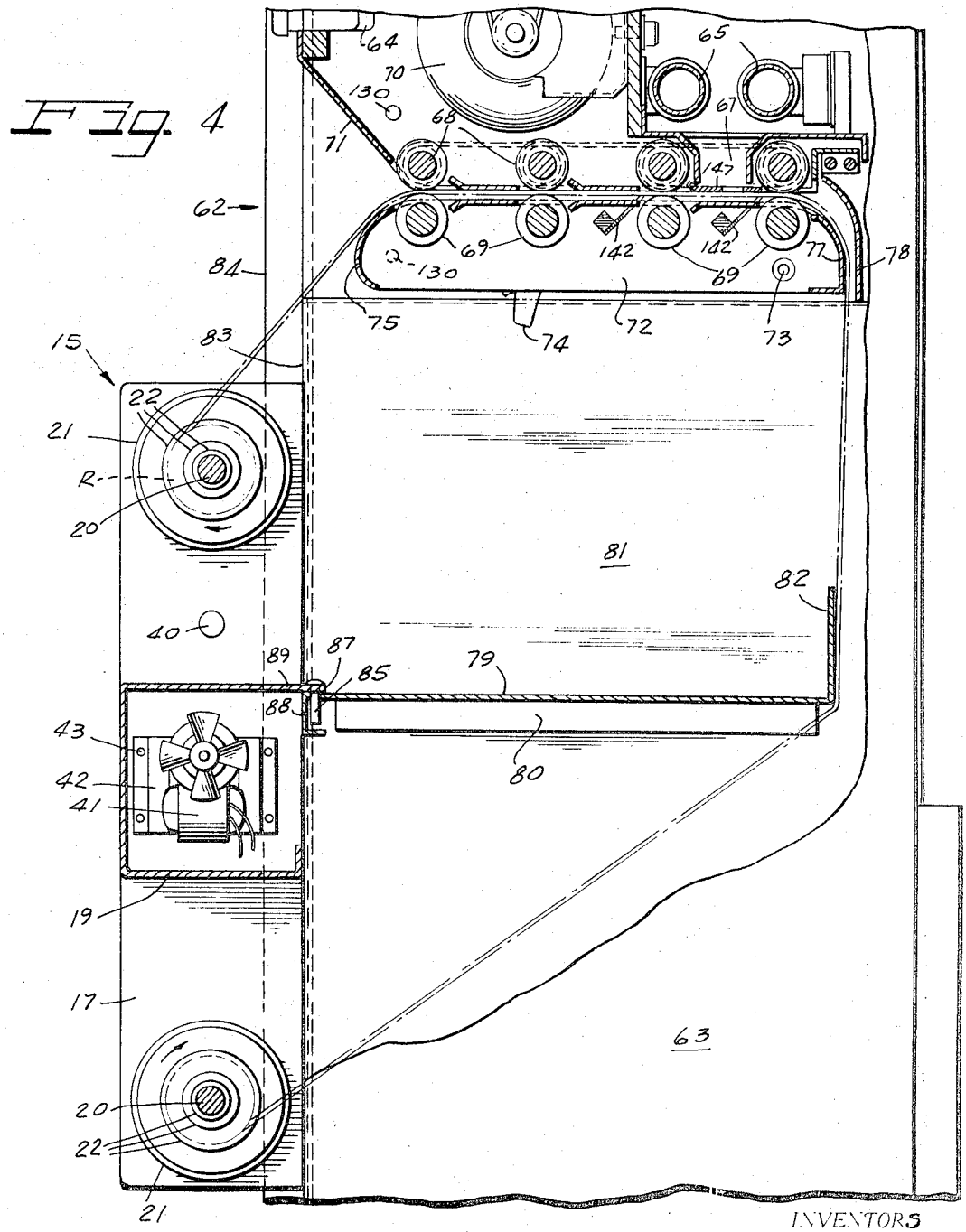
DOCUMENT FEEDING APPARATUS FOR MICROFILMING MACHINE

Filed Feb. 12, 1965 5 Sheets-Sheet 2

Fig. 4



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DOCUMENT FEEDING APPARATUS FOR MICROFILMING MACHINE

Filed Feb. 12, 1965 5 Sheets-Sheet 3

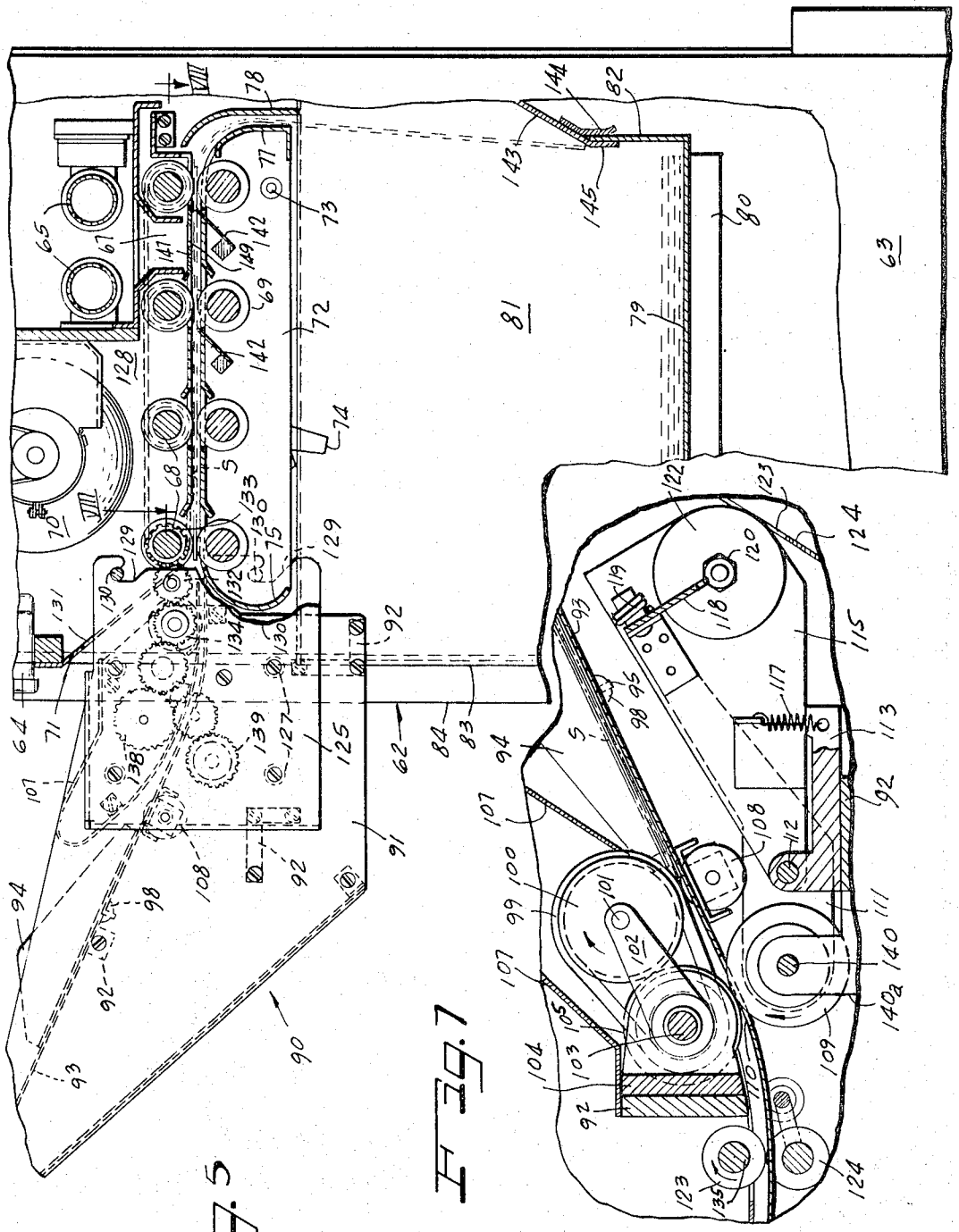

FIG. 5

FIG. 7

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DOCUMENT FEEDING APPARATUS FOR MICROFILMING MACHINE

Filed Feb. 12, 1965 5 Sheets-Sheet 4

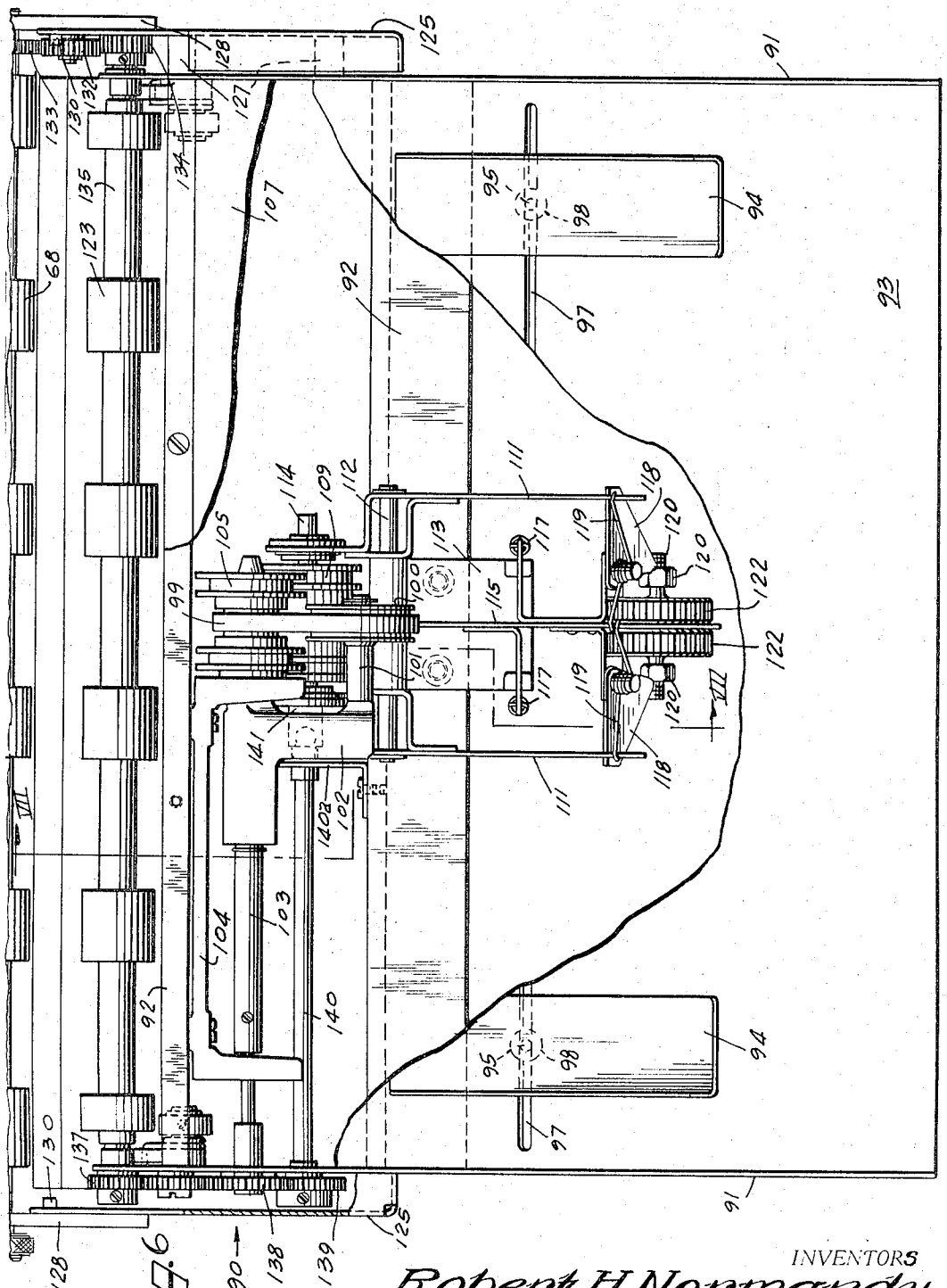

FIG. 6

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DOCUMENT FEEDING APPARATUS FOR MICROFILMING MACHINE

Filed Feb. 12, 1965 5 Sheets-Sheet 5

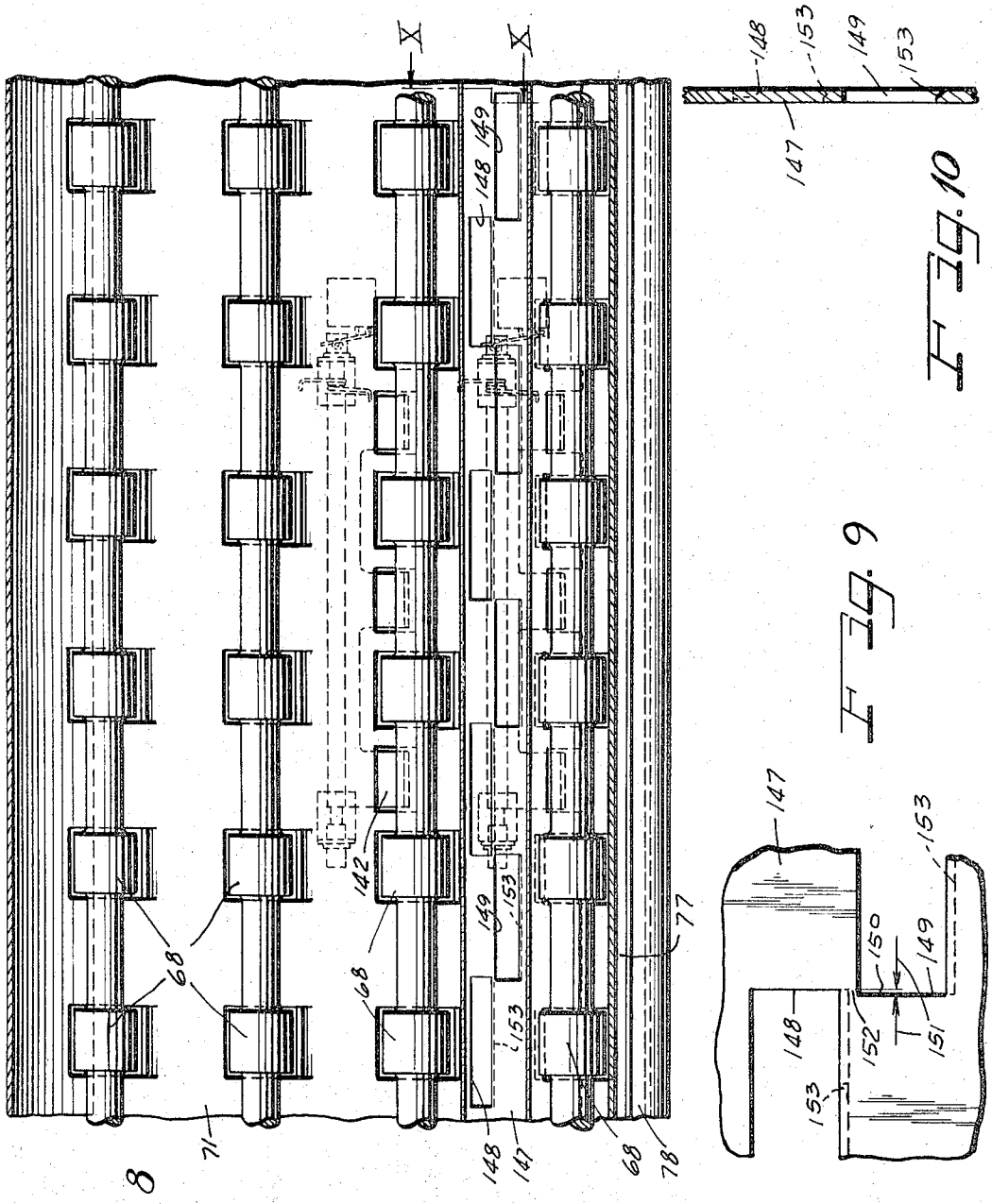

FIG. 8

FIG. 10

FIG. 9

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United States Patent Office

3,354,777

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DOCUMENT FEEDING APPARATUS FOR MICROFILMING MACHINE

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Filed Feb. 12, 1965, Ser. No. 432,367
24 Claims. (Cl. 88—24)

The present invention relates to improvements in document feeding apparatus for use with and in combination with a machine for photographically recording, as by microfilming, documents as disclosed in the copending application of Daniel D. Call Serial No. 229,540 filed Oct. 10, 1962, now patent No. 3,255,662, issued June 14, 1966, assigned to the same assignee as the present application. That machine is especially adapted for microfilming fan-folded documents such as the continuous forms extensively employed in tabulating machines, and the like, for accounting and bookkeeping purposes. However, insofar as the document transport, scanning and microfilming features of the machine are concerned, it is capable of microfilming continuous strip form documents other than fan-folded, as well as individual documents.

It is, accordingly, an object of the present invention to provide new and improved means for handling continuous strip form documents, and more particularly such documents comprising a rolled continuous strip, for photographically recording, as by microfilming, in a machine of the character identified.

Another object of the invention is to provide a new and improved apparatus which may be readily attached to a machine as identified for selectively converting the machine for photographically recording, as by microfilming, of rolled continuous strip documents.

A further object of the invention is to provide a rolled document handling apparatus for microfilming machines which is highly adaptable to accommodate document rolls of various lengths and core bore diameters, which is simple and easy to load and unload, and is relatively simple and rugged in construction.

Yet another object of the invention is to provide a new and improved optional or auxiliary attachment apparatus for converting a machine of the character identified for photographically recording, such as microfilming a succession of separate or single sheet documents.

A yet further object of the invention is to provide a new and improved easily attachable and detachable sheet feeding unit constructed and arranged to be mounted selectively in association with the document transport mechanism of a photographic recording such as a microfilming machine.

It is also an object of the invention to provide in a photographic recording such as a microfilming machine, capability of handling various types of documents and thus substantially increasing the range of utility of the machine.

It is a still further object of the invention to provide in a document photographing machine, said as a microfilming machine, new and improved scanning aperture means for smoothly guiding the leading edges of documents through the scaning aperture area.

Other objects, features and advantages of the present invention will be readily apparent from the following detailed description of certain preferred embodiments thereof taken in conjunction with the accompanying drawings, in which:

FIGURE 1 is a front elevational view of a document roll handling and feeding apparatus especially constructed and arranged for use with and in combination with a microfilming machine as identified;

FIGURE 2 is a side elevational view of the roll handling

unit of FIGURE 1 looking toward the left side of the unit as depicted in FIGURE 1;

FIGURE 3 is an opposite side elevational view of the device of FIGURE 1;

FIGURE 4 is an enlarged fragmentary vertical sectional detail view through the device of FIGURE 1 and the microfilming machine to which attached, taken substantially on the line IV—IV of FIGURE 1;

FIGURE 5 is a sectional elevational detail view showing a single sheet feed attachment or accessory on the microfilming machine;

FIGURE 6 is an enlarged top plan view of the single sheet feed device of FIGURE 5, with certain parts broken away and in section to reveal details of structure;

FIGURE 7 is a fragmentary sectional elevational detail view taken substantially on the line VII—VII of FIGURE 6;

FIGURE 8 is an enlarged fragmentary sectional plan view taken substantially on the line VIII—VIII of FIGURE 5;

FIGURE 9 is an enlarged fragmentary plan view of a portion of the aperture plate of FIGURES 5 and 8; and

FIGURE 10 is a fragmentary enlarged sectional detail view taken substantially on the line X—X of FIGURE 8.

On reference to FIGURES 1–4, a device **15** for handling and feeding documents in roll form is depicted. It comprises a frame structure of generally wide H-shape configuration when viewed in front elevation provided with respective left and right side parallel spaced coextensive vertical legs **18** and a horizontal cross bar **19** of suitable width rigidly connected to and between the legs. Suitably the frame structure may be fabricated from sheet material such as appropriate gauge sheet metal. Each of the side legs **17** and **18** is of a box-like hollow structure opening toward its side of the frame, and the cross bar **19** is of hollow beam construction and may open rearwardly for access into its interior. This affords a rigid and rugged frame of relatively lightweight, especially where the material from which fabricated is of relatively lightweight such as aluminum.

The legs **17** and **18** provide, in effect, a pair of opposed upwardly extending spaced arms and a pair of opposed downwardly extending spaced arms. Mounted on and between such arms are means for supporting and feeding and rewinding a roll R of continuous strip or web document of the type on which tabulating, bookkeeping or accounting records are imprinted in an office machine employing such rolls, generally paper. Filing of such record rolls requires substantial storage space and therefore the content of the rolled document is desirably microfilmed for record purposes enabling storage in very small space. For economy and standardization, each of the roll-supporting means comprises a similar shaft or spindle **20**. Each of the spindles **20** supports a pair of opposed concentric complementary flanged hub disks **21**. Each of the hub disks **21** has a roll engaging face provided with a plurality of stepped, respectively graduated diameter, concentric, annular roll core engaging shoulders **22** adapted to be received in respective diameters of core bores of different makes or sizes of document paper rolls. To accommodate various lengths of rolls of paper, and thus to accommodate various widths of paper web, the supporting hub disks **21** are adjustable longitudinally along the spindle **20** in each instance and for this purpose the disks include an outer face hub **23** carrying a set screw **24** by which the disk is secured fixedly on its spindle after adjustment by longitudinal sliding of the disk on the spindle into the adjusted position. Through this arrangement, mounting or removal of the paper roll R with respect to the spindle **20** is adapted to be effected by inserting the spindle through the core bore of the roll with either or both of the associated supporting disks **21**

removed although one of the disks may conveniently remain on the spindle. Then the remaining of the disks **21** is slid into place on the spindle and to engagement with its end of the paper roll. The two roll supporting disks are then adapted to be adjusted anywhere desired longitudinally along the spindle **20** to orient the paper web or strip as preferred. As a convenience in setting the roll supporting disk **21** for various lengths of paper roll, the spindle **20** is provided with indicia, suitably comprising annular index marks **25**.

Mounting of the spindles **20** interchangeably between either the upper or lower legs of the supporting frame is effected in a manner which avoids the need for any tools but enabling quick mounting or removal of any one of the spindles quickly by simple manual effort. For this purpose, each end of each of the spindles **20** carries quick disconnectable coupling means desirably in the form of an axial boss or head **27** carrying one or more radial interlock lugs **28**. On one of the side members of the frame, herein the member **18**, each of the arms carries a rotary inwardly projecting journal member **29** affording an inwardly opening socket receptive of an associated one of the mounting heads **27** and having a radial notch or notches **30** in which the associated interlock lug **28** is engageable. Each of the hubs **29** is journalled in a bearing **31** fixedly supported on and within the hollow chamber of the side member **18**. Each of the journal members **29** is axially reciprocable as well as rotatable and is normally biased inwardly of the frame by means such as a leaf spring **32** rigidly mounted on the frame adjacent to one end and thrusting toward the engaged end of the associated hub **29**. Through this arrangement, mounting or dismounting of the associated spindle **20** is readily effected by assembling one end of the spindle with the inner end of the hub **29** and thrusting axially toward the hub **29** to displace it in opposition to its spring bias sufficiently to clear the opposite end coupling head **27** of the spindle with respect to an inner coupling end of a complementally socketed supporting hub **33** journalled in the side member **17** in coaxial alignment with the opposite hub **29**. Each of the hubs **33** has an interlock lug receiving notch **34**. Thus, in mounting the spindle **20** it is thrust endwise into the socket of the hub **29** and such hub displaced until registration of the opposite end interlock head of the spindle is effected with respect to the socket in the associated hub **33**, and upon release of the counter-biasing mounting thrust, the spindle is urged into retaining engagement with the hub **33** by the biasing spring **32**. Removal of the spindle is effected by reverse manual maneuver.

Means are provided within the side member **17** for effecting a pay-out drag on one of the hubs **33** and a take-up drive on the other of such hubs. Accordingly, both of the hubs **33** are rotatably mounted on respective bearing structures **35** fixedly attached to the side member **17** within the chamber defined thereby. Each of the hubs has an end portion exposed within the side member chamber.

Herein, the upper of the spindle supporting hubs **33** is equipped with pay-out drag means, herein comprising a leaf spring member **37** which has an upper end portion bearing against the opposing end of the hub **33** and a lower end portion thrusting against the opposing inner wall of the side member **17** with an intermediate portion of the leaf spring normally spaced from such wall. For adjusting the drag pressure of the spring **37** an adjustable tensioning device is provided comprising a tensioning plate nut **38** engaging the face of the spring opposite the opposed frame wall and threadedly engaged upon a tightening screw **39** extending through the frame leg wall and provided with a digitally engageable head **40** by which the tightening screw is manipulated to provide the desired drag tension on the spring **37**.

Driving of the lower one of the hubs **33** is effected by means such as an electric motor **41** which is desirably

mounted on the side member **17** within the chamber afforded by the hollow cross beam **19**, being carried by a mounting plate **42**. Vertical adjustment of the motor **41** is enabled by securing the mounting plate **42** by means of screws **43** which extend through respective vertical adjustment slots **44**. A drive shaft **45** extends through a vertical clearance slot **47** and carries fixedly thereon a small diameter drive wheel **48** in the form of a pulley connected in a speed reduction arrangement including a first flexible driving member comprising a belt **49** trained over a larger diameter pulley **50** having its shaft journalled on a vertically adjustable mounting plate **51** and having a fixed coaxial small speed reducing driving pulley **52** over which is trained a drive belt **53** drivingly engaged on a pulley **54** which is rotatably mounted on a stub shaft **55** projecting into the end member chamber from the lowermost of the mounting hubs **33**. Friction slip clutch means connect the shaft **55** with the transmission pulley **54** and herein comprise a star spring **57** concentric with the shaft **55** and having its ars resiliently thrusting against the outer face of the pulley **54**, with a spring tensioning member **58** mounted fixedly on the stub shaft **55** in thrusting engagement against the clutch star spring. Desirably the thrust member **58** comprises a knurled head or knob which is manually engageable for turning the shaft **55** and thereby the associated hub **33** and the interconnected spindle **20** for initial take-up winding of the spindle when setting up for operation or to effect take-up adjustment of the spindle and a roll take-up core supported thereby.

Electrical operation and control of the motor **41** is conveniently effected by supplying it with a source of electrical energy through an electrical circuit including a cord **59** carrying a plug **60** by which it is adapted to be connected to a suitable electrical source outlet. Control of the electrical circuit is through a suitable switch including an actuator comprising a lever **61** which may be suitably mounted on the upper side of the cross beam **19**. Through this arrangement, the unit **15** is provided with a self-contained actuating drive under the control of the switch lever **61**.

Desirably, the open sides of the side frame members **17** and **18** are closed as by means of respective removable panels (not shown)adapted to be attached to suitable mounting brackets **17***a* and **18***a*.

Means are provided for removably mounting the unit **15** operatively in association with and on a microfilming machine **62** disclosed in the aforesaid application Serial No. 229,540. The disclosure of that application to the extent necessary for a full understanding of the instant disclosure, and to incorporate details there described but herein omitted in the interests of diminution of the instant disclosure, is included herein by reference. Suitable supporting framework and a cabinet housing **63** are provided for the machine. Within the upper front portion of the cabinet is a microfilm camera chamber **64**, rearwardly from which is optical means adapted to direct to the camera a suitably reduced image of a document illuminated by lamps **65** as it passes an exposure aperture **67** over the rear portion of a front-to-rear document transport assembly including a set of upper driven rollers **68** and a set of matching idler rollers **69**. Means for driving the camera and the rollers **68** include a driving motor **70**.

While the driven transport rollers **68** are mounted on fixed axes in the cabinet and have a document guide plate **71** associated therewith, the idler rollers **69** are carried by a break-away plate structure **72** which is hingedly mounted as at **73**. A latch **74** normally maintains the break-away plate or roller carriage **72** in its operative position as shown in FIGURE 4 and by releasing the latch the break-away carriage can drop down to facilitate inserting a document into position between the transport rollers. On its front margin, the break-away carriage plate **72** has a curved lead-in flange **75**, while at its rear margin the plate has a lead-off rearwardly and downwardly curved flange **77** cooperating with a deflector **78** by which a docu-

ment is guided downwardly through a space below the document transport and which space is divided by a horizontal supporting panel **79** having side flanges **80** by which it is secured fixedly to front-to-rear inner vertical liner panels **81** of the cabinet housing. At its rear margin the supporting panel **79** has an upstanding guide flange **82** generally aligned with the lower edge of the downturned guide flange **77** of the transport roller plate.

Above and below the supporting panel **79**, the cabinet opens forwardly, and each of the side liner panels **81** has along each side of the opening a narrow vertical front flange portion **83** inset relative to front corner frame bars **84** of the cabinet **63**. Within the vertical rabbet grooves thus provided, the document roll handling unit **15** is adapted to be mounted and for this purpose is of a matching or complementary width so that the side members **17** and **18** will seat conveniently in the vertical grooves. Removable support of the unit **15** in vertical position wherein the upper of the roll-supporting spindle assemblies is adjacently below the document transport mechanism of the machine is conveniently effected by means of downwardly projecting anchoring studs **85** carried by a rearward flange extension **87** on the upper wall defining the cross beam **19** and adapted to overlap the front margin of the supporting panel **79** which is flush with the inset seating panels **83** and is provided with a downwardly and inwardly turned reinforcing and finishing flange **88**. Desirably, there are two of the studs **85**, one located adjacent to each of the side members **17** and **18**, and the front margin of the supporting plate **79** has corresponding socket holes **89** within which the attachment studs are engaged by downward sliding movement of the unit **15** with the studs in registering alignment with the socket holes. Thereby, the upper, pay-off spindle **20** is located adjacent to the document transport and the lower take-up spindle **20** is located below the supporting panel **79**.

When a document roll to be microfilmed is newly mounted on the upper pay-out spindle **20**, the idler roll carriage **72** is desirably released to a generally pendant position and the leading end of the web manually fed from the roll past the inner end of the carriage and then brought downwardly past the guide flange **82** and then forwardly and started onto the take-up spindle **20** which is facilitated by manual turning of the take-up spindle as by manipulating the knob **58**. After the web has been thus threaded, and the break-away carriage **72** has been returned and latched in its operative transport position, the machine and the device **15** may be activated. If the device **15** is started ahead of the machine, the slip clutch drive will spin while the web is held by the transport rollers **68** and **69**. Should the machine be started ahead of the device **15**, the web will gather in the lower portion of the cabinet until the take-up spindle is actuated. Desirably a slight overrun differential speed in the take-up spindle is afforded to take-up any slack in the web passing from the document transport of the machine. Desirable tension on the web at the pay-out spindle **20** is readily regulated by manipulation of the adjustment knob **40**. As the document web strip travels continuously through the document transport system of the machine, the upwardly facing surface of the document is continuously microfilmed by the flow camera in the housing **64** and synchronized in operation with the document transport mechanism.

Where, instead of continuous web documents, single sheet documents are to be microfilmed, the machine **62** is equipped with a sheet feed apparatus **90**, desirably comprising a self-contained unit constructed and arranged to be quick-detachably asembled with the front of the machine in feeding alignment with the mouth or lead-in into the front of the document transport mechanism, as shown in FIGURE 5. This unit comprises a supporting frame including side plates or panels **91** and a plurality of rigid, suitably located, transverse frame bars **92** to the respective ends of which the side frame panels **91** are attached.

In order to feed sheets S (FIG. 7) with at least partial gravity assist, a sheet-supporting platform **93** provides part of the unit frame and is secured between the side panels **91** to slope downwardly and rearwardly as shown in FIGURES 5 and 7. To support a stack of document sheets of any width within a substantial range in desirably centered alignment on the platform **93**, a spaced, opposed pair of adjustable alignment bars or flanges **94** is provided, mounted slidably on the platform for transverse slidable adjustment through the medium of guide studs **95** projecting downwardly from the flanges through transverse aligned slots **97** in the platform **93** and having friction washer means **98** thereon pressing against the bottom of the platform and retaining the flanges resiliently in position to which adjusted for guiding sheets from a stack deposited therebetween in a desirably centered relation with respect to sheet feeding means toward which the leading edges of the sheets are directed in the rear portion of the unit.

Immediately forwardly from the sheet guiding flanges **94** means are provided for drawing the document sheets S successively from the top of the stack. Such means herein comprise a frictional draw-in belt **99** trained over an idler pulley **100** carried by a stub shaft **101** (FIG. 6) mounted on a rocker arm **102** relatively pivotally mounted on a shaft **103** carried by a bracket **104** mounted on the adjacent one of the frame bars **92**. Fixed corotatively on the shaft **103** in alignment with the pull-in belt **99** is a feed roller **105** affording an intermediate hub over which the belt is drivingly trained, whereby through the shaft **103** the pull-in belt **99** and the feed roller **105** are adapted to be driven in the in-feeding direction. Desirably, a combination feed throat and cover plate **107**, attached to the adjacent frame bar **92** provides a feed throat converging toward the draw-in belt **99** and the feed roller **105** and having another portion overlying the draw-in belt and feed roller protectively.

Since there is planetary torque in the operation of the pull-in belt **99** tending to thrust the belt toward the platform plate **93**, an underlying anti-friction roller **108** is desirably mounted to project peripherally slightly above the platform plate, as best seen in FIGURES 5 and 7, directly under the draw-in nip of the belt. This not only facilitates pulling in of the successive document sheets, but also provides an anti-friction backing for the belt in the absence of any sheet.

To prevent all but one document at a time from passing through the feed roller assembly, a reversing roller **109** is mounted in alignment under the feed roller **105** to project upwardly peripherally through a clearance opening **110** to cooperate with the feed roller **105**. Both of the rollers **105** and **109** are formed from a peripherally high friction material, but the feed roller **105** is of a higher coefficient of friction than the reversing roller **109** so that a single document engaged between the rollers will be positively advanced while a second document is prevented by the roller **109** from advancing until the trailing edge of the superposed document leaves the nip of the rolls and the pull-in belt **99** thrusts the next succeeding document, which has been held back by the roller **109**, into the nip of the rollers for onward feeding.

Mounting of the reversing roller **109** preferably such that if, for any reason, it is desired to defeat the same, it can be shifted away from the feed roller **105**. Therefore, the roller **109** is mounted on the rear portion of a supporting frame comprising complementary left and right side arms **111** intermediately pivotally mounted on a shaft **112** carried by a supporting block **113** mounted on the adjacent frame bar **92**. At their rear end portions, the arms **111** support a rotary shaft **114** on which the roller **109** is corotatively mounted. Control of the arms **111** is through a medially longitudinally intermediate lever arm **115** journalled at its rear end portion upon the shaft **112** and normally biased by means of springs **117** against the bracket block **113**. Adjacent to its forward or outer end, the lever **115** pivotally supports a pair of aligned oppositely ex-

tending outrigger-like bell crank levers **118** which are adapted to underlie and support the outer end portions of the arms **111** biased thereagainst by torsion springs **119**. Each of the levers **118** is engaged with a nut **120** which is engaged on a threaded stub **121** of a respective adjustment wheel **122** pivotally mounted on the outer end portion of the lever plate **115**. Through this arrangement, lifting of the outer end portion of the lever plate **115** by engagement of the outer end portion thereof or the wheels **122** through an access opening **123** in a front guard and closure plate **124** on the unit **90** effects corresponding downward swinging of the reversing roller **109**. Further, adjustment of the reversing roller **109** for optimum cooperation with the feed roller **105** for any predetermined thickness of documents to be fed and also to afford square feeding of the rollers is adapted to be accomplished by appropriate rotary manipulation of both of the wheels **122** for thickness adjustment and individual adjustment of the wheels as necessary to attain square feeding.

Beyond the feed roller **105**, the document S being fed is guided onward by a guiding inner end portion guiding extension of the platform plate **93** which turns to a generally horizontal position and affords with a narrowly spaced overlying rearward extension of the guide plate **107** a generally funnel passage leading rearwardly past an upper driven feed roller **123** and a lower resiliently upwardly biased idler roller **124** so disposed that as the fed document is advanced from the feed roller **105** which engages only a limited central longitudinal area of the document, the document is promptly gripped over substantially its entire width between the rollers **123** and **124** and positively advanced from the rear end portion of the feed unit.

Means are provided for mounting the feed unit **90** in proper position in front of the document transport assembly of the microfilming machine **62** for substantially accurate alignment of the discharge end of the guide funnel within the entry mouth defined by the guide plate **71** and the guide flange **75** and adjacent to the outermost of the opposed transport rollers **68** and **69**, as best seen in FIGURE 5. For this purpose, a pair of coextensive, substantially similar left and right side latch-on members **125** are provided on the rear end portions of the side frame plates **91**. Desirably, the latch-on members **125** comprise suitably dimensioned plates serving the dual function of housings mounted on the outer sides of the frame plates **91** as by means of spacer blocks **127** to afford an overall outside spaced apart relationship of the attachment or latching plates **125** to fit closely but freely within the forward margins of respective opposite vertically extending front-to-rear frame member plates **128** which form part of the supporting structure for the document transport assembly as well as other associated components of the microfilming machine **62**. At their rear end portions, the latching plates **125** project beyond the adjacent ends of the frame plates **91** and are each provided with vertically spaced rearwardly opening bayonet slots **129** within which are received inwardly projecting respective fixed supporting studs **130** rigid with the supporting or mechanism frame plates **128**. Through this arrangement, mounting of the feeder unit **90** is adapted to be easily effected by lifting it into position, by projecting the rear end portions of the attachment plates **125** through respective clearance slots afforded in the front portion of the guide plate **71** and into position alongside the inverted tray-like break-away transport plate **72** until the bayonet slots **129** are in registration with the studs **130** whereupon a rearward and downward movement engages the downwardly opening hook-like formations defining the upper ends of the bayonet slots latchingly over the studs. The weight of the feeder unit **90** then firmly maintains it in the mounted operative, aligned relation in front of the document transport mechanism.

Synchronized driving of the feeder unit mechanism with the document transport rollers **68** and **69** is effected automatically upon mounting of the feeder unit **90** on the machine **62**. To this end, one of the attachment and housing plates **125**, herein the one located at the right side of the unit **90** has rotatably mounted on the upper portion of its rear margin within the housing defined thereby a power transmission pinion **132** which desirably has its toothed perimeter closely adjacent to and preferably projecitng slightly beyond the adjacent rear edge of the plate **125** so as to mesh with a driving pinion **133** carried by the shaft of the adjacent driven transport roller **68** (FIGURE 6) which derives its power from the drive motor **70** in the manner fully described in application Ser. No. 229,540.

Driving power transmitted through the transmission pinion **132** drives a pinion **134** meshing therwith and corotative on a shaft **135** journalled on the inner end portions of the frame plates **91** and mounting the feed roller **123**. At its opposite end, the shaft **135** carries a driving pinion **137** within the housing afforded by the latching and housing plate **125** and this pinion drives a cluster of gears including a driving gear **138** on the feed roller shaft **103**. The gear **138**, in turn, drives the reversing roller **109** through a meshing driven gear **139** on a shaft **140** which is journalled through the adjacent frame side plate **91** and a supporting bracket **140***a* mounted on the adjacent frame bar **92**. An inner end portion of the shaft **140** is coupled by a flexible coupling **141** to the adjacent end portion of the reversing roller shaft **114**, thereby enabling adjustments of the reversing roller transversely to the fixed axis of the shaft **140**.

As the successive document sheets S fed from the magazine afforded by the feeder **90** are transported by the rollers **68** and **69** to the exposure aperture area **67**, they successively trip serially arranged camera synchronizing control switches **142** (FIGURE 5). After each of the document sheets has been photographed it passes down the chute defined by the flanges **77** and **78** toward the supporting plate **79** which affords a receiving tray for the photographed documents. In order to deflect the documents into the tray, an adapter deflector plate **143** is mounted on the upper edge of the rear flange **82** to extend upwardly and rearwardly diagonally therefrom. Suitable quick releasable means such as spring clips **144** may be provided on the lower portion of the deflector plate **143** cooperative with a downturned gripping flange **145** to engage the upper margin of the flange **82** in frictional slide-on, slide-off relation.

In order to avoid any problem of deflection upwardly into the exposure aperture area **67** of the successive leading edges of the document sheets S as transported at fairly high speed through the exposure and scanning zone, a safety exposure aperture plate structure **147** (FIGURES 4, 5 and 8) is provided. This may, if desired, comprise a separate added or supplemental piece mounted in or over the open exposure aperture of an existing machine in order to adapt it for sheet processing, but is preferably constructed as an original integral part of the guide plate **71** so that the machine may be used alternately for continuous web microfilming or sheet microfilming without regard to the exposure aperture.

Full exposure of the entire width of the document passing the exposure aperture **67** is effected through the aperture plate structure or section **147**, by the provision of a plurality, in this instance two, transversely extending closely adjacent, relatively staggered rows of individual exposure apertures **148** and **149**. In both of the series, the apertures are slightly longer than the space between adjacent apertures in that row. As a result, as best seen in FIGURE 9, the edges defining the adjacent ends of the apertures **148** and **149** are relatively offset as indicated by the graphic line **150** and the arrows **151**, whereby the aperture areas are in overlapping relation in the direction of transport movement of the documents through the exposure zone. All of the apertures in the parallel rows are as close together as practicable while affording a narrow but structurally adequate integral connecting

portion or area **152** between the relatively overlapping aperture area ends. Thereby, while the aperture plate structure **147** is of adequate strength to be self-sustaining and free from any objectionable warpage, it provides for adequate exposure and scanning of the entire document flowing under the aperture plate. Further, longitudinal streaking is avoided by not only assuring that all portions of the area are exposed through the successive rows of end overlapping exposure apertures, but also by avoiding overexposure in the overlapping areas by maintaining such areas to the barest minimum.

To avoid any possible catching of paper edges on the downstream edges defining the apertures **148** and **149**, such aperture defining edges are provided with respective chamfers **153** as best seen in FIGURE 10, but also indicated in FIGURES 8 and 9.

From the foregoing it will be readily apparent that the present invention affords great versatility in a microfilming machine since the machine is adapted for alternatively and selectively handling continuous web documents, whether fan-folded or in rolls, or sheet forms of documents of various sizes. Conversion of the basic machine initially devised for expeditiously handling fan-folded documents to be microfilmed, is readily effected by quick attachment of the proper conversion unit, and without requiring any alteration, readjustment or dismantling of the basic machine. Each of the roll document attachments **15** and the sheet feeding attachment **90** is constructed as a conveniently manipulated, self-contained unit which anyone may mount in its operative position on the machine without exercise of any mechanical aptitude and by following the simplest sort of instructions. This ready convertability of the machine enables microfilming of a full range of business machine documents, and more particularly those produced by accounting and record keeping machines, in the one microfilming machine and without requiring a multiplicity of microfilming machines or units for the purpose.

It will be understood that modifications and variations may be effected without departing from the scope of the novel concepts of the present invention.

We claim as our invention:

1. In a machine for photographically recording, as by microfilming either continuous web or sheet form of documents and including a document transport assembly and a document exposure aperture structure associated with said transport assembly for the exposure and scanning of documents carried by the transport assembly for continuous flow photographing of the documents,

said machine having a frame structure,

a continuous web supporting unit,

a sheet magazine and feeding unit,

each of said units having means for attaching it to said machine frame structure,

and means carried by said machine frame structure and releasably engageable by said attaching means for mounting of the units in position on the machine to supply continuous documents from said web feeding unit and from said sheet magazine and feeding unit to said transport assembly for transport thereby.

2. In a machine for photographically recording, as by microfilming, either continuous web or sheet form of documents and including a document transport assembly and a document exposure aperture structure associated with said transport assembly for the exposure and scanning of documents carried by the transport assembly for continuous flow photographing of the documents,

said machine having a frame structure,

a continuous web supporting unit,

a sheet magazine and feeding unit,

each of said units having means for attaching it to said machine frame structure,

means carried by said machine frame structure and releasably engageable by said attaching means for mounting of the units in position on the machine to supply continuous documents from said web supporting unit and sheets from said sheet magazine and feeding unit to said transport assembly for transport thereby,

and an exposure aperture plate structure in said exposure aperture over the path of movement of documents through the transport assembly and having overlappingly staggered exposure apertures affording full exposure of documents transported thereby but preventing leading edge deflection of documents into the exposure aperture.

3. In a document photographing machine including a document transport assembly and document exposure and scanning aperture means associated with said transport assembly,

and means for alternatively feeding continuous web documents and a succession of single sheet documents to said sheet transport assembly.

4. In an upright photographing machine having in the upper portion thereof photographing means including a horizontal front-to-rear document transport with an overhead exposure aperture structure adjacent the rear of the transport and a front entry into the transport and a rear discharge from the transport,

continuous web document supply means,

sheet document supply means,

and means on the front of the machine to support said supply means in position for respectively supplying continuous web documents and sheets into the entry of the transport for photographing.

5. In a photographing machine,

an upright forwardly opening cabinet having in the upper portion thereof photographing means and a generally horizontal front-to-rear document transport with exposure aperture means adjacent to the rear of the transport and downward discharge from the transport,

continuous rolled web document supply means,

sheet document magazine and feeding means,

and means located along the front of the cabinet to support said means in position to supply respectively continuous web and sheets to said transport for photographing.

6. In a photographing machine,

an upright forwardly opening cabinet having in the upper portion thereof photographing means and a generally horizontal front-to-rear document transport with exposure aperture means adjacent to the rear of the transport and downward discharge from the transport,

continuous rolled web document supply means,

sheet document magazine and feeding means,

means on the front of said cabinet adjacently below said transport to support said rolled document supply means in position to supply continuous web from a roll into said transport for photographing,

and means on said cabinet adjacent to the front of said transport to support the sheet supply means in position to supply sheet documents to the transport for photographing.

7. A photographing machine including an upright cabinet having therein photographing means including a document transporting assembly,

a rolled document supporting assembly carried by said cabinet including a removable supply roll spindle structure and a take-up spindle structure by which a web document is adapted to be rolled from the supply spindle structure through the transport assembly and then rewound on the take-up spindle structure,

means for driving said take-up spindle structure,

and leaf spring means for applying selective drag to said supply spindle structure.

8. In a photographing machine of the character described including an upright cabinet having an open front and a document transport assembly in the upper portion

thereof running inwardly and associated with document photographing means,

a generally H-shaped supporting frame,

means detachably securing said frame onto the front of the cabinet in generally vertical position, with a transverse beam on the frame extending horizontally and respective opposite side vertical legs on the ends of the beam engaging the front of the cabinet,

a rolled document supply spindle,

means detachably supporting the supply spindle on and between the upper portions of said side legs above said beam for supplying a web document from the supply spindle into said transport assembly,

a take-up reel,

means for supporting the take-up reel detachably on and between the lower portions of said side legs below said beam for receiving and winding up the document web after it leaves said transport assembly,

and means carried by said H-frame for driving said take-up spindle.

9. In a self-contained rolled web document handling unit having means for removably mounting it on a cabinet in which the web document is transported in a given path,

a substantially H-shaped frame comprising a horizontal beam and spaced vertical side arms extending above and below said beam coextensively,

a detachable roll carrying spindle between the opposed portions of said arms above, and another detachable roll carrying spindle between the opposed portions of said arms below the beam,

and means for driving one of said spindles.

10. In a rolled web document handling unit adapted to be removably mounted as a unit with respect to a document photographing machine of the character described,

a substantially H-shaped frame comprising a horizontal beam and spaced vertical side arms extending above and below said beam coextensively,

a respective detachable roll carrying spindle between each of the opposed portions of said arms above and below the beam,

means for driving one of said spindles,

and means for applying selective drag to the other of said spindles.

11. In combination in a roll web handling unit adapted for attachment to a microfilming machine,

a supporting frame,

means for attaching the frame to a microfilm machine,

a supply roll spindle carried by the frame,

a take-up spindle carried by the frame,

an electrical motor carried by the frame,

a driving transmission from the electrical motor to the take-up spindle,

and a control switch on the frame for controlling operation of said motor.

12. A roll document supporting unit for use with a machine of the character described and comprising a supporting frame,

a document roll supporting shaft spindle,

opposite ends of the spindle having attachment heads,

socketed supporting hubs on said frame for receiving said heads,

corotational interlock means on said heads and on said socketed hubs,

at least one of said hubs being spring biased toward the spindle and being displaceable by manual pressure applied thereto through the spindle for assembling and removing the spindle with respect to said hubs.

13. A machine including a cabinet having photographing means therein and a document transport assembly extending in a front-to-rear direction in the machine,

a sheet magazine and feeding unit,

and means for mounting the unit in alignment with the front of the transport assembly including spaced respective latch plate members on opposite sides of the unit and each having spaced bayonet slots, and fixed complementary lugs on the cabinet detachably engageable within said bayonet slots of the latch plate members.

14. A machine of the character described including a horizontal document transport assembly having an entry and a discharge,

a sheet magazine and feeding unit including means for feeding successive sheets from a stack supported by the unit into said transport assembly,

means for driving said transport assembly,

means detachably mounting the unit in alignment with said transport assembly,

and means affording a driving connection between said transport assembly and said sheet feeding means of said unit including an automatic driving coupling operative incident to mounting of the unit in place on the machine and automatically disconnectible incident to removal of the unit from the machine.

15. A sheet magazine and feeding unit comprising a frame structure,

adjustable sheet supporting magazine means carried by said frame structure,

single sheet feeding means carried by said frame structure in alignment with said magazine structure,

means for driving the sheet feeding means,

means for movably attaching the unit in operative position in alignment with a sheet transport of a photographing machine,

and a driving coupling carried by the unit for driving coaction with a complementary coupling on the machine.

16. In a machine of the character described including a document transport assembly having a rotary shaft,

means for driving said shaft,

a sheet magazine and feed unit adapted to be removably mounted as an accessory in alignment with said transport assembly and adjacent to said shaft,

means on said unit and on said machine for detachable mounting of the unit,

sheet feeding means carried by the unit including a coupling pinion,

and a driving gear carried by said shaft and automatically meshing with said coupling pinion in the mounted position of the unit to drive said feeding means.

17. In a sheet magazine and feeding unit having a frame including means for detachably assembling the unit in alignment with a document transport of a machine of the character described,

sheet stack magazine means,

sheet pull-in means mounted in alignment with the magazine means,

a feed roller immediately succeeding the pull-in means,

a reversing roller coacting with the feeding roller to permit only one sheet at a time to pass therebetween,

a feed roller assembly immediately succeeding said feeding and reversing rollers,

driving means for said pull-in means and the feeding roller and the reversing roller coupled with said feed roller assembly,

and means providing a disconnectible driving coupling between said feed roller assembly and driving means on a machine with which the unit is operatively assembled.

18. In a microfilming machine including means for supplying documents to be microfilmed,

microfilming means including means defining an exposure aperture area,

a document transport assembly arranged to transport the documents to be microfilmed in a plane through said exposure area,

and means for guiding the documents through said ex-

posure area including a plate overlying and holding the documents substantially against deflection from said plane and including a plurality of transversely located series of spaced apart apertures with the apertures of the respective series staggered with respect to the other series of apertures and with the end portions of the apertures in overlapping relation considered with respect to the direction of movement of the documents,

whereby full exposure of the documents moving through the exposure area is attained but the documents are held substantially in said plane and leading edges of the documents are prevented from deflection out of such plane.

19. A photographing machine including an upright cabinet having a front wall with an opening therein affording access to an upper photographing and document transporting assembly operative to transport a document from the front of the cabinet rearwardly and then downwardly, and the front wall having a lower discharge opening below said transporting assembly:

a continuous web document supply device comprising a removable unit having means mounting it on said front wall of the cabinet;

an upper supply roll support on said unit located adjacent to said upper opening and positioned for paying out a rolled document web therefrom to travel through said upper opening to and through said document transporting assembly and then rearwardly and downwardly toward said lower discharge opening;

and lower take-up means on said unit adjacent to said lower opening for receiving and rewinding the document web through said lower opening.

20. A machine as defined in claim **19**, including means within the cabinet for guiding the document web smoothly from the transporting assembly to said take-up means.

21. A machine as defined in claim **20**, in which said unit has self-contained means for driving said take-up means.

22. A self-contained unit for handling a continuous web for feeding through a machine of the character described:

a generally box frame including a horizontal body beam and vertical side arms on said beam each extending above and below said beam coextensively;

a spindle shaft and means on the upper portions of said arms for supporting said spindle shaft rotatably and in readily detachable relation to facilitate mounting of a web roll thereon;

a second spindle shaft and means on the lower portions of said arms for rotatably detachably supporting said second spindle shaft between said lower portions;

and means carried within one of said arms and said beam for rotatably driving the rotatable mounting means for one of said spindle shafts.

23. A self-contained unit for handling a continuous web for feeding through a machine of the character described:

a generally box frame including a horizontal body beam and vertical side arms on said beam each extending above and below said beam coextensively;

a spindle shaft and means on the upper portions of said arms for supporting said spindle shaft rotatably and in readily detachable relation to facilitate mounting of a web roll thereon; a second spindle shaft and means on the lower portions of said arms for rotatably detachably supporting said second spindle shaft between said lower portions;

and means on said beam for removably attaching the unit to the machine.

24. In a roll web handling device of the character described:

a supporting frame;

a roll supporting shaft spindle;

bearings rotatably mounting the opposed ends of said spindle on the frame;

a pair of adjustable hubs slidably longitudinally adjustable on said spindle and having means thereon for supporting hollow rolls of different core bore diameter;

means on the spindle for gaging adjustment of the hubs for different lengths of roll;

and means on the hubs for securing them releasably in respective positions of adjustment on the spindle.

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