

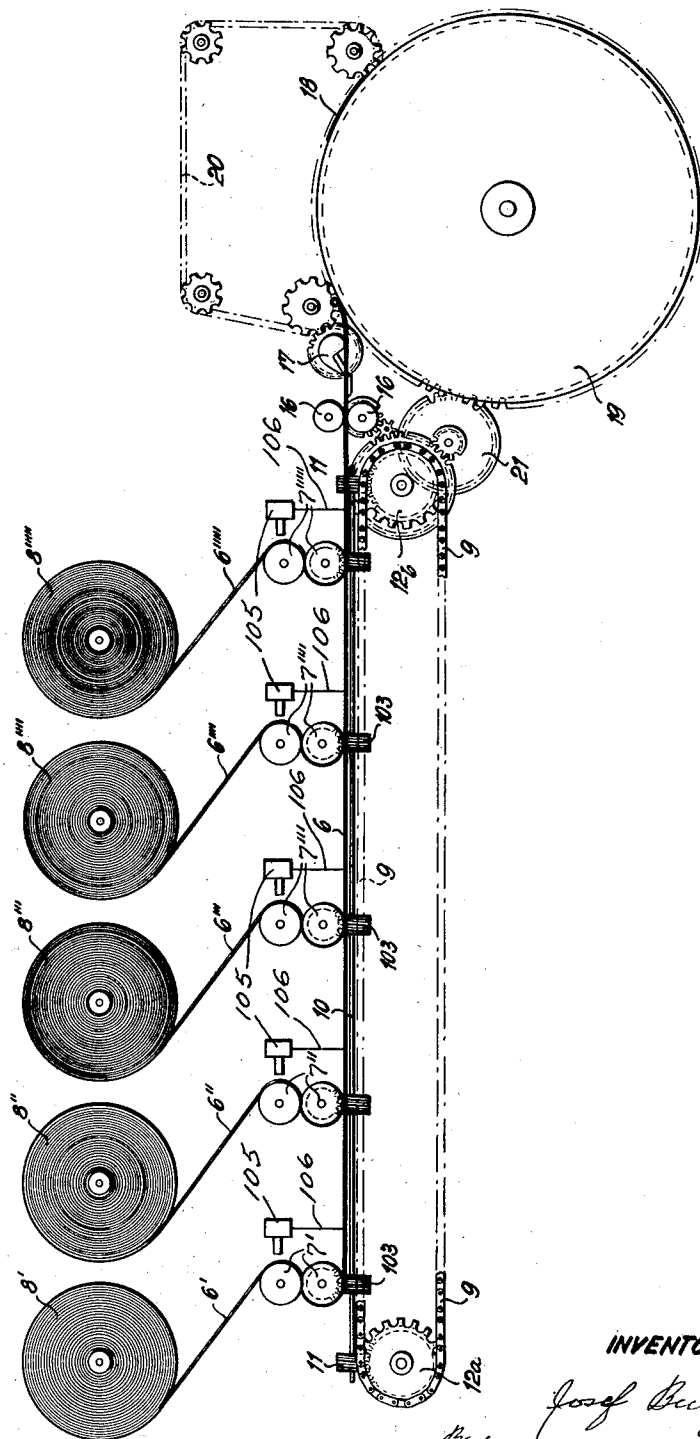
July 23, 1957

J. BURGMER
APPARATUS FOR THE ASSEMBLY AND FINISHING
OF SETS OF DUPLICATING FORMS

2,800,325

Filed March 27, 1953

3 Sheets-Sheet 1



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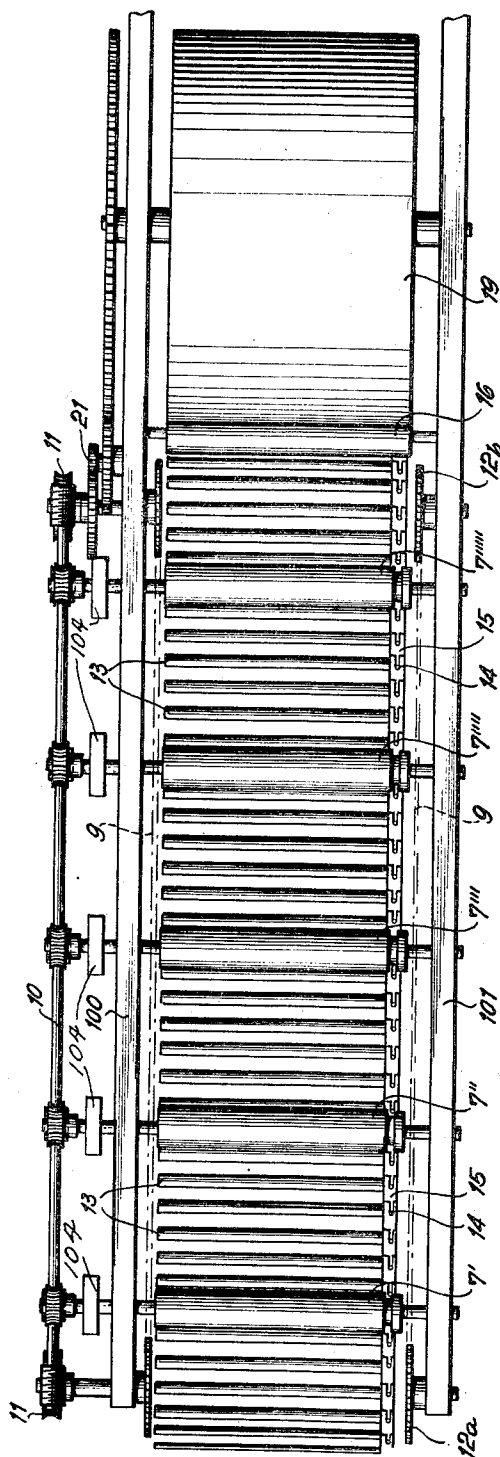
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FIG. 2



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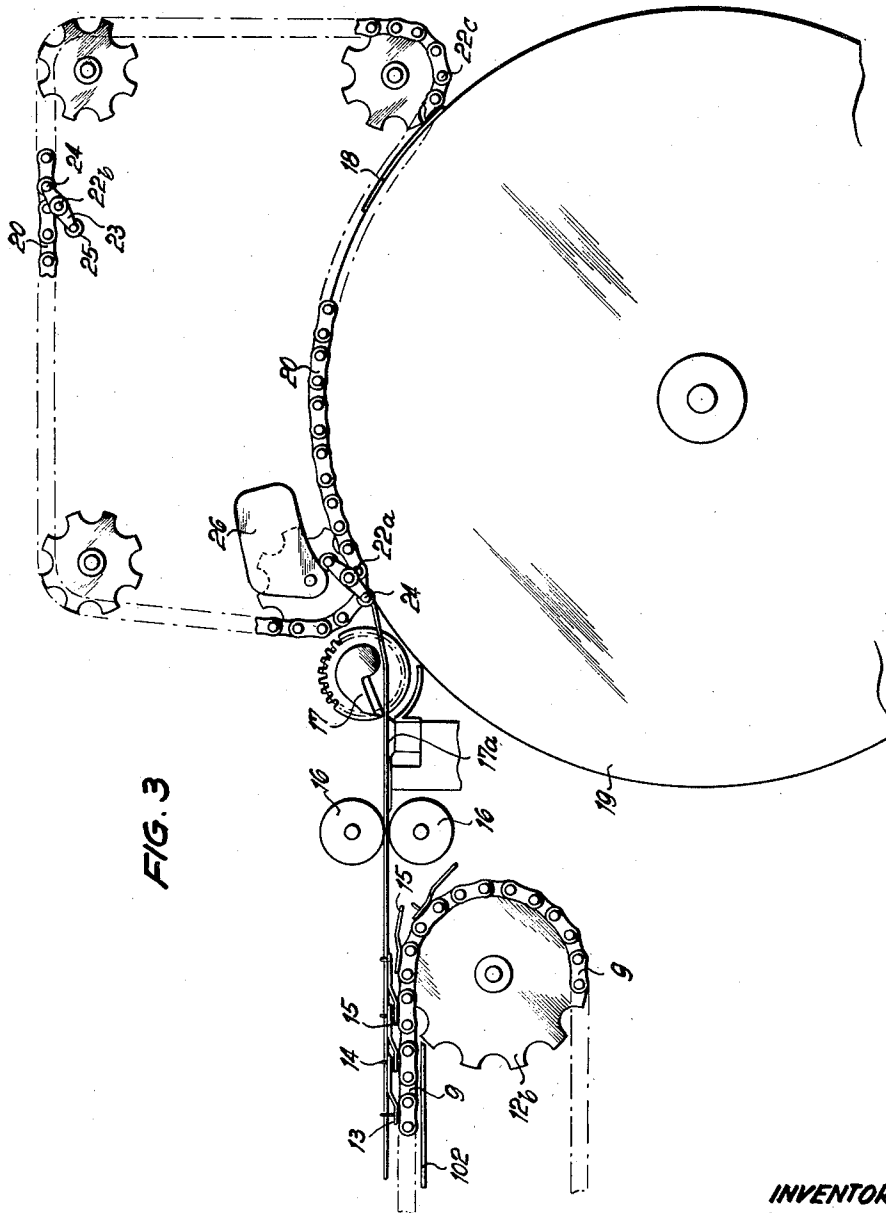
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APPARATUS FOR THE ASSEMBLY AND FINISH- ING OF SETS OF DUPLICATING FORMS

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6 Claims. (Cl. 270—52)

The invention relates to arrangements for the continuous production of sets of duplicating forms or the like from a plurality of possibly printed webs or strips of writing paper and webs of carbon paper disposed therebetween, which are assembled to form a multi-layer web which is thereafter cut, perforated or treated in any other suitable manner.

In the arrangements of this type which are already known, the separate paper webs are drawn off from supply rollers by means of pairs of rollers and thereafter placed one above the other on an endless conveyor belt, which feeds the manifold web which is formed to the further handling devices. In order with these arrangements to guide together the different webs of writing paper in correct registry, that is to say, in such manner that the associated impressions and other signs or markings are accurately superimposed, and in order to maintain this relative position of the paper webs in the multi-layer web during the feeding and supplementary handling operations, conveyor bands are known on which the paper webs are held at relatively widely spaced intervals, for example, corresponding to the length of a form, by needles or pins which are distributed over the width of the web and are arranged on a transverse slat provided on the conveyor band. However, these arrangements have defects in various respects.

In the first place, it is disadvantageous that these known assembly devices are only adapted to be used for a definite length of form and the adaptation thereof to another width and especially length of form is not possible or is only possible with difficult conversion. Moreover, with the known devices, displacements of the impression or even tearing of the paper webs can easily occur at those places which are pierced by the driver pins. These tears are caused, on the one hand, by the fact that the driver pins take up an inclined position in the region of the reversing rollers at the end of the conveyor band, the pins additionally experiencing a supplementary acceleration. On the other hand, owing to the tensile strain in the conveying region of the conveyor band, it is possible in certain cases for the paper webs to be stretched to different degrees, such stretching being dependent on the actual fibre structure.

The invention, the object of which is to obviate the afore-mentioned defects, follows the guiding principle that the separate paper webs are so spread out and laid one above the other on a conveyor band, using pairs of drafting rollers or the like which preferably have a regulatable drive, so that the webs, regardless of any differences in length, lie in correct registry one above the other, that is to say, in accordance with the impression or other marking, and maintain this position in the region of the working run of the conveyor band.

An essential feature of the arrangement forming the subject of the invention therefore consists in that the upper run of the conveyor band, the working surface of which is formed of slats or the like arranged at intervals transversely of the direction of travel, has arranged above

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it a series of drafting rollers which are disposed parallel to the axis of the reversing rollers of the conveyor band and which successively spread out the separate paper webs free from tension on the conveyor band, the one margin of the assembled web being releasably secured to the slats of the conveyor band, while maintaining the relative positions, which band thereafter feeds the manifold web which is formed to the other device or devices provided for further handling operations.

Conveyor bands constructed in the form of a grid of slats have already been proposed for perforating machines or the like for feeding multi-layer paper webs. The known arrangements, however, are not adapted to be used, and are also not intended, for the assembly of a plurality of individual webs into a multi-layer web, such as is required for the production of sets of duplicating forms or the like. Furthermore, in the known arrangements, the paper webs were only clamped on the slat grid after the assembly into a multi-layer web, being retained in a uniformly tensioned condition and fed forward.

In contrast hereto, the essence of the present invention requires that the paper webs are laid on the conveyor band under different conditions of tension and are secured in a predetermined position relatively to one another, which is independent of their individual tensions. This is rendered possible by the fact that the slats of the conveyor band are arranged at a suitable spacing from one another, so that the longer paper webs can shift relatively to the shorter paper webs during the assembly.

As securing means for the paper webs, the slats forming the grid may advantageously be provided at their one ends with upwardly directed pins or the like, which pierce and thereby secure the separate paper webs.

In order, when using such driver pins, to facilitate the detachment of the multi-layer web in the region of the reversing roller of the conveyor band at the end of its working run, the separate pins are arranged, according to a further feature of the invention, to be retractable in relation to a supporting element which is associated therewith and provided for the paper web. For this purpose, each slat may be provided at one end with an upwardly directed needle or pin which extends through an opening or recess of a plate or strap of the next adjacent slat, which strap covers the said needle in this position. Since these straps are still travelling in the path of the paper web shortly before the commencement of the reversing movement, they lift the multi-layer web from the downwardly travelling pin as soon as the associated slat has commenced its reversing movement at the end of the conveying range. By this means, there is prevented a relative displacement, which could be caused by the manifold web being lifted off the pin too late.

In order to produce a steady and uniform feeding of the collected paper webs and thus also to avoid a tearing of the holes engaged by the pins during the feeding movement, the feeding speed of the grid of slats is so adjusted according to the invention that it does not exceed the smallest of the peripheral speeds of the drafting rollers for the separate paper webs, said peripheral speeds perhaps differing from one another. Furthermore, according to the invention, the grid of slats in the conveying range is relieved of tensile strains, for example, by a common synchronous drive for all chain reversing rollers.

The collected paper webs can be further handled in various ways:

If they are to be separated into separate sets (after being bound or stuck together) by means of a transverse severing device, then for this purpose, according to the invention, there is provided a second conveyor band or the like which runs with a higher feeding speed and on to which is guided the forward end of the multi-layer web

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after leaving the grid of slats. The paper web at this point is applied and tensioned, directly before each cutting operation, by means of gripper devices which are also travelling and provided with freely rotatable pressure rollers.

As a second conveyor means in this case, there may perhaps be used a feed roller of sufficiently large circumference. The grippers, which travel with the same speed as the feed roller and are urged against the latter with adjustable spring pressure, produce an accurately determinable paper tension. Up to the point of cutting, the pressure rollers of the gripper roll on the upper layer of the multi-layer web which is still being displaced slowly forwards. After the cutting, the adjusted bearing pressure is sufficient in order to move forward the severed set of forms or the like so quickly that this set can be stacked or handled in any other suitable manner before the succeeding set is cut off.

The subject of the invention is illustrated by means of a number of embodiments by way of example in the drawing, wherein,

Figure 1 is a diagrammatic side elevation of an apparatus for bringing together five paper webs to form a manifold web and for subsequently cutting the manifold web.

Figure 2 is a top plan view of the feeding device of a constructional example according to Figure 1, but to a larger scale.

Figure 3 shows as a diagrammatic side elevation, to a larger scale, a part of the feeding device and the device for cutting the paper web.

The apparatus shown in the drawing comprises a frame, formed of spaced longitudinally disposed bars or cheeks 100, 101 having the bearings and guides for the various moving members. Arranged in the lower part of the frame is a feeding device 9 which is constructed in the manner of an endless conveyor band and which runs over the reversing rollers 12a, 12b. The feeding means is formed by two sprocket chains, which are interconnected by a series of bars 13 which are substantially parallel to one another and extend transversely of the direction of movement of the band. At least the upper run of the conveyor band or of the chains slides in a fixed guideway 102 of the machine frame, so that the conveyor run of the feed device is moved practically in one plane.

For the purpose of driving the conveyor device, there may be provided toothed wheel gears, such as worm gears 11, which mesh with a corresponding toothing of the reversing rollers 12a, 12b. The two drives for the reversing rollers 12a, 12b are connected with the driving motor by means of a driving shaft 10 which is common to both.

The result achieved by this method of driving is that the conveyor band or chains are relieved in the operating run from the tension of the return run.

Mounted above the feeding device 9 are a series of pairs of rollers 7' which are rotatable in the machine frame. The shafts of these pairs of rollers extend in practice parallel to the shafts of the reversing rollers 12a, 12b. The lower roller of each pair is driven from the shaft 10, each advantageously by means of a worm wheel 103 which, in turn, may be operatively connected to a variable gear (not shown), so that the speed of the different rollers 7' can be regulated independently of one another.

Provided in the machine frame above the rollers 7' are the mountings for the separate supply drums 8', 8'', 8''', 8'''' on which are wound the separate paper webs to be handled.

The arrangement illustrated serves for the production of sets of forms or the like with five different paper webs, namely, three webs 6', 6'' and 6''' of writing paper and two webs 6'''' and 6''''' of carbon paper. Associated with each of these paper webs is a pair of rollers 7', which serves to withdraw the corresponding paper web with

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accurately adjustable speed from its supply drum 8' and spread it out on the slat-type conveyor band 9.

The webs of writing paper are provided with an impression corresponding to the form to be produced, said impression being regularly repeated.

Each pair of feed rollers 7' also has associated with it a control means which is schematically indicated as a drive assembly 104, which can be adjusted or operated in any suitable manner, such as by hand, or by a steering mechanism, or by a photoelectric cell, and which influences the peripheral speed of the driven roller in such manner that of all the paper webs provided with an impression or other markings, there is delivered to the conveyor device 9 in a predetermined time exactly that part of the paper web which corresponds to the length of the form. This control drive 104 for the rollers 7' may, for example, be of an optical type, such that the beginning of the impression or the sequence of specially printed markings on the paper web are detected by light-sensitive cells and converted into current impulses which influence the gearing provided in the drive of the rollers 7', that is to say, maintain the peripheral speed of the rollers 7' constant or vary such speed.

Instead of an optical control means for the rollers 7', it is also possible to provide other means, for example, wheels fitted with detector pins, which pins engage in a continuous perforation of the paper webs, the regulating gear of the rollers 7' being influenced according to the speed of the wheel. In order to adjust the rollers independently of human hands, photoelectric cells 105 may be provided which register the passing of the markings, identifying the beginning of the form, as each of the webs is fed between its associated pair of rollers. This operation must take place simultaneously on all the paper tracks since, if one track is out of operation because of lengthening or shortening, the marking appears in the photoelectric cell earlier or later than in the rest of the cells. As a result of this, the steering impulse is released and is transmitted to the adjustable drive assembly 104, so as to produce an adjustment movement which is indicated in Figure 1 by the lines 106.

As a result of these arrangements, which are known per se to persons skilled in the art, the result is obtained that the associated paper web is so laid on the conveyor band by the rollers 7' that the beginning of each form or impression in all the paper webs are exactly superimposed, independently of the actual length of the impression in each web. For example, if the web 6'' of writing paper has stretched somewhat after the printing or the impression was not effected exactly in agreement with the impression on the other webs 6', 6''' of writing paper, the three webs of paper are nevertheless placed one above the other on the conveyor band in correct registry with the arrangement which has been described, because the rotation of the feed rollers 7' is controlled in dependence on the return of marks or the like arranged at a certain position on each set of forms. For this purpose, there is preferably employed a transverse line, for example, at the beginning of each form impression, as a marking with the optical control, so that therefore the commencement of the form impression in all form sets is exactly superimposed. Any well known and suitable means for insuring proper registry of the webs, when fed to the conveyor, may be provided, such as disclosed in the Stevenson patent, 1,594,761, and German patents, 491,963, 621,761, 682,295, and 619,574, each of which shows means for proper feeding the webs in registry and may be associated with the present invention for maintaining the proper registry of all paper webs when assembled on the conveyor and brought together to form a manifold.

As will be seen from Figure 1, the paper webs 6' on the rollers 7' are successively delivered to the conveyor device 9, so that a multi-layer band is formed. In order that the individual paper webs do not change their posi-

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tion after being deposited on the conveyor device, needles or pins 14 are provided at the one ends of the bars or slats 13, which pins perforate at the margin the paper webs delivered by the rollers 7'.

In the arrangement illustrated, therefore, first of all the paper web 6' fed by the rollers is perforated and retained by the pins 14 of the slats 13, then the paper web 6'' which is placed on the paper web 6' by means of the rollers 7'', thereafter the paper webs 6''' and 6''', and finally the paper web 6''''', all paper webs being accurately retained in that position and extent which is determined by the peripheral speed of the rollers 7'.

The individual paper webs therefore do not lie absolutely flat one above the other on the conveyor band 9, but one or other web can lie in more or less corrugated form, the space between the bars or slats 13 permitting a shifting of the lower webs.

In practical operation, the corrugated disposition of the paper webs can usually be recognised by the fact that one web is more strongly tensioned and the other web is less strongly tensioned.

In order that the paper webs are not torn by the pin 14 with this arrangement, the feeding speed of the conveyor band is always selected to be equal to the peripheral speed of the roller 7' travelling at the slowest speed, which means that the paper web delivered by the roller running at the slowest speed is in practice spread out flat on the conveyor band 9.

The driver pins 14 of the bars 13 are so arranged in accordance with the invention that they are quickly separated from the paper web upon running on to the reversing roller 12b, before they come into an inclined position relatively to the manifold web. For this purpose, the invention advantageously uses the arrangement shown in the left half of Figure 3.

Associated with each transverse bar 13, at the end on which the pin 14 is provided, is a plate or strap 15 which engages over the bar 13 which precedes it in the direction of movement. The strap 15 has an opening or slot through which penetrates the pin 14 of the preceding transverse bar 13. When a bar 13 runs on to the reversing roller 12b and then commences its downward movement, the paper web above this bar 13 is held by the strap 15 of the next-following transverse bar 13, so that the pin of the transverse bar which has commenced the downward movement is retracted from the paper web. In this manner, a tearing of the paper web is prevented.

Instead of the arrangement according to Figure 3, it is also possible to provide other movement means for the driver pins. It is also possible in accordance with the invention to arrange the driver pins in a movable manner at the ends of the transverse bars and to provide means in order to retract the pins from the paper web through the opening of the transverse bar when the transverse bar runs on to the reversing roller 12b, or just prior to this. With this arrangement, the straps 15 are dispensed with.

The manifold web assembled on the conveyor band 9 is gripped by the pair of rollers 16 after leaving the conveyor band, which rollers are driven by a suitable toothing of the reversing roller 12b in such manner that the manifold web is carried forward at the same speed as it is fed by the conveyor band. The manifold web then passes to a cutting device 17, which is formed by a blade rotating at adjustable speed, said blade cooperating with a fixed cutter 17a. The rotation of the blade 17 is so adjusted that the manifold web which is formed is subdivided exactly in accordance with the length of the sets of forms to be produced.

The separate sets of forms which are cut off and which are indicated at 18 in the drawing then pass to a feed roller 19, which is driven from the driving shaft 10 by way of the reversing roller 12b and the toothed wheel gearing 21. The gearing is so adjusted that the roller 19 has a higher peripheral speed than the feeding speed

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of the conveyor band 9. The result attained in this way is that the free end of the manifold web is tensioned shortly before being severed by the device 17, whereby a sharp and clean cut is obtained.

An arrangement 20 formed in the manner of an endless conveyor band cooperates with the feed roller 19, said device consisting of two sprocket chains, the links of which are connected at certain intervals corresponding to the actual length of the forms by rods 22a, 22b, 22c. Pivotaly mounted on these rods 22 are two-armed levers 23, which carry freely rotatable rollers 24 on one arm and guide rollers 25 on the other arm. The rollers 24 bear in the region of the feed roller 19 against the free end of the paper web or the front end of the severed set of forms, so that the latter is carried along according to the peripheral speed of the feed roller 19.

In the range of movement of the guide rollers 25, a guide member 26 is provided in the machine frame, said member being so constructed and arranged that the rollers 24 grip and carry along the free end of the paper webs 6 shortly before the severing operation, whereby the end of the paper web is brought, before the severing operation, to the tension which is expedient for the purpose.

After the severing operation, the severed set of forms 18 is moved forward at increased speed, so that sufficient time is available at the end of the arrangement between the arrival of the separate severed sets of forms in order to take up and set down the separate sets.

Instead of having a severing device, the machine according to the invention may also be provided with a device for perforating the manifold web at the boundary between the separate sets of forms, for example, in order that the manifold webs can be continuously rolled and folded in zig-zag form.

I claim:

1. A machine for continuously assembling a plurality of paper webs each bearing printed impressions or the like which are to be accurately superimposed into an accurately registered manifold form comprising an endless conveyor including endless traction means having a series of transversely disposed bars connected thereto, guide means operatively associated with said bars for guiding the latter in a substantially straight path of movement within the upper run of said conveyor, reversing rollers for said conveyor at the ends of said guide means, means for continuously feeding the separate paper webs on the moving conveyor bars so that the webs form a manifold assembly, said means comprising pairs of cooperating feed rollers, means for driving at least one of said rollers of each pair, means cooperating with said feed roll drive means to feed said webs onto said conveyor in registry, the axes of rotation of each feed roller pair being parallel with the axes of rotation of said reversing rollers, pins extending upwardly above said conveyor bars within the range of said paper webs for penetrating the latter as they are delivered from said roller pairs to the conveyor bars and for holding said webs fast independently of their tension, and means at one end of said guide means for removing the assembled manifold form from said pins.

2. A machine of the character described in claim 1 wherein said pins are disposed adjacent at least one end of said bars for penetrating a margin of said paper webs.

3. A machine of the character described in claim 1 wherein said last mentioned means comprises a strap for each of said pins, each of said straps having an aperture for receiving its associated pin and being connected to said conveyor means for movement therewith whereby the associated pin extends upwardly through said aperture during said substantially straight path of movement and said strap is moved upwardly with respect to said pin as said conveyor moves over the reversing roller at said one end.

4. A machine of the character described in claim 1

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including a transverse severing device disposed to receive the assembled manifold form as it proceeds from said one end of said conveyor, said device comprising a second conveyor, means for driving the severing device at a higher peripheral speed than said endless conveyor, a driven cutter between said conveyors, and means co-operating with said second conveyor for tensioning said manifold form.

5. A machine for continuously assembling a plurality of paper webs as called for in claim 1 in which longitudinally spaced pairs of driven rollers are provided for gripping each paper web, each pair of driven rollers being superposed one on the other.

6. A machine for continuously assembling a plurality of paper webs, as called for in claim 1, in which said conveyor is of such a length as to cooperate with all of said feed roll pairs, and said pins are sufficiently closely

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spaced on the conveyor so that all the paper webs may be retained and assembled by the pins in a fixed position on the conveyor in order that the webs forming the manifold to be produced cannot change their position relative to one another and are secured together in registration as long as they are positioned on the conveyor, the tension on each web being independent from the other webs forming the manifold form.

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