March 5, 1929. G. M. SACERDOTE 1,704,020

MANIFOLDING ATTACHMENT FOR TYPEWRITERS

Filed March 3, 1925 4 Sheets-Sheet 1

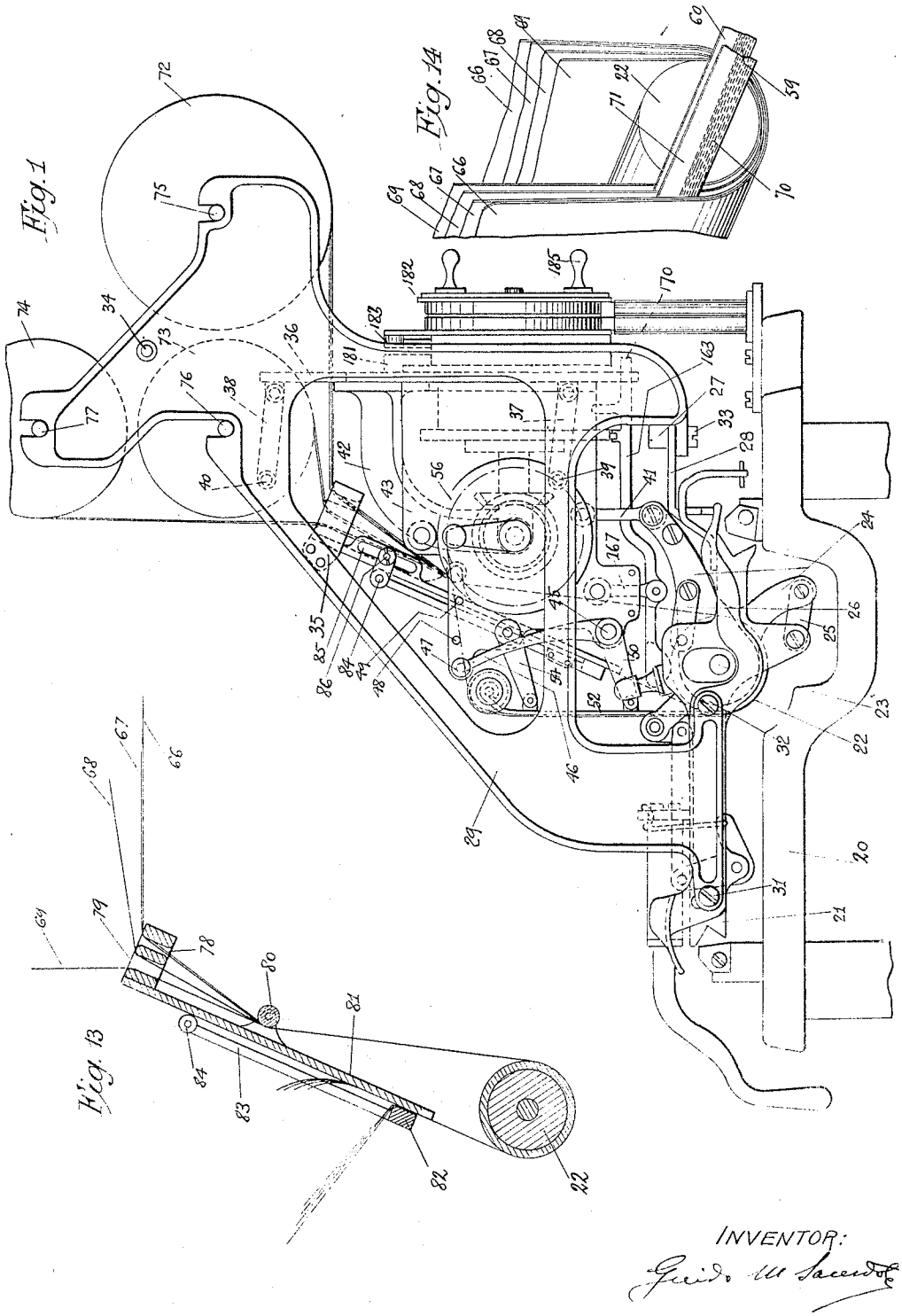


Fig. 1

Fig. 14

Fig. 13

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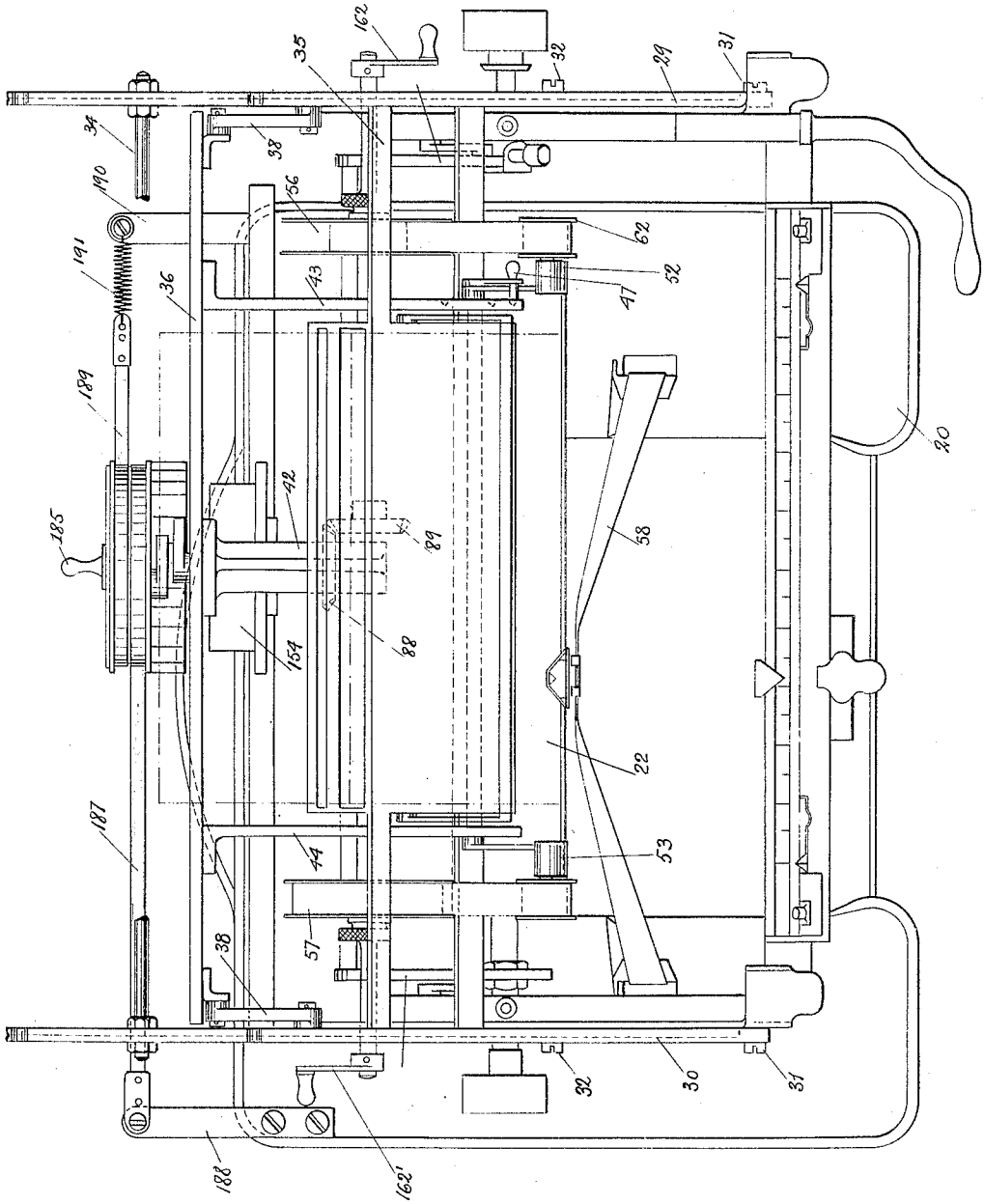


Fig. 2

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MANIFOLDING ATTACHMENT FOR TYPEWRITERS

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Fig. 3

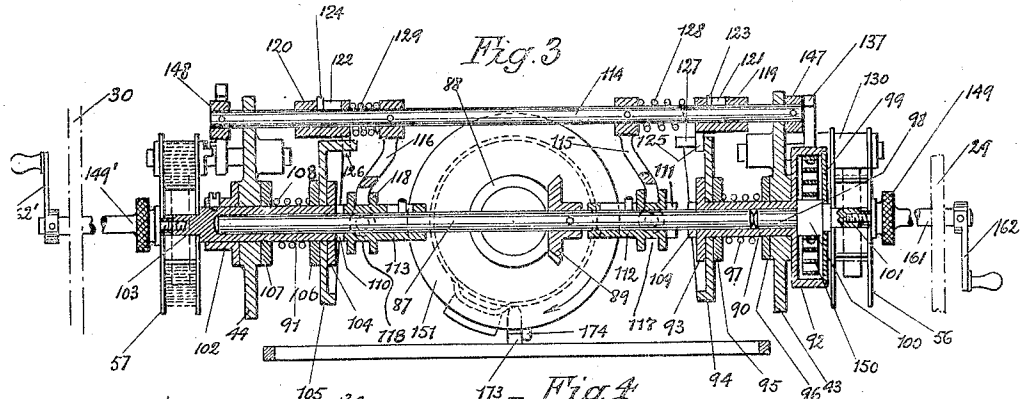


Fig. 4

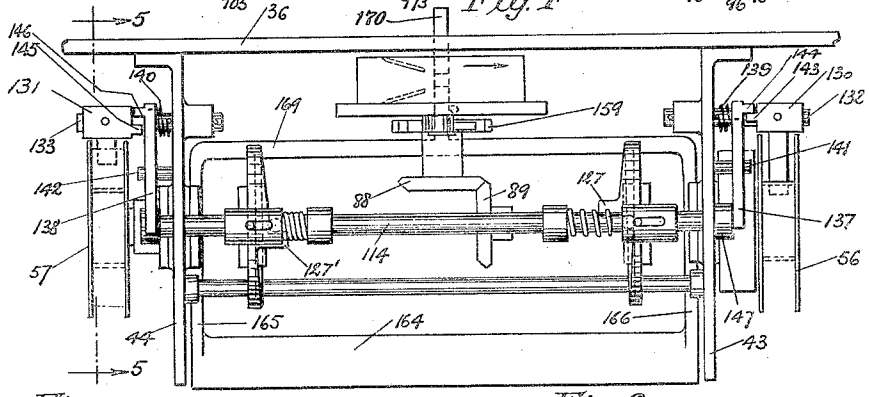


Fig. 5

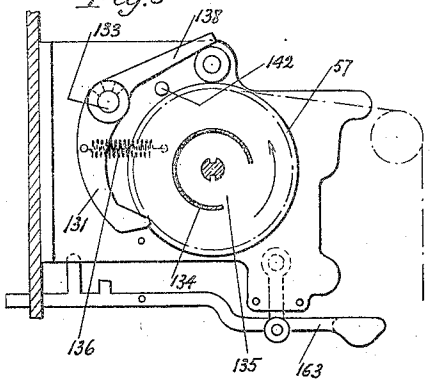


Fig. 6

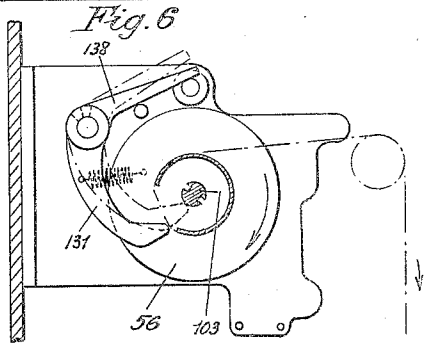
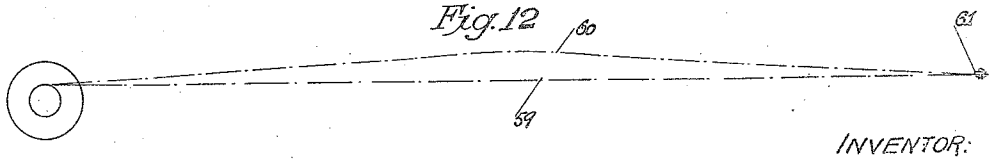


Fig. 12



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MANIFOLDING ATTACHMENT FOR TYPEWRITERS

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Fig. 7

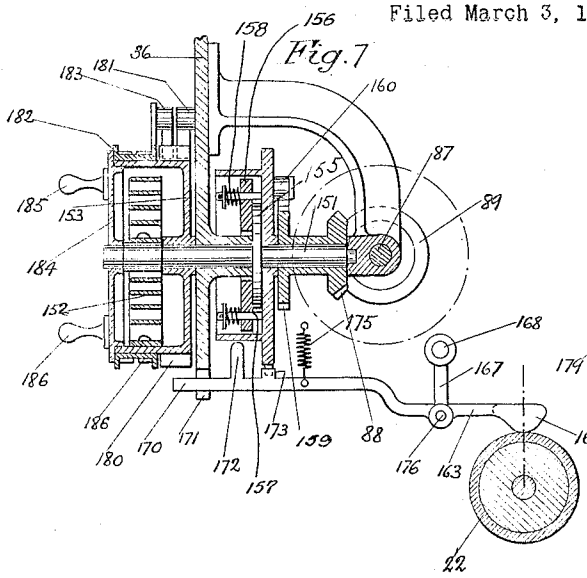


Fig. 8

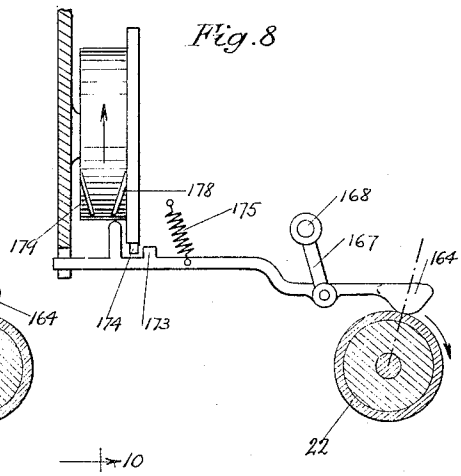


Fig. 10

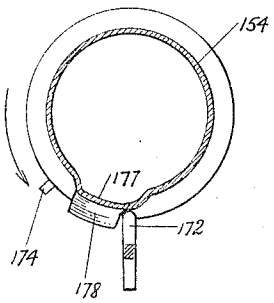


Fig. 9

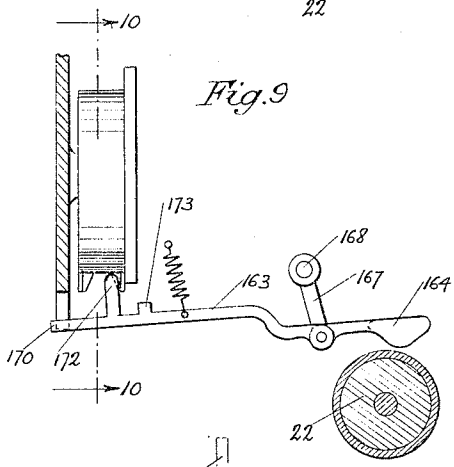
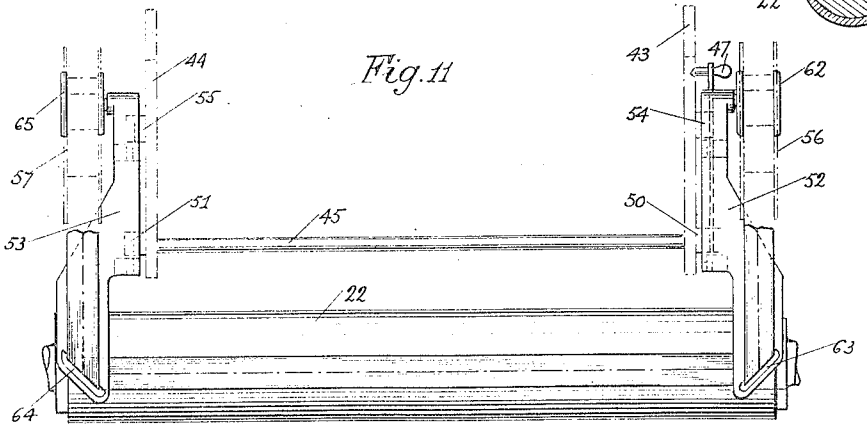


Fig. 11



INVENTOR:

Guido M. Sacerdote

Patented Mar. 5, 1929. 1,704,020

UNITED STATES PATENT OFFICE.

GUIDO M. SACERDOTE, OF BAYSIDE, NEW YORK.

MANIFOLDING ATTACHMENT FOR TYPEWRITERS.

Application filed March 3, 1925. Serial No. 12,975.

This invention relates to manifolding typewriters, and more particularly refers to devices of this character where a ribbon or ribbons are employed for the production of manifold records, instead of loose carbon sheets.

The primary object of this invention is to provide means for the control of the manifolding ribbon or ribbons, insuring perfect feed and alinement of the same at all times, whether the platen is rotated in one or the other direction.

Another object is to provide a novel and improved manifolding device which is practically self contained and which can be mounted upon an ordinary typewriter as an attachment which does not interfere with the normal operation of the typewriter itself.

A further object is to provide, in a manifolding typewriter, an improved arrangement of manifolding ribbon or ribbons, whereby shifting of the platen for upper case printing may take place in the normal manner, and whereby the manifolding ribbon or ribbons may be shifted for multicolor printing or may be moved entirely away from the printing line.

The invention comprises numerous other advantages and improvements cooperating one with the other in order to produce a complete, positive, reliable and practical device, and these will more fully appear as the description proceeds, and will be particularly pointed out in the appended claims.

In the drawings:

Fig. 1 is a side view in elevation of the manifolding attachment mounted on a Remington typewriter;

Fig. 2 is a plan view of the same;

Fig. 3 is a front sectional view in elevation of a detail including the ribbon feeding and reversing mechanism;

Fig. 4 is a plan view of the same;

Fig. 5 is a detail side view in elevation of the mechanism controlling the ribbon feed reversal;

Fig. 6 is a similar view of the same mechanism at the time when reversal takes place;

Fig. 7 is a detail side sectional view in elevation of the mechanism controlling the ribbon feed;

Fig. 8 is a detail side view in elevation of the detent mechanism;

Fig. 9 is a similar view showing the means of returning the controlling member to its normal position;

Fig. 10 is a cross sectional view in elevation through line 10—10 of Fig. 9;

Fig. 11 is a detail front view in elevation showing the means of mounting the manifolding ribbon or ribbons;

Fig. 12 is a diagrammatic view showing a multiple ribbon in its extended position;

Fig. 13 is a detail side sectional view in elevation of a type of paper severing means which can be employed in connection with the device; and,

Fig. 14 is a detail fragmentary perspective view showing the relative arrangement of manifolding ribbons and blanks, when a ribbon is employed for the simultaneous production of two copies.

The main difficulty heretofore encountered in the operation of ribbon manifolding devices, has been in providing positive and reliable means for insuring at all times proper alinement of the ribbon. This difficulty is created by the frictional adherence of the manifolding ribbon or ribbons to the surfaces of the paper webs between which they are interposed, which causes the ribbon to follow the paper when the platen is rotated in one or the other direction. This tendency is much more pronounced when the platen is moved backward, and the friction between paper and ribbon increases as this movement takes place, on account of the pressure exerted by the pressure rollers against the platen; so that if the ribbon is allowed to deviate from its normal alinement, it becomes also increasingly difficult to feed it in the normal way.

In a co-pending application for patent on a "manifolding typewriter", filed by me June 23, 1923, Serial No. 647,275, I have disclosed a method for partly obviating this difficulty, which consists in feeding the ribbon across the platen, after the platen has been rotated for paper feeding purposes; so that whatever distortion the ribbon has undergone is counterbalanced by the tension subsequently applied to it during its feeding, and its alinement is restored.

This action is contingent upon the use of the line spacing lever for effecting the return movement of the carriage, the feed of the ribbon being actuated by the carriage during such return movement, and after the paper

feed has occurred, since it is well known that when the line spacing lever is used for this purpose, the feeding of the paper precedes the return movement of the carriage.

However, while this is the normal way in which a typewriter should be operated, there are a number of instances where the platen is operated by hand, in one or the other direction; and in such cases, there is no assurance of a proper alinement of the ribbon and of a proper feed, unless the operator is careful to move the carriage back and forth several times before starting to write, in order to restore the alinement of the ribbon, in the manner set forth.

This means that the device itself is not fool proof and reliable in every respect; and furthermore, as stated, if the platen is moved backward to any considerable extent, the ribbon becomes so entangled, and so firmly held, that it is difficult to subsequently pull it to its proper position. On the other hand, any device which limits the operation of the typewriter to certain conditions, limits by just so much the usefulness and the speed of the machine, and is therefore not practical for general purposes.

In some devices which have come to my notice, an attempt has been made to solve the problem by causing the ribbon feed to be operated directly by the platen, whether the platen is operated by means of the line spacing lever, or by hand. In one device, the shaft controlling the ribbon feed is geared directly to the platen; but such an arrangement is open to the objection that to a limited angular motion of the platen corresponds a limited feed of the ribbon. When feeding of the ribbon takes place, it is generally necessary to move it a substantial amount, if the distortion previously undergone by it has to be fully corrected; this means a large multiplication of movement if the feed is controlled by the platen, and on the other hand a high ratio is scarcely applicable without seriously impairing the ease of operation of the platen.

In other devices, the step by step motion of the carriage is utilized to produce a step by step feed of the manifolding ribbon or ribbons; but this also is believed to be an unsatisfactory solution of the problem, for various reasons which would require a long discussion to cover. Among other objections, I will mention that this imposes an additional duty upon the spring motor actuating the carriage, which cannot fail to reflect unfavorably on its sensitiveness and speed and reliable operation; also, that while the arrangement might work if the ribbon is held in proper alinement, it will almost surely fail to work if the ribbon is held distorted between the paper webs, offering therefore considerable frictional assistance.

By experiment I have found, however, that if the ribbon is fed longitudinally at a suitable speed, while the platen is being rotated one way or the other, there is no possibility that the ribbon may be caught and dragged along by the platen. I have also found that a slight initial movement of the platen either way does not impair the ease with which the ribbon may be fed. Furthermore I have found, that it is preferable to assure a condition where the ribbon is still moving in its longitudinal direction when or after the movement of the platen is stopped. At the same time, a substantial pull should be exerted on the ribbon for feeding, so as to overcome the friction to which the ribbon is subjected, and a substantial length of ribbon should be fed at each time.

Accordingly, I have met these various conditions in the present device, by providing a novel and improved arrangement assuring satisfactory feeding and alinement of the manifolding ribbon or ribbons at all times. This arrangement, which I will later describe in detail, comprises a feed controlling member, which is operated directly by the platen whether the platen rotates in one or the other direction, causing instant feed of the ribbon; and in order to avoid the necessity of transforming what may be a limited motion of the platen into what should preferably be, as stated, a substantial movement of the ribbon, the arrangement also comprises a source of power for the feeding of the ribbon, which is entirely independent of the equipment ordinarily found in a typewriting machine. This may be a source of stored energy, such as represented by a spring motor, or else it may be some other suitable means of generating power. In the drawings I illustrate the use of a spring motor for this purpose.

The result of this combination is an extremely sensitive control of the feeding mechanism, which becomes operative instantly as the platen is rotated one way or the other. The ribbon is fed a substantial amount, which may vary with the diameter of the take-up reel, whether the platen is rotated a small or a considerable amount. If the movement of the platen ceases before the feed movement has been completed, this will continue until an automatic stop is applied, under the desirable condition of the ribbon feed continuing to operate after the platen has once more become stationary. If the movement of the platen still continues after the feed movement has been completed, a new feed movement is initiated and so on, until the platen is stopped.

The use of an independent source of power for the ribbon feed, insures a sufficient and satisfactory feed at all times, without imposing any extra load upon the operator or the machine, and also insures positive and effective operation at all times; the main advantage thus gained being, of course, proper

alinement of the ribbon no matter what the operation of the platen may be. This is the main feature on which the practical value of the device depends.

It is also important, in devices of this kind, that means be provided assuring proper tension of the ribbon or ribbons at all times. If for any reason the status of the ribbon or ribbons is altered independently of the movement of the platen, as is the case, for instance, when the ribbon is shifted for multicolor printing, an extension of the ribbon may take place which may result in some portion of it hanging loose when the ribbon is reinstated to its normal position. In this case I may employ means whereby a certain amount of tension is maintained on the ribbon at all times, said means being preferably in the form of a spring device capable to take up any slack which would occur in the ribbon for any reason. However, while a ribbon tensioning device is shown in the drawings to illustrate this point, I prefer to so design the guiding means for the ribbon that practically no change in the length of the extended portion of said ribbon occurs when the ribbon is shifted for multicolor printing or for displacement thereof, from the printing line.

My invention also comprises another feature which facilitates its operation to a considerable extent. I have stated before, that considerable friction develops between the surfaces of the paper and the manifolding ribbon or ribbons, and this friction is all the greater, as the number of paper webs and ribbons increases, due to their increased combined thickness. This condition constitutes quite a serious limitation when a considerable number of copies is desired, because, the general practice being to provide a ribbon or a stretch of ribbon for each copy to be produced, in a case, for instnace, where four copies besides the original are needed, the thickness at the printing line would be five sheets of paper and four interposed ribbons. When such a condition develops it becomes increasingly difficult to properly feed the ribbons, which are practically clamped between the sheets with considerable pressure. Another cause of increased thickness, and consequent increased resistance to ribbon feeding, lies in the necessity of at times preventing impression upon the rear surface of one or more of the blanks produced, by the ribbon interposed between such and the next sheets or blanks. In this case a strip of paper may be interposed, or some specially prepared ribbon writing on one side only, must be used.

This is especially objectionable when a spring motor is used for the ribbon feed, because such a condition creates the necessity of using an extra powerful motor while manufacturing and cost considerations make it desirable to use light and unobstrusive parts.

By a special arrangement of the ribbon or ribbons in relation to the paper, I am enabled to use a single ribbon for the simultaneous production of two copies, so that if four copies besides the original are desired, it is necessary to employ only two ribbons.

This result is obtained by dividing the copies in sets of two, and by interposing a ribbon between the two copies of the same set, using, however, transparent paper for the front copy of each set. By this simple expedient, the printing action of the rear surface of the ribbon is utilized to produce a copy which is visible and utilizable owing to the transparency of the paper employed. The feeding of the ribbon or ribbons is therefore made much easier, and longer ribbons can be employed for the same maximum diameter of the winding reels. At the same time I achieve the advantage of preventing any writing upon the rear surface of the original and of the direct copies, without having to make any special provision for it.

Furthermore, this arrangement makes it also possible to produce six or eight copies besides the original, by employing only three or four manifolding ribbons, and this greatly facilitates the operation of the device.

Owing to the special arrangement employed, I also make it possible to introduce the feature of multicolor printing for some or all of the copies produced. The same arrangement also permits of entirely removing the manifolding ribbon or ribbons from the printing line, so that the machine can be used like an ordinary typewriter.

In my other patient application above-referred to, I have pointed out the importance of providing an automatic reversal of the ribbon feed, which is very rapid and positive in its action. Such a feature is accordingly provided by means of an entirely novel and simple arrangement, insuring quick and positive action.

Although the various features of my invention may be embodied in the construction of a specially designed typewriting machine, I prefer to make the device in the form of an attachment which can be mounted on machines of the type currently found on the market, without necessitating any material changes in the construction of the machines themselves; therefore in the drawings, I have shown this preferred type of construction.

In said drawings:

20 designates the frame of an ordinary Remington typewriter, 21 the carriage, mounted on said frame, 22 the platen, 23 the platen shaft, and 24 the platen supporting frame, on which said shaft is rotatably mounted, which is shown in its normal position, and which can be shifted upwardly a limited amount for upper case printing, as is well known. For this purpose the platen supporting frame is connected to the carriage

frame by means of two parallel links 25, 26, at each side. 27 designates the column spacing bar, that in this type of machine is supported at the rear upon carriage frame extensions 28.

The attachment, proper, comprises a main frame consisting of two sides or uprights 29, 30, which are secured one at each end of the carriage frame by means of screws 31, 32, and by screws 33 used for securing spacing bar 27 upon extensions 28, said two sides or uprights being rigidly connected to form a single frame by a tie rod 34, and by a bridge member 35. The frame thus obtained, therefore, is supported by, and travels with the carriage.

The attachment furthermore comprises a secondary frame 36 which extends at the rear between the two sides or uprights 29, 30, and which is mounted onto said uprights in a manner permitting its being shifted in a vertical direction so as to follow the movement of the platen and platen frame when shifted to the upper case printing position. To this end, frame 36 is connected to the uprights of the main frame at each end by means of articulated links 37, 38, which are pivotally connected to the main frame at 39, 40, respectively, and is also connected to the platen frame by means of links 41, one at each end of the frame.

Secondary frame 36 is provided with a central downwardly directed goose-neck bracket 42, extending towards the front of the device, and with two forwardly extending frame sides 43, 44, on which the operating mechanism, proper, is mounted. A shaft 45 runs through both sides 43, 44, and can be rocked by means of a hand lever 46, provided with a spring button 47 adapted to set the lever at its normal position shown, or at points 48, 49, representing two successive steps in the angular motion of said shaft.

At each end of said shaft 45 is mounted an arm 50, 51, pivotally connected, respectively, to ribbon guiding members 52, 53; and said guiding members are also connected to sides 43, 44, by articulated links 54, 55, which form parallelograms with arms 50, 51, respectively, insuring vertical alinement of the ribbon guiding members, and causing the same to move to two successive upward positions, when shaft 45 is rocked to positions 48, 49, of button 47.

Externally to each side 43, 44, is mounted a reel 56, 57, for the winding of the manifolding ribbon or ribbons. Only one ribbon is used, besides the one normally employed for writing the original, shown at 58, if only two copies are desired, as stated; if three, or four copies are to be produced besides the original, two manifolding ribbons will be employed, and more if more copies are desired. It is to be understood, that the manifolding ribbon or ribbons are interposed between the sheets or webs on which copies of the original writing are to be produced, running from end to end, and traveling together with the platen. While a line is being written, the manifolding ribbon or ribbons remain stationary, but as a line is completed, the ribbon or ribbons are fed longitudinally a substantial amount, which need not necessarily be, however, in any definite relation to the length of the written line.

When more than one manifolding ribbon is employed, I prefer to simultaneously wind the two or more ribbons used on the same reels. In the drawings, Figs. 12 and 14, I show how a multiple ribbon composed of two strands can be assembled and used, for the production of three copies besides the original. In the same, the manifolding ribbon is shown composed of an inner and shorter strand 59, and an outer and longer strand 60, joined at the two ends as at 61.

The difference in their length is a function of their thickness, which causes a corresponding increase in circumferential length from the inner to the outer strand, when the two are simultaneously wound in a spiral upon the same reel. For each coil the difference is very small, but for a considerable number of turns, such as there are in practice, the difference between the respective lengths of the two strands may amount to from one to three inches. This is the reason for using the novel type of multiple ribbon, composed of strands having different lengths, as shown.

The device is shown in a position where the manifolding ribbon is being wound upon reel 57, being fed from right to left, and unwinds from reel 56, the supply on said reel being about to be exhausted, as shown in Fig. 6.

From reel 56, the ribbon runs over a guiding roller 62 carried by ribbon guiding member 52, then downwardly to the end of said ribbon guiding member and through a 45° slot 63 which causes a right angle bending of the ribbon, and across the platen, in front thereof, in correspondence of the writing line, to another similar slot 64 inclined in the opposite direction, provided in ribbon guiding member 53. The ribbon is passed through said slot, which causes it to bend at right angle upwardly and to run over a guiding roller 65 carried by said ribbon guiding member 53, and reaches then reel 57, to which its other end is attached.

It will be observed that during the practically vertical displacement of ribbon guiding members 52, 53, effected for ribbon shifting purposes, the distance between said guiding members and the reels remains substantially the same. It will also be observed that rollers 62, 65 in the intermediate position of the ribbon guiding members, remain at a height which is about on a level with the circumference of the reels when the ribbon is about half wound upon one reel and half on the other; so that the stretch of ribbon connecting each guiding roller to its respective

reel substantially acts as a pivotal arm for the vertical movement of the roller due to the displacement of the ribbon guiding members, said stretch of ribbon remaining substantially of the same length for all of the positions which may be occupied by said roller.

The result of this arrangement is that the displacement of the ribbon guiding means for shifting purposes does not cause any variation in the length of the part of the ribbon which is unwound from the reels; therefore, the use of a ribbon tensioning device may be omitted if desired.

The working portion of each strand of the ribbon, which is that part running from one guiding member to the other, along the front part of the platen, is interposed between two adjacent sheets or webs of paper, as shown in Fig. 14. It the same, 66 designates the front sheet, upon which the original is written, in the usual manner. 67 is the first copy, and is transparent, 68 is the second copy; strand 59 is interposed between 67 and 68, and writes on the reverse side of 67 and on the front side of 68, but the writing on 67 is visible from the front, and is legible in the normal way, owing to the transparency of the paper. Incidentally, the use of sheet 67 in the manner shown protects the reverse side of the original from any impression, and this is an additional advantage, inasmuch as the original is generally forwarded to the customer or correspondent, and its neat appearance is an important consideration.

The other strand 60 of the ribbon is in its turn interposed between sheet 68 and sheet 69, with the result that sheet 68 will be printed on both sides. However, should it be necessary or desirable to obtain four copies instead of three besides the original, it is a comparatively simple matter to interpose another sheet of transparent paper between sheet 68 and strand 60, producing an additional copy written on the reverse side. In this case, the original and all the copies produced would be written on one side only.

A typewriter ribbon is generally wide enough to be used first along one-half of its width, and then along the other half, doubling its life and usefulness. In many cases this feature is utilized instead for writing in two different colors, the ribbon being shifted half of its width one way or the other according to whether one or the other color must be used. For instance, the ribbon shown in Figs. 11, 14, is shown divided in two longitudinal sections of different color, one being for example, black, while the other is red, as shown at 70, 71.

The use of means for shifting the ribbon for multicolor printing or for double wear, is a feature provided in most modern typewriting machines, and is considered part of their ordinary equipment; but this feature is comparatively new in connection with manifolding ribbons in manifolding typewriters, where no corresponding shifting means have heretofore been provided.

In the present device, when the ribbon guiding members are held in the position shown in Fig. 1, the upper half portion of the manifolding ribbon is in operative position. By shifting lever 46 to position 48, a slight angular motion of shaft 45 is produced, sufficient to shift the ribbon so as to present its lower half portion to the action of the type bars. Therefore this feature can either be utilized to produce multicolor printing of the copies to correspond with that of the original, or else to use first one half section of the manifolding ribbon and then the other, without disturbing its general arrangement, and without spending the time and labor otherwise necessary to suitably rearrange it.

As stated, the manifolding ribbon can also be entirely removed from the line of printing, by moving lever 46 to position 49. In this position, the typewriter can be used without interference with or by the manifolding ribbon, and furthermore, the raised position of the manifolding ribbon greatly facilitates its insertion between the paper webs, when a new ribbon, or a new supply of paper is inserted in the machine.

The device is particularly designed for use in connection with paper in the form of strips, wound upon rolls in order to provide a supply of paper which will last for considerable time without need of recharging the machine. As each blank and corresponding copies are produced, they are detached or cut from the strips, and the next set of blanks is ready for immediate production. The obvious advantage of such an arrangement is the saving of the time ordinarily required by preparing a number of sheets of paper with interposed carbon sheets, and then inserting and feeding them to the printing position. This is particularly important in the preparation of invoices, orders, shipping slips, way bills, and in all those instances where only a comparatively limited amount of written matter is required, because in such cases, the feeding of the paper to the machine in the usual manner consumes more time than the preparation of the work itself.

Accordingly, the main frame of the device is designed to receive a number of rolls of paper, as shown at 72, 73, 74. The same may be mounted on the frame in any suitable manner, for instance by rotatably mounting the rolls upon shafts 75, 76, 77, merely inserted in vertical slots or housing provided for this purpose in sides or uprights 29, 30.

Each roll of paper may contain only one strip, or more than one strip may be wound simultaneously on the same roll; as an example, roll 72 comprises both the original strip 66 and the transparent strip 67, while

rolls 73, 74, are respectively formed by a single strip, 68, 69.

From the rolls, the strips of paper are directed to the rear or feeding side of the platen in any suitable manner, for instance by passing them through guiding slots 78, 79, provided in bridge portion 35, then over a guiding roller 80 carried by a guide plate 81, then to and around the platen to the front side thereof, then upwardly over the surface of a guide plate, 81, arranged in a position tangential to the surface of the platen, slightly inclined to the rear. (See Fig. 13.)

The object of this guide plate is to provide a support for the written portion of the sheets, thereby improving their visibility; at the same time, said plate may also be used as a backing for a cutting edge or knife 82, carried by two side arms 83 pivoted at 84, and adjustable to and from the platen through slots 85, by means of clamping screws 86. The adjustment of the cutting edge is particularly useful for setting the device so as to detach the printed blanks when the next set of blanks is in the right position to be started; the adjustment therefore depends upon the space left for the heading of the blanks. In the type of cutting device illustrated, the written blanks may be detached by pressing the cutting edge against the surface of the guiding plate; but a spring pressure may be used for this purpose, if preferred.

The operation of the typewriter proceeds in the normal manner, and the paper is fed by the rotation of the platen also in the usual manner; and when the platen is raised to upper case printing position, links 41 will produce a corresponding movement of the secondary frame 36, together with the ribbon and operating mechanism, as explained.

The operating mechanism, which I will now explain, has the object of regulating the operation of the manifolding ribbon, and performs the following functions:

(*a*).—It feeds a substantial length of ribbon instantly as the platen is rotated in one or the other direction, terminating the feed of the ribbon only when or after the platen has come to a stop.

(*b*).—It instantly reverses the direction of feed of the ribbon, as the supply from the paying reel is exhausted.

(*c*).—It maintains the ribbon under tension at all times, so as to take up any slack which should occur for any reason in said ribbon.

(*d*).—It automatically causes rewinding of the spring if a spring motor is used, limiting the tension thereof to a predetermined extent, and also includes means whereby the rewinding may be effected by hand.

(*e*).—It permits feeding of the ribbon by hand, whenever desired.

(*f*).—It provides a convenient arrangement for the easy insertion and removal of the ribbon reels and of the ribbon itself.

The operating mechanism is mounted on the secondary frames 36, 43, 44, and is movable therewith.

The feeding operation is effected by means of a main shaft 87 running longitudinally of the machine, which is rotated always in the same direction by a conical gear 88 in mesh with conical gear 89, mounted on said shaft, in a manner which I will describe later.

Shaft 87 is rotatably mounted at the ends through hollow shafts 90, 91, which are in their turn rotatably mounted, respectively, through sides 43 and 44 of the secondary frame. Shaft 90 is integral with a spring drum 92 external to side 43, and is provided with a collar 93 at its inner end. 94 designates a cam loosely mounted on shaft 90, the function of which I will presently explain, 95, 96, two friction discs also loosely mounted on shaft 90 between side 43 and cam 94, and 97 is a pressure spring interposed between the said two discs. The result is that the web of cam 94 is frictionally held against collar 93 by friction disc 95, so that the cam will follow the rotation of shaft 90, unless prevented from doing so by some stationary stop opposing its rotation. Another result is that shaft 90 is frictionally held against rotation by the friction between the inner surface of drum 92 and frame side 43, due to the action of spring 97; so that shaft 90 will only rotate when the driving force exerted upon the same is sufficient to overcome said frictional resistance. Another short shaft 98, coaxial with shaft 87, is also rotatably mounted within shaft 90, and is held in position by means of cover 99 of the spring drum, which abuts against an enlarged portion 100 of the shaft. Said shaft is also formed with an outwardly projecting stud 101, upon which one of the ribbon reels, 56, may be fixed in any suitable manner.

Shaft 91 is mounted through frame side 44, and is positioned by means of a collar 102 fixed on said shaft, externally to side 44. Beyond the portion upon which this collar is fixed, this shaft also is formed with an outwardly projecting stud portion of a smaller diameter, 103, upon which is fixed the other reel 57. Said shaft also carries at its inner end a collar 104, a cam 105 adjacent to said collar loosely mounted on the shaft, and two friction discs 106, 107, loosely mounted on said shaft between cam 105 and frame side 44. A pressure spring 108 is interposed between said two discs, and creates a frictional connection between the shaft and the cam, and a frictional resistance opposing the rotation of the shaft, between the shaft and side 44, same as explained in connection with shaft 90.

The inner end of both shaft 90 and shaft 91, is provided with clutch teeth 109, 110, adapted to be engaged by similar teeth 111 in-

tegral, respectively, with clutch sleeves 112, 113, slidably keyed upon shaft 87. The movement of said clutch sleeves in or out of engagement is controlled by a shifting rod 114, mounted parallel to shaft 87 through frame sides 43, 44, carrying clutch arms 115, 116, which are in the usual form of forked clutch levers, allowing the clutch sleeves to rotate, but controlling their longitudinal movements by engaging their collar portions 117, 118, respectively.

Shifting rod 114, therefore, is used to effect the reversal of the ribbon feed, when the ribbon has become entirely unwound from one of the reels, and wound upon the other.

In my other patent application above-referred to, I have pointed out the importance, in a device of this kind, of providing an absolutely reliable and quick-acting ribbon feed reversing mechanism. The importance of this feature derives from the necessity of having the ribbon taut and in correct alinement at all times, and the same also assists in avoiding undue stretching or breaking of the ribbon, when the feeding pull happens to be exerted on it at the time when the end of the supply has been reached at the paying end.

A slow-acting feed reversing mechanism, such as usually employed in typewriting machines, is therefore to be preferably avoided. In order to insure quick action, I prefer to employ the suddenly released energy stored in a spring, to effect the reversal; and this I obtain by a novel arrangement, the operation of which I will presently explain, which includes:

Two sleeves, 119, 120 mounted on rod 114, rotatable therewith, and each capable of a limited longitudinal movement in relation to said rod. In the present case this is obtained by providing each sleeve with a longitudinal slot 121, 122, through which projects a pin 123, 124, radially extending from rod 114. Each sleeve is provided with a radially extending lug or pin 125, 126, abutting, respectively, against the rim of cams 94, 105. Said rim extends longitudinally, and has a spiral outline, with a stop portion 127 which prevents rotation of the cam when abutting against its respective lug or pin 125, 126, in either direction. The result of this stop arrangement is that each cam may be caused to rotate in one or the other direction to an extent of angular travel which is limted by the angular distance between the two stop positions delimited by said stop portion.

The spiral portion of the rim of each cam is directed inwardly, so that partial rotation of each cam will cause shifting motion of its respective sleeve 119 or 120 in the direction of the other, that is, towards clutch arm 115 or 116. A pressure spring 128, 129, is interposed around rod 114 between clutch arm 115 and sleeve 119, and between clutch arm 116 and sleeve 120, respectively. When fully extended, said springs are shorter than the distance separating the hub of each clutch arm from the inner face of its respective sleeve when the sleeve is set at its extreme outward position; this is seen, for instance, at the right of Fig. 3, where sleeve 119 is set with its lug or pin 125 directly abutting against the web of cam 94, at the beginning of its spiral rim portion.

On the other hand, when one of the cams is rotated to its other extreme angular position, causing longitudinal shifting of its respective sleeve inwardly, the spring interposed between said sleeve and the clutch arm nearest thereto, becomes compressed, as illustrated in the case of spring 129 at the left of Fig. 3.

In addition to the above parts, the mechanism also comprises two arms 130, 131, each fixed on a rocking shaft 132, 133, mounted through frame sides 43, 44 respectively, at a distance from the center of the reels somewhat greater than the radius of the reels. Said arms control the ribbon feed reversing mechanism, and their operation is in its turn controlled by the unwinding of the ribbon from the paying reel. It is obvious that when a ribbon is being unwound from a reel, its diameter gradually decreases, and this decrease offers a means for controlling the operation of a feed reversing member when the diameter of the reel has reached a certain minimum.

However, the ribbon, especially if composed of a single strand, is so thin, that the diameter of the reel only varies by a minute quantity for every revolution, and while it can be done, it is not altogether satisfactory to rely on such small changes in diameter as gradually take place in order to control the operation of the reversal mechanism. I prefer to make this control dependent upon a sudden and substantial change in diameter, and for this I utilize a certain type of reel which is readily found on the market, the hub of which, 134, is in the form of a hollow cylindrical segment with a peripherical opening 135, as shown in Figs. 5, 6. These figures, which illustrate two different stages of the operation of reel 57 from the left of Fig. 3, show that the tip of arm 131, which is held against the surface of the ribbon wound upon the reel by a tension spring 136, swings inwardly towards the center of the reel as the diameter of the reel decreases, owing to the action of said spring; until the last turn of the ribbon having started to unwind and opening 135 being gradually uncovered by the ribbon, the arm is free to snap into said opening, traveling a substantial angular amount, as represented by the angular distance between the full line and the dotted line representation of arm 131 in Fig. 6.

On shafts 132, 133, between arms 130, 131, and frame sides 43, 44, respectively, are also loosely mounted finger arms 137, 138, which are connected to their respective frame sides by spiral springs 139, 140, which are under tension, and cause in said finger arms a tendency to inward angular motion. If said motion is free to occur, therefore, said finger arms will normally abut against stop pins 141, 142, respectively, outwardly projecting from frame sides 43, 44. The hub of arm 130 is provided with an inner lateral lug or extension 143, and the hub of finger arm 137 is provided with an outer lateral extension or lug 144 which comes to abut against 143, when one of said elements 130, 137, is moved angularly towards the other, until a certain predetermined minimum angular distance between the two elements is reached. By acting against the action of springs 136, 139, respectively, however, the angular distance between the two elements can be increased.

In a similar manner, the hub of arm 131 is provided with an inner lateral extension or lug 145, and the hub of finger arm 138 with an outer lateral extension or lug 146, which limit the minimum angular distance between the said two parts, by abutting against each other when said minimum angular distance is reached.

When finger arms 137, 138 are abutting against stop pins 141, 142, respectively, their free end is in the path of and blocks the longitudinal motion of shifting rod 114. To this end, rod 114 is provided at each end with a collar 147, 148, and the relative dimensions and arrangements of the various parts is such that said collars come to abut against one or the other of the frame sides as the shifting rod is moved to one or the other of its extreme positions; and when one of the said collars is thus abutting against the frame side, as is the case with collar 147 in the position represented in Figs. 3 and 4, the finger arm at that end of the rod is free to move inwardly due to the action of its spring 139 or 140, locking the rod against longitudinal motion.

The minimum angular distance between each finger arm and its arm 130 or 131, is represented by the angle at which the finger arm abuts against its stop pin 141 or 142 when the arm associated with said finger arm has its tip about even with the outer diameter of the reel hub 134, as shown in full lines in Fig. 6. Since from this position it is not possible to move either the finger arm or the arm towards each other, on account of the abutment between their respective lateral hub projections, it follows that if either element moves in the direction of the other, the other will participate in said motion, just as if the two members were rigidly connected parts of the same lever. Therefore, if at any time the uncovering of opening 135 in the reel hub permits its respective arm 130 or 131 to snap towards the stud 101 or 103, owing to the action of its spring 136, the finger arm associated therewith will move angularly in the same direction, clearing the path of the shifting rod. Since the movement of the finger arm is in this case antagonistic to its spring 139 or 140, it follows that the action of spring 136 must be stronger, so as to prevail.

The new position assumed by the combined arm and finger arm associated therewith, is illustrated in dotted lines in Fig. 6. As the finger arm assumes said position, the shifting movement of rod 114 will occur, bringing its collar 147 or 148 in the angular path of finger arm 137 or 138, as shown in Fig. 5. Fig. 5 represents reel 57 about to reach the end of its winding movement, which takes place by rotating the reel in a counter-clockwise direction as seen from the left of Figs. 3, 4, as the arrow indicates; and Fig. 6 represents the same reel about to reach the end of its unwinding movement, which takes place due to a pull exerted on the ribbon by the winding reel, in the direction of the arrow, causing rotation of the reel in a clockwise direction, as indicated.

Figs. 3 and 4 illustrate the entire mechanism in the position corresponding to that of Fig. 5, where reel 57 is about to reach the end of its winding movement.

In this position, where gear 88 rotates in a clockwise direction during the feeding periods, as the arrow indicates, shaft 87 rotates in a counter-clockwise direction as seen from the left of Figs. 3 and 4, as shown in Fig. 5.

Shifting rod 114 has been shifted towards the left, causing clutch sleeve 113 to interlock with hollow shaft 91, so that the same is now connected to main shaft 87, and is driven thereby; this causes winding action of reel 57, which is mounted on shaft 91. When the connection between shaft 87 and shaft 91 was originally established, as will be better understood at a later stage of this description, cam 105 was at the extreme position of its angular travel, corresponding to extreme outer position of sleeve 120 on rod 114, spring 129 being extended and uncompressed. As soon as shaft 91 started to rotate, however, cam 105 was driven in the same direction through its frictional engagement, and brought to its other extreme position shown in Figs. 3 and 4, where its stop portion 127' abuts against lug or pin 126; in the meantime, its spiral shaped rim has exerted a cam action against said lug or pin, causing inward axial motion of sleeve 120 to the position shown, where spring 129 is compressed between said sleeve and the hub of clutch arm 116. From this point, shaft 91 has continued to rotate, while cam 105 has remained stationary, and the diameter of reel 57 has grad-

ually increased, forcing outwardly arm 131, as shown in Fig. 5. During all this time, finger arm 138 has been maintained in its position detached from its stop pin 142, by collar 148 on rod 114, which is in the path of its angular motion, and finger arm 137 has remained abutting against its stop pin 141, blocking the longitudinal motion of rod 114 towards the right, and assisting therefore in maintaining positive connection between sleeve 113 and shaft 91.

While shaft 91 is thus connected to shaft 87, shaft 90 is disconnected, and is therefore free to revolve.

When the connection between shaft 87 and shaft 91 was first established, reel 56 was the full reel, and 57 the empty reel; let us assume that a new ribbon had just been inserted in the machine by putting a new reel at the position indicated by 56. This is a comparatively simply operation, the reel being provided with a central circular opening with two radial inwardly directed lugs, and being inserted over the stud 101, which has two longitudinal grooves registering with said lugs, said reel being maintained in position by a screw 149.

From this new reel, the ribbon has been extended to pass over roller 62, then through slots 63, 64 and upwardly to and over roller 65, and has been connected to the empty reel 57. At this time, there is no tension in a spiral spring 150. As shaft 87 is first rotated, reel 57 exerts a pull on the ribbon, which causes reel 56 to also rotate, paying out the ribbon. Together with reel 56, shaft 98 will also rotate, being rotatably mounted through shaft 90. However, the spiral spring 150 connects the enlarged portion 100 of shaft 98 with the inner surface of the rim of drum 92, so that the rotation of shaft 98 will gradually cause said spring to become under tension until such time when said tension is sufficient to overcome the frictional resistance caused by spring 97 to the rotation of shaft 90 and drum 92. At this time shaft 90 will follow the rotation of shaft 98, but in the meantime the tension in spring 150 remains, causing the ribbon to be fed under tension and to remain under tension at all times thereafter.

As shaft 90 is caused to follow the rotation of shaft 98, which takes place in a counter-clockwise direction looking from the right of Figs. 3 and 4 towards the machine, cam 94 will remain stationary, being prevented from following the rotation of shaft 90 by lug or pin 125 of sleeve 119 abutting against stop portion 127 of the cam rim.

These conditions remain as described throughout the period during which the ribbon is being wound upon reel 57, and unwound from reel 56. When the last turn of the ribbon on reel 56 is reached, and the opening 135 in its hub is uncovered, arm 130 will suddenly snap with its tip through said opening, moving its finger arm 137 out of the path of collar 147 on rod 114, in a manner analogous to that described in connection with Fig. 6.

As previously stated, the initial rotation of shaft 91 has been participated in by cam 105, with the result that spring 129 has become compressed between sleeve 120 and clutch arm 116. As soon as finger arm 137 is forced outwardly, therefore, by the angular motion of arm 130 due to its spring 136, shifting rod 114 will quickly snap to the right due to the pressure exerted by spring 129, causing disengagement of clutch sleeve 113 from shaft 91, and then causing engagement of sleeve 112 with shaft 90. The rotation of shaft 87 will therefore instantly be transferred from shaft 91 to shaft 90, which will now rotate in a clockwise direction looking from the right of Figs. 3 and 4. From driving, shaft 98 will now become driven, the rotation of shaft 90 and drum 92 being transmitted to shaft 98 through spiral spring 150; and since shaft 90 now rotates in a direction opposite to that in which it was formerly driven, the tension of spring 150 remains, and is maintained while the ribbon travels in the opposite direction.

As shaft 90 is first rotated in the new direction stated, cam 94 will follow its rotation, until its stop portion 127 will once more abut against lug or pin 125. During this partial revolution, its rim has forced lug or pin 125, and therefore sleeve 119, inwardly, compressing spring 128 between said sleeve and the hub of clutch arm 115. This is made possible owing to the fact that when rod 114 was shifted to the right by the action of spring 129, collar 148 was moved out of the path of finger arm 138, so that this was free to angularly move inwardly to abut against stop pin 142, due to the action of its spring 140, locking rod 114 against return motion.

The ribbon will now continue to be wound upon reel 56, unwinding from reel 57, until the opening in the hub of reel 57 will in its turn become uncovered by the ribbon, and a new reversal, due to the combined action of the outward movement of finger arm 138, permitting shifting of rod 114 to the left, and spring 128, effecting said shifting movement, will take place.

Owing to the comparatively large diameter of cams 94, 105, the cam action of their spiral shaped rims is very effective in compressing springs 128, 129, and for positive operation to take place it is only necessary that springs 97, 108, be somewhat stronger than springs 128, 129.

I will now explain how the operation of shaft 87 is directly controlled by the operation of the platen in one or the other direction. In the device illustrated, I use a spring motor as a source of power, but it will be made

clear from the description, that with some suitable modifications, an electric motor may be used as well.

Broadly, the principle of operation of the ribbon feed driving mechanism, may be compared to that used in the operation of a power press. In a press, the source of power, which is represented by a continuously rotating flywheel, is normally operative only when a clutch member is released to connect said flywheel with the operating shaft.

The clutch is normally held in its inoperative position against the action of a spring, which will force the clutch into operative position when released; but the rotation of the shaft thus determined, is terminated at the end of one revolution by suitable stationary cam acting means which once more force the clutch into its inoperative position, setting the spring in readiness for the next release.

A quite similar arrangement could be used here, by controlling the clutch release by the action of the platen, especially if an electric motor is used, furnishing a convenient means of maintaining a member in continuous rotation. But for simplicity's sake, I prefer to use a mechanism where the source of power itself is not only normally inoperative, but is also normally stationary; although its function is quite parallel to that just described, since I use a source of power which is normally inoperative, means controlled by the action of the platen to render said source of power temporarily operative, causing one revolution of the operating shaft, and means controlled by the rotation of said shaft, automatically once more rendering inoperative said source of power at the end of said revolution.

The one revolution of the operating shaft thus obtained every time the platen is rotated in one or the other direction, is transmitted to shaft 87, causing a substantial angular motion thereof; for instance, if the ratio is 1:1, as shown in the drawings, causing one revolution of said shaft. This in its turn corresponds to one revolution of the pick-up reel, and the feeding of a length of ribbon which is a function of the diameter of the pick-up reel at that particular moment. With a reel such as ordinarily used in a Remington or other standard typewriter, the minimum diameter of the reel corresponds to about three inch feed, and the maximum diameter to about eight inch feed for one revolution.

The device specifically illustrated comprises a driving shaft 151, which constantly tends to rotate in a clockwise direction as the arrow indicates in Fig. 3, owing to the action of a spiral spring 152 which has its inner end attached to said shaft, and its outer end attached to the rim of a spring drum 153 loosely mounted on said shaft. The spring is maintained under tension by means which I will later describe. 154 designates an actuating drum which is frictionally connected to shaft 151 by clamping a disc 155 fixed on the shaft between its inner wall surface, and a pressure plate 156 inserted on pins 157 rearwardly extending from said wall, and maintained against the rear surface of disc 155 by the pressure exerted by springs 158. The result of this arrangement is that if drum 154 is free to revolve, it will follow the rotation of the shaft, and if it is prevented from rotating it will prevent the rotation of said shaft; but if the force driving said shaft should become sufficient to overcome the friction exerted by the actuating drum and by its pressure plate against the surface of the disc, the shaft will be able to rotate even though the actuating drum should be locked against rotation.

On the front end of shaft 151 is rotatably mounted a conical gear 88 which, as stated, is in mesh with and drives gear 89 on shaft 87. Said gear 88 is integral with a ratchet wheel 159, which is engaged by a pawl 160 carried on the front face of drum 154, and which causes said ratchet wheel and gear 88 to follow the rotation of said actuating drum. On the other hand, such an arrangement permits of the gear 88 and ratchet wheel 159 being rotated in the same direction independently of shaft 151.

This feature, therefore, permits of feeding the ribbon by hand whenever desired, if suitable means for directly or indirectly rotating shaft 87 in the normal direction are provided. This may be done in a number of ways, for instance, merely by providing screws 149, 149′ with an extension 161, provided with a crank handle 162 which can be rotated by hand. Screw 149 will have a right hand thread, while screw 149′ will have a left hand thread; in this manner, means are provided for directly rotating the take-up reel in the proper direction.

From the preceding description, it will be understood that actuating drum 154 is constantly tending to rotate in the direction of the arrow in Fig. 3; its rotation, however, is normally prevented by a feed controlling member 163 made in the form of a rectangular frame comprising a front longitudinal bar or contact member 164 normally contacting with the upper surface of the platen, as shown in Fig. 7, two side members extending to the rear, 165, 166, pivotally suspended by vertical links 167 to the secondary frame sides at 168, a rear longitudinal member 169 closing the rectangle, and a rearwardly directed extension 170 which helps in guiding the front to rear motion of said feed controlling member by passing through a slot 171 in frame 36, and which is provided with an upwardly extending finger 172 reaching the surface of drum 154 about midway of its width.

Said feed controlling member is also pro-

vided with an upwardly extending lug 173, which when the feed controlling member is in its normal position shown in Fig. 7, is directly in line with the front wall or web of drum 154.

Said wall or web has a substantially circular outline, as shown in Fig. 3, and is provided with a radially extending stop pin 174 which abuts against lug 173 when this is in the same vertical plane, that is, in the normal position of the feed controlling member. Said feed controlling member is maintained in its normal position by a tension spring 175, which being directed at right angle to the front to rear motion of the feed controlling member, will be subject to increased tension whether the feed controlling member is moved towards the front or towards the rear, and will therefore tend to oppose its motion in either direction.

At the same time said spring has the object of maintaining the front part of the feed controlling member, that is, contact bar 164, into frictional contact with the upper surface of the platen, using the pivotal connections 176 between links 167 and the side members 165, 166, as a fulcrum for said feed controlling member.

The crown part of drum 154, which is shown in section from the rear in Fig. 10, has its major portion with a circular outline, and a minor portion 177 bulging or raised from the circular surface, at a short angular distance from stop pin 174, and preceding said pin in the sense of the movement of the drum. Said minor portion therefore has a segmental circular outline having a radius greater than the rest of the drum; furthermore, in its rear portion, that is, in its portion which is closer to the stop pin, said bulging portion is provided with two radially extending rib members, 178, 179, converging from the two sides of the crown portion of the drum, towards the direction of pin 174.

By means of this arrangement, a double cam action is obtained, first in a vertical plane, and then in a horizontal plane, against finger 172, in order to return the feed controlling member to its normal position at the end of one revolution of drum 154.

This mechanism is extremely sensitive, and operates as follows:

If the platen is rotated, even slightly, in one or the other direction, its motion will be followed by the feed controlling member, on account of the frictional contact existing between contact bar 164 and the surface of the platen. This movement may be compared to that of a gear and rack mechanism, and is illustrated in Fig. 8, where the platen has been slightly moved in a direction opposite to its normal feeding direction of rotation. The ensuing forward movement of the feed controlling member causes lug 173 to release stop pin 174, and drum 154 is thus free to rotate together with shaft 151, driving gear 88 and through it, shaft 87. As the end of one revolution of drum 154 approaches, its raised portion 178 presses against finger 172, causing tilting of the feed controlling member around its pivots 176, so as to detach its contact bar 164 from the surface of the platen; exerting, in other words, a cam action in the vertical plane against the feed controlling member.

Immediately after the front part of the feed controlling member has been so raised, the converging ribs 178 or 179, in this case 178, will gradually force finger 172 inwardly, that is towards its normal position in a horizontal direction. As said position is reached, the bulging portion 177 terminates, and allows spring 175 to return to feed controlling member to a position where bar 164 contacts with the surface of the platen; at the same time, the normal position of the feed controlling member having been resumed, lug 173 is once more in the path of stop pin 174, and will bring the movement of the drum to a sudden end.

If at this time the platen is still in motion, the feed controlling member will be once more immediately driven in the direction of the rotation of the platen; and the cycle of operations will be repeated, and will continue to be repeated, as long as the platen is kept in motion. On the other hand, a very slight angular motion of the platen, such, for instance, as necessary to feed the paper for one line space printing, is sufficient to insure the feed of a substantial length of ribbon.

Said feed starts immediately after the platen has been rotated a small angle, therefore the ribbon is in the best conditions for feeding; the ribbon being maintained in motion throughout the period when the platen rotates, it is practically impossible for the ribbon to become caught and entangled between the platen and the feed rollers; and the ribbon being maintained in motion up to, or after the point when the motion of the platen terminates, it will remain in perfect alinement at the end of its feeding movement, being assisted in this also by the tension created by spring 150.

In connection with a spring motor, such an illustrated, means must also be provided insuring tension of the spring, as well as means effectively preventing the possibility of putting an excessive tension or strain upon the spring. To these ends, the following arrangement is provided:

The spring drum 153 is provided with an external circumferential series of ratchet teeth 180 extending for a portion of its width and frame 36 is provided with a pawl 181 interlocking with said teeth, permitting rotation of the spring drum in a clockwise direc-

tion, as indicated by the arrow in Fig. 3, but preventing its rotation in the opposite direction. Another drum 182 is rotatably inserted over the remaining portion of the width of drum 153, and carries another pawl 183, also engaging ratchet teeth 180 so as to cause drum 153 to follow its motion when drum 182 is rotated in the direction of the arrow. However, owing to this construction, drum 153 is free to rotate in the same direction independently of drum 182, and drum 182 is free to rotate in the opposite direction without engaging drum 153. Therefore, by fixing a rear plate 184 to drum 153, and by providing said rear plate with two projecting handles 185, 186, spring 152 may be wound up by hand to the desired tension, when nocessary.

Normally, however, the tension of the spring is automatically reached and maintained, by utilizing the return motion of the carriage to wind the spring. To this end, a flexible steel band 187 is attached at one end to the surface of drum 182, upon which it is wound for a suitable length, and is attached at the other end to a fixed extension 188 attached to the main frame of the machine. If the carriage has reached the end of its writing stroke, and is about to be returned, and if during the step by step motion of the carriage towards the left band 187 has been caused to wind upon drum 182, it is obvious that when the carriage is moved towards the right in order to start a new line, band 187 will cause drum 182 to rotate in a clockwise direction, as indicated by the arrow in Fig. 3. The result is, that pawl 183 will force drum 153 to follow the rotation of drum 182, winding the spring which is held at its inner end by shaft 151. Shaft 151 is held stationary by the friction exerted by the clamping action exerted by drum 154 and pressure plate 156 against the surface of disc 155, since drum 154 is normally prevented from rotating by the action of lug 173 against stop pin 174.

The tension of spring 152 is therefore a function of the friction between members 154, 156, and disc 155. When the spring should be wound in excess of the normal tension allowed by conditions, that is, to a point sufficient to overcome the frictional resistance developing against the surface of disc 155, shaft 151 will follow the rotation of drum 153, being driven by said spring, and disc 155 will slip between its clamping surfaces. In this manner, excessive winding of the spring, and possible consequent damage, is effectively avoided.

The winding of band 187 upon drum 182 as the carriage moves towards the left might be obtained by means of an additional spring arrangement; but I prefer to use a more positive and simpler arrangement, comprising another steel band 189, wound upon drum 182 in a direction opposite to that of band 187, and attached to a rearward projection 190 from the machine frame, at the right, preferably by means of a tension spring 191.

As the carriage progresses in its step by step motion towards the left, band 189 unwinds from drum 182, causing the same to rotate in a counterclockwise direction; this movement can take place, as stated, without interference from the ratchet teeth 180 on drum 153, and automatically causes band 187 to wind upon drum 182 as the movement of the carriage progresses. When the carriage is moved in the opposite direction, as stated, band 187 will cause reverse movement of the drum, and this time this movement will be transmitted to the spring by pawl 183. At the same time, this reverse movement of the drum will cause winding of band 189, so that the unwinding of each band will automatically cause the winding of the other.

The object of spring 191 is to provide a yielding attachment for band 189, allowing vertical shifting of the spring motor which takes place when the secondary frame 36 moves upwardly with the platen frame, to occur without difficulty. Movement of the motor in a vertical plane obviously alters the distance between the motor drum and the points of attachment of bands 187, 189, and since the two bands act in two opposite directions, the device would be locked against vertical motion if no yielding connection were provided. As the device stands, if the motor is moved upwardly, slightly increasing the distance separating it from extension 188, band 187 will cause a slight angular motion of drum 182 in the direction of the arrow in Fig. 3, and this will cause winding of a corresponding length of the other band, 189, upon the drum; and spring 191 will allow such winding to take place, and will become slightly extended to counterbalance it.

In the preceding description I have endeavored to clearly point out those advantageous features of my invention which are new per se, independently of the mechanism employed, and also those constructions and arrangements of parts which are more in the nature of improvements in the modes of producing certain results which in themselves are not necessarily new. It is obvious that, while the drawings represent a thoroughly practical embodiment of my invention, in so far as the new features are concerned the same must be interpreted as being for illustrative purposes only, and not in a limiting sense; inasmuch as any feature may usually be duplicated in a machine by employing different means, through the employment of purely mechanical skill, which does not depart from the scope of the inventive idea.

I therefore reserve myself the right to carry my invention into practice in all those

ways and forms which may enter, fairly, into the scope of the appended claims.

I claim:

1. In a typewriting machine, the combination with a carriage, a platen rotatably mounted on said carriage, and a ribbon extending along the printing line on said platen, of means for longitudinally feeding a minimum amount of ribbon when said platen is rotated in either direction and controlling means therefor, operatively associated with said platen, adapted to terminate the operation of said feeding means after the termination of the angular travel of said platen.

2. In a typewriting machine, the combination with a carriage, a platen rotatably mounted on said carriage, a ribbon extending along the printing line on said platen, and feeding means for said ribbon, of an independent source of power, adapted to operate said feeding means, and controlling means therefor, operatively associated with said platen, rendering said source of power operative when said platen is rotated in either direction.

3. In a typewriting machine, the combination with a carriage, a platen rotatably mounted on said carriage, a ribbon extending along the printing line on said platen, and feeding means for said ribbon, of a source of power tending to operate said feeding means, means for energizing said source of power, and means normally locking said source of power against operation, said locking means being operatively associated with said platen, and rendering said source of power operative when said platen is rotated in either direction.

4. In a typewriting machine, the combination with a carriage, a platen rotatably mounted on said carriage, a ribbon extending along the printing line on said platen, and feeding means for said ribbon, of a rotatable member independent of said platen adapted to drive said feeding means, and a member movable in relation to and controlled by said platen, governing the operation of said rotatable member.

5. In a typewriting machine, the combination with a carriage, a platen rotatably mounted on said carriage, a ribbon extending along the printing line on said platen, feeding means for said ribbon, and driving means therefor, of a controlling member adapted to be shifted by said platen, shiftable thereby transversely to the axis thereof, when said platen is rotated in one or the other direction, governing the operation of said driving means.

6. In a typewriting machine, the combination with a carriage, a platen rotatably mounted on said carriage, a ribbon extending along the printing line on said platen, and feeding means for said ribbon, of a rotatable member adapted to drive said feeding means, and a controlling member operatively associated with said platen, adapted to be shifted thereby transversely to the axis thereof, normally maintaining said rotatable member inoperative, and rendering said rotatable member operative when said platen is rotated in one or the other direction, causing shifting movement of said controlling member.

7. In a typewriting machine, the combination with a carriage, a platen rotatably mounted on said carriage, a ribbon extending along the printing line on said platen, and feeding means for said ribbon, of a rotatable member adapted to drive said feeding means, a member operatively associated with said platen, and movable in relation thereto, normally maintaining said rotatable member inoperative, rendering said rotatable member operative when said platen and member associated therewith are moved in one or the other direction, and means associated with said rotatable member returning said associated member to its normal position.

8. In a typewriting machine, the combination with a carriage, a platen rotatably mounted on said carriage, a ribbon extending along the printing line on said platen, and feeding means for said ribbon, of a rotatable member adapted to drive said feeding means, an independent source of power for said rotatable member, means causing the operation of said rotatable member as said platen is rotated in one or the other direction, and means causing said operation to terminate, as said rotatable member completes a predetermined amount of angular travel.

9. In a typewriting machine, the combination with a carriage, a platen rotatably mounted on said carriage, a ribbon extending along the printing line on said platen, and feeding means for said ribbon, of a spring motor adapted to drive said feeding means, means controlled by said platen governing the operation of said spring motor, means for winding said motor during the return motion of said carriage, and means safeguarding said motor against excessive winding.

10. In a typewriting machine, the combination with a carriage, a platen frame mounted on said carriage adapted to be shifted to lower and upper case printing positions, and a platen rotatably mounted on said platen frame, of a main frame fixed on said carriage, a secondary frame movably mounted on said main frame, means transmitting shifting movements of said platen frame to said secondary frame, and a ribbon and feeding and operating means therefor, mounted on said secondary frame.

11. In a typewriting machine, the combination with a carriage, a platen frame mounted on said carriage adapted to be shifted to lower and upper case printing positions, and a platen rotatably mounted on said platen frame, of a main frame fixed on said carriage,

a secondary frame mounted on said main frame operatively associated with said platen frame and shiftable therewith, a ribbon extending along the printing line on said platen, and winding reels therefor, carried by said secondary frame, driving means for said reels and operating means therefor also carried by said secondary frame, and a member operatively associated with said platen, and movable in relation thereto, governing the operation of said operating means.

12. In a typewriting machine, the combination with a carriage, a platen frame mounted on said carriage adapted to be shifted to lower and upper case printing positions, and a platen rotatably mounted on said platen frame, of a main frame fixed on said carriage, a secondary frame operatively associated with said platen frame and shiftable therewith, a ribbon extending along the printing line on said platen, and winding reels therefor, carried by said secondary frame, driving means for said reels, a rotatable member adapted to operate said driving means, and means impelling said member to rotate also carried by said secondary frame, a member operatively associated with said platen, and movable in relation thereto, normally engaging said rotatable member preventing its rotation, and releasing said rotatable member when said operatively associated member is moved in one or the other direction, and means returning said operatively associated member to its normal position.

13. In a typewriting machine, the combination with a platen, of ribbon reels rotatably mounted above said platen, spaced in a front to rear direction therefrom, a ribbon extending for the entire length of the writing line in front of said platen, then upwardly, then in a front to rear direction to one of said reels at each end thereof, guiding means for said ribbon independent of said platen and adapted to be shifted in relation thereto, so as to set one or the other of the marginal portions of said ribbon opposite said writing line, and means for moving said guiding means in a plane substantially tangential to a circumference having for its radius the front to rear tracts of said ribbon.

14. In a typewriting machine, the combination with a platen, of ribbon reels rotatably mounted above said platen, spaced in a front to rear direction therefrom, a ribbon extending for the entire length of the writing line in front of said platen, then upwardly, then in a front to rear direction to one of said reels at each end thereof, guiding means for said ribbon independent of said platen adapted to be shifted in relation thereto, so as to set one or the other of the marginal portions of said ribbon opposite said writing line, or so as to move said ribbon away from the writing line, and means for moving said guiding means in a plane substantially tangential to a circumference having for its radius the front to rear tracts of said ribbon.

15. In a typewriting machine, the combination with a carriage, a platen frame mounted on said carriage adapted to be shifted to lower and upper case printing positions, and a platen rotatably mounted on said frame, of a main frame fixed on said carriage, a secondary frame mounted on said main frame operatively associated with said platen frame and shiftable therewith, a ribbon having a portion extending along the printing line on said platen, and winding reels therefor, carried by said secondary frame, driving means for said reels and operating means therefor also carried by said secondary frame, a member operatively associated with said platen, and movable in relation thereto, governing the operation of said operating means, and guiding means for said ribbon, mounted on and movable in relation to said secondary frame, adapted to shift said ribbon to various positions in relation to said platen.

16. In a typewriting machine, the combination with a carriage, a platen frame mounted on said carriage adapted to be shifted to lower and upper case printing positions, and a platen rotatably mounted on said frame, of a main frame fixed on said carriage, a secondary frame mounted on said main frame operatively associated with said platen frame and shiftable therewith, a ribbon having a portion extending along the printing line on said platen, and winding means therefor, carried by said secondary frame, driving means for said winding means and operating means therefor also carried by said secondary frame, means operatively associated with said platen governing the operation of said operating means, means for shifting said ribbon to various positions in relation to said platen, and means automatically reversing the ribbon feed.

17. In a typewriting machine, the combination with a carriage, a paper feeding mechanism comprising a platen, and a spooled ribbon extending along the printing line of said platen, of means for feeding said ribbon in one or the other direction and a normally inoperative individual source of power for operating said ribbon feeding means, said source of power being controlled by said paper feeding mechanism, and becoming operative whenever said platen is rotated in either direction.

18. In a typewriting machine, the combination with a carriage, a paper feeding mechanism comprising a platen rotatably mounted on said carriage, a ribbon extending along the printing line of said platen, feeding means therefor, and a normally inoperative individual source of power for operating said ribbon feeding means, of means controlled by said paper feeding mechanism, rendering said source of power operative to actuate said

ribbon feeding means, whenever said platen is rotated in either direction.

19. In a typewriting machine, the combination with a carriage, a platen rotatably mounted on said carriage, a ribbon extending along the printing line of said platen, feeding means therefor, and a normally inoperative individual source of power for operating said ribbon feeding means, of means operatively associated with said platen rendering said feeding means operative whenever said platen is rotated in either direction.

20. In a typewriting machine, the combination with a carriage, a platen, and a spooled ribbon extending along the printing line of said platen, of means for feeding said ribbon in one or the other direction and a source of power adapted to operate said feeding means, said source of power being controlled by said platen, and being adapted to generate power independently of that actually required for the operation of said machine.

21. In a typewriting machine, the combination with a carriage, a platen rotatably mounted on said carriage, a ribbon extending along the printing line on said platen, and feeding means for said ribbon, of driving means therefor, and a controlling member in operative engagement with said platen, rendering said driving means operative whenever said platen is rotated in either direction.

22. In a typewriting machine, the combination with a carriage, a platen rotatably mounted on said carriage, a ribbon extending along the printing line on said platen, feeding means for said ribbon, and driving means therefor, of a controlling member in operative frictional engagement with said platen, rendering said driving means operative whenever said platen is rotated in either direction.

23. In a typewriting machine, the combination with a carriage, a platen rotatably mounted on said carriage, a ribbon extending along the printing line on said platen, and feeding means for said ribbon, of a rotatable member adapted to drive said feeding means, means impelling said member to rotate, a detent mechanism operatively associated with said platen, controlling the operation of said rotatable member, said mechanism comprising means normally engaging said rotatable member preventing its rotation, and releasing it when said platen is operated in either direction, and means for returning said engaging and releasing means to their normal position.

24. In a typewriting machine, the combination with a carriage, a platen rotatably mounted on said carriage, a ribbon extending along the printing line on said platen, and winding reels, one at each end of said ribbon, of means for alternately winding said ribbon upon one or the other of said reels, and spring means associated with one of the said reels, tending to rotate said reel in a direction opposite to that of the movement of said ribbon, and maintaining said ribbon under continuous tension, both when said ribbon is wound upon or unwound from said reel, said spring means being interposed between said winding means and said reel, transmitting movement from the former to the latter, when said reel is rotated in its winding direction.

25. In a typewriting machine, the combination with a carriage, a platen rotatably mounted on said carriage, a ribbon extending along the printing line on said platen, and winding reels, one at each end of said ribbon, of means for alternately winding said ribbon upon one or the other of said reels, and spring means associated with one of the said reels, said spring means being adapted to be set under tension by said reel when the ribbon is unwound therefrom, and being adapted to be set under tension by said winding means, when said ribbon is wound upon said reel.

26. In a typewriting machine, the combination with a carriage, a platen rotatably mounted on said carriage, a ribbon extending along the printing line on said platen, and winding reels, one at each end of said ribbon, of means for alternately winding said ribbon upon one or the other of said reels, spring means associated with one of the said reels, said spring means being adapted to be set under tension by said reel when the ribbon is unwound therefrom, and being adapted to be set under tension by said winding means, when said ribbon is wound upon said reel, and friction means associated with said spring means regulating the tension thereof.

27. In a typewriting machine, the combination with a carriage and a platen carried thereby, of a manifolding attachment comprising a frame adapted to be mounted on said carriage, ribbon reels, guides and driving means carried by said frame, and a member controlling said driving means also carried by said frame, arranged to be moved into operative relation with said platen, when said frame is placed on said carriage, said member being operated by said platen both when said platen is rotated in one or in the other direction.

28. In a device of the class described, the combination with a platen, of a manifolding ribbon, winding reels therefor located above said platen, and guiding means for said ribbon movable tangentially of said platen and of said winding reels, said guiding means extending from the printing line on said platen to a point substantially on a level with the winding section of said reels.

29. In a device of the class described, the combination with a platen, of a manifolding ribbon, winding reels therefor located above said platen, and guiding means for said rib-

bon movable tangentially of said platen and of said winding reels, said guiding means extending from the printing line on said platen to a point substantially on a level with the winding section of said reels, and hand controlled means for causing transversal displacement of said guiding means and ribbon in relation to the writing line on said platen.

30. In a typewriting machine, the combination with a carriage, a manifolding ribbon and winding means therefor, of a spring motor adapted to drive said winding means independently of said carriage, and means utilizing the return motion of said carriage to rewind said motor.

31. In a typewriting machine, the combination with a carriage, a manifolding ribbon and winding means therefor, of a spring motor adapted to drive said winding means independently of said carriage, said spring motor comprising a spring and tensioning means therefor, means operatively associated with said tensioning means utilizing the return motion of said carriage to rewind said spring, and frictional means interposed between said spring and tensioning means allowing slippage of one in relation to the other to avoid excessive winding of said spring.

32. In a typewriting machine, the combination with a frame, a carriage mounted on said frame, a manifolding ribbon and winding means therefor, of a spring motor adapted to drive said winding means, said spring motor comprising a spring, a shaft connected to one end of said spring adapted to be driven thereby, and a member connected to the other end of said spring adapted to be rotated in a direction increasing the tension of said spring, means on said frame preventing rotation of said member in the opposite direction, a rotatable tensioning member coaxial with said member adapted to cause the rotation thereof, in the tensioning direction, a flexible member connecting said tensioning member to one end of said frame, causing rotation thereof in said tensioning direction during the return motion of said carriage, and another flexible element connecting said tensioning member to the other end of said frame, causing rotation thereof in the opposite direction, rewinding said first mentioned flexible element on said tensioning member, during the travel of the carriage in its normal operative direction.

33. In a typewriting machine, the combination with a frame, a carriage mounted on said frame, a manifolding ribbon and winding means therefor, of a spring motor adapted to drive said winding means, said spring motor comprising a spring, a shaft connected to one end of said spring adapted to be driven thereby, and a drum connected to the other end of said spring adapted to be rotated in a direction increasing the tension of said spring, means on said frame preventing rotation of said drum in the opposite direction, a rotatable tensioning member coaxial with said drum adapted to cause the rotation thereof, in the tensioning direction, a flexible member connecting said tensioning member to one end of said frame, causing rotation thereof in said tensioning direction during the return motion of said carriage, another flexible element connecting said tensioning member to the other end of said frame, causing rotation thereof in the opposite direction, rewinding said first mentioned flexible element on said tensioning member, during the travel of the carriage in its normal operative direction, and frictional connecting means interposed between said drum and said shaft allowing slippage of one in relation to the other to avoid excessive winding of said spring.

34. In a typewriting machine, the combination with a frame, a carriage mounted on said frame, a manifolding ribbon and winding means therefor, of a spring motor adapted to drive said winding means, said spring motor comprising a spring, a shaft connected to one end of said spring adapted to be driven thereby, and a drum connected to the other end of said spring adapted to be rotated in a direction increasing the tension of said spring, means on said frame preventing rotation of said drum in the opposite direction, a rotatable tensioning member coaxial with said drum adapted to cause the rotation thereof, in the tensioning direction, a flexible member connecting said tensioning member to one end of said frame, causing rotation thereof in said tensioning direction during the return motion of said carriage, another flexible element connecting said tensioning member to the other end of said frame, causing rotation thereof in the opposite direction, rewinding said first mentioned flexible element on said tensioning member, during the travel of the carriage in its normal operative direction, and adjustable frictional connecting means interposed between said drum and said shaft allowing slippage of one in relation to the other to avoid excessive winding of said spring.

35. In a typewriting machine, the combination with a platen, a manifolding ribbon, winding means and an operating shaft therefor, of a normally inoperative source of power, means controlled by said platen rendering said source of power temporarily operative, causing a predetermined angular movement of said operating shaft upon the operation of said platen, and means controlled by the rotation of said shaft, automatically rendering said source of power once more inoperative, upon completion of said angular movement.

36. In a typewriting machine, the combination with a platen, a manifolding ribbon,

winding and driving means therefor, and a stop member operatively associated with said platen, normally preventing the operation of said driving means and releasing the same upon the operation of said platen, of means for resetting said stop member in its normal position after a predetermined period of operation of said driving means.

37. In a typewriting machine, the combination with a platen, a manifolding ribbon, winding and driving means therefor, of a stop member operatively associated with said platen, and adapted to be shifted thereby transversely thereof, normally preventing the operation of said driving means and releasing the same when shifted in either direction, due to the operation of said platen in one or the other direction.

38. In a typewriting machine, the combination with a platen, a manifolding ribbon, winding and driving means therefor, of a stop member operatively associated with said platen, and adapted to be shifted thereby transversely thereof, normally preventing the operation of said driving means and releasing the same when shifted in either direction, due to the operation of said platen in one or the other direction, of means tending to maintain said stop member in its normal position and tending to oppose its being moved away from said normal position in either direction.

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