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Bohm

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[45] **Dec. 16, 1975**

[54] **PRINTING MACHINE**

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[21] Appl. No.: **500,467**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 293,171, Sept. 28, 1972, abandoned.

[52] **U.S. Cl.** **101/116;** 101/247

[51] **Int. Cl.**[2] **B41L 13/08**

[58] **Field of Search** 101/114, 115, 199, 247, 101/116, 119

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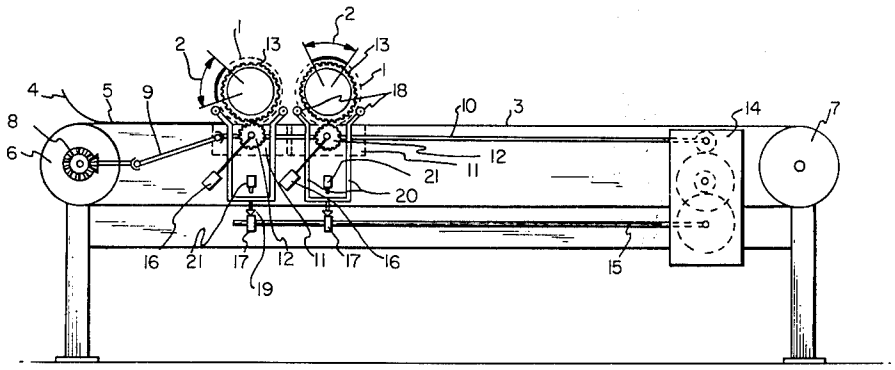
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[57] **ABSTRACT**

The invention is concerned with printing machines used for the printing of large overall patterns which are periodically repeated. At present such machines using rotating printing members require the printing members to be of such a size that the circumference thereof corresponds to the total length of the overall repeated pattern. Thus, with overall patterns having very long lengths, the machines are uneconomical in use. The present invention overcomes that disadvantage by providing a printing machine having at least two rotating cylindrical printing members with means for temporarily interrupting the contact of each member with the material to be printed. Thus interruption of the printing process is controlled in accordance with the pattern to be printed and with the portion of each cylinder having therein a printing portion. The individual printing members are rotated at different angular speeds during their individual printing periods and during their individual periods of interruption of contact with the material.

11 Claims, 7 Drawing Figures



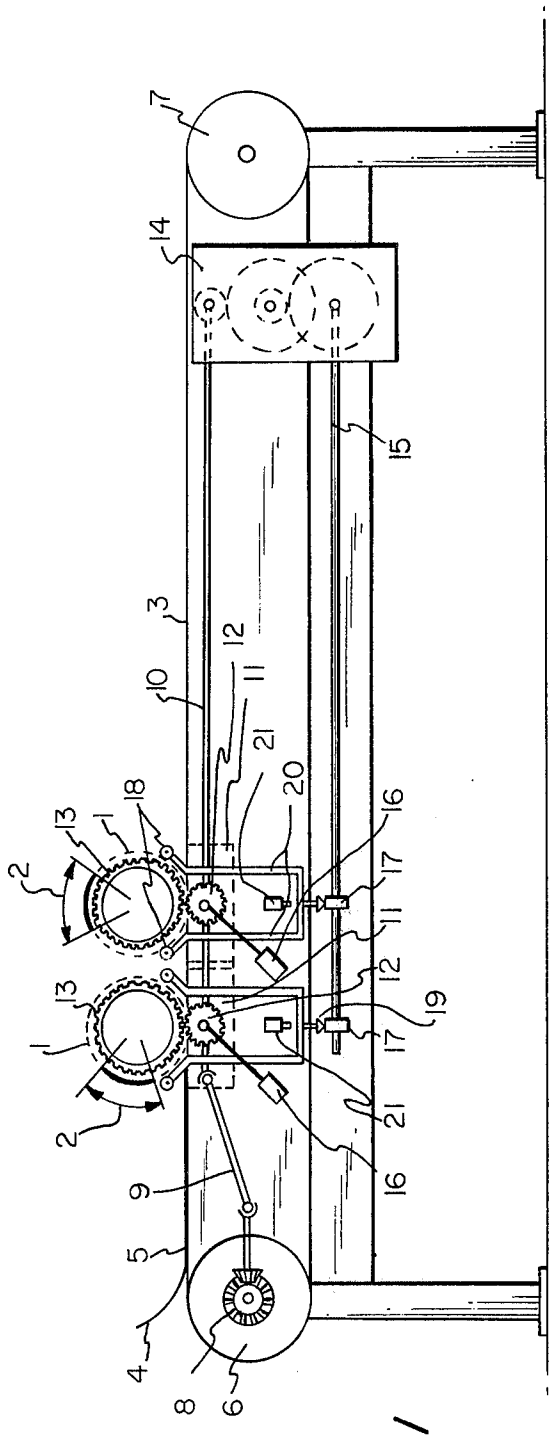

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FIG. 1

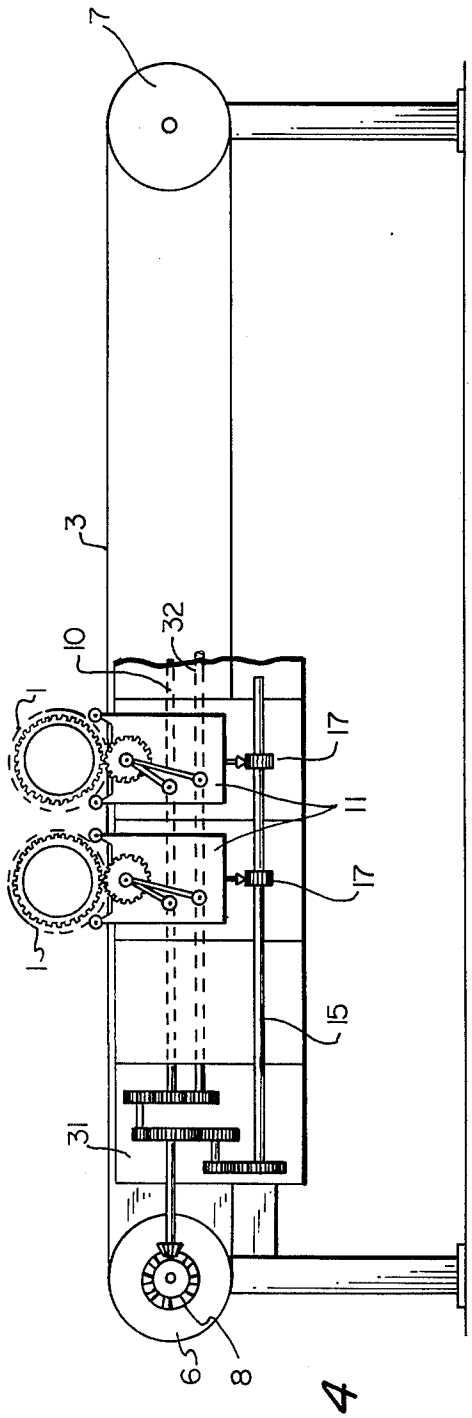

7
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FIG. 4

FIG. 7

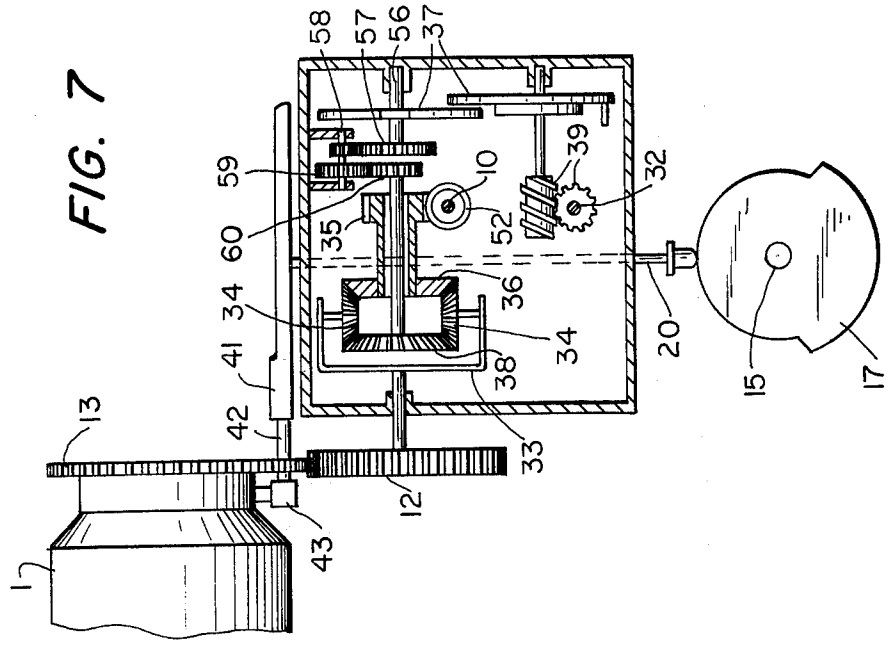


FIG. 6

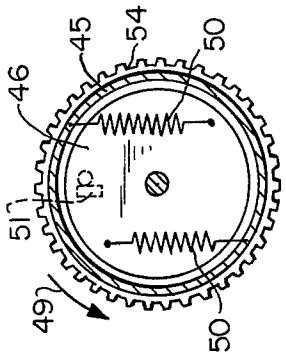
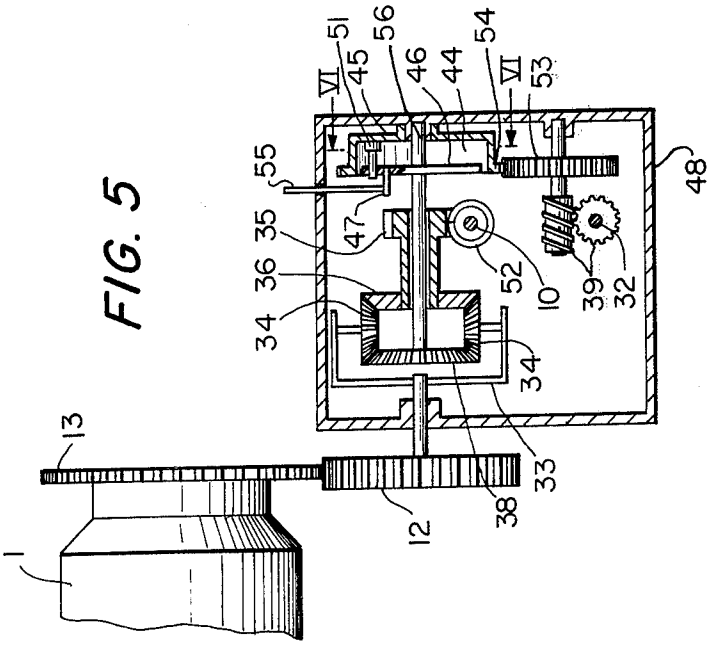


FIG. 5



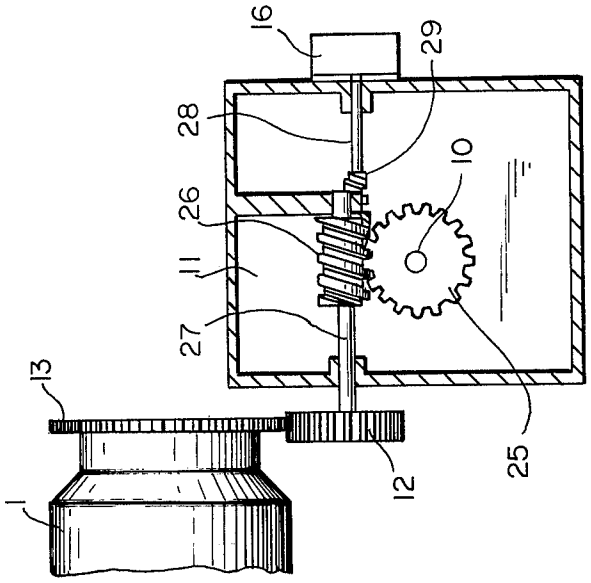


FIG. 3

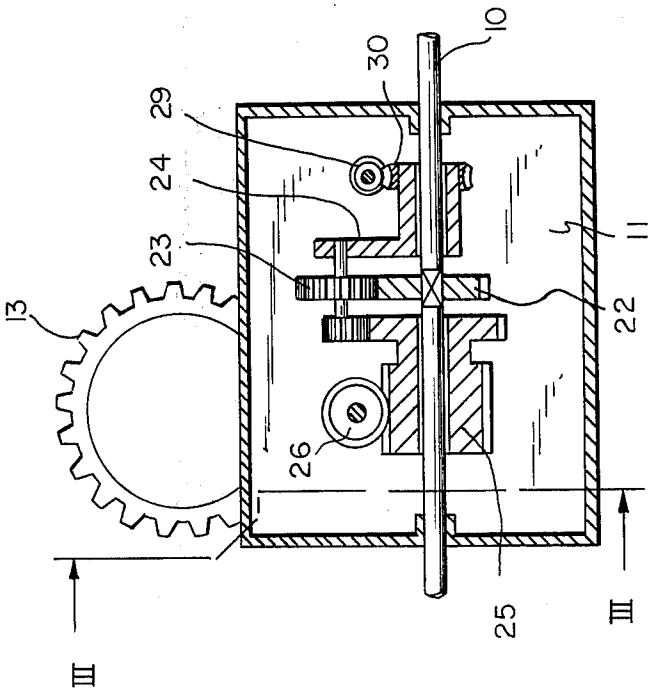


FIG. 2

PRINTING MACHINE

This is a continuation-in-part of application Ser. No. 293,171, filed Sept. 28, 1972, now abandoned.

BACKGROUND OF THE INVENTION

This invention relates to a device for use in printing machines for the printing of large overall patterns which are periodically repeated with the assistance of at least two rotating cylindrical printing members which for the purpose of temporary interruption of the printing process, required by the pattern, are each temporarily brought out of contact with the material to be printed.

At present in the printing of webs of material with the assistance of rotating printing members, it is usual to select the size of the circumference of the printing members to correspond to the total length of the overall repeated pattern. In the printing of large such patterns, this requires such large printing members that their use, because of the devices requisite for their production, is uneconomical.

SUMMARY OF THE INVENTION

It is an object of the invention to make possible the printing of large overall repeated patterns on webs of material with the assistance of printing members, the size of the circumference of each of which is smaller than and not an integral multiple of the total length of the overall pattern to be printed.

According to the invention this is obtained by operating each of the individual printing members during their individual printing periods and during their individual periods of interruption of contact with the web of material, at different angular velocities.

In this way it is possible to print on a web of material an overall pattern which is distributed over the peripheries of several printing members in continually recurring series, without the places, at which the parts of the pattern printed by the individual printing members coincide, appearing in the printing diagram.

According to the invention the rotary movement of the printing members, as soon as they are lifted out of contact with the web of material, have superimposed thereon an additional rotary movement, preferably in the same direction, the size of which is dependent on the structural design of the various rotating elements. Suitably, for the development of this additional rotation the main drive mechanism of the printing machine is provided as differential gearing (wherein the output speed is the difference between the two input speeds) or integrated gearing (wherein the output speed is the sum of the two input speeds). The additional rotation can be initiated by a suitable control device, for example a stepping motor.

The invention will be explained in more detail with reference to rotary screen printing machines without it being limited thereto, and with reference to the following detailed description taken with the accompanying drawings. The invention is usable on all printing machines with rotating cylindrical printing members as for example in roller printing, rotary intaglio printing, etc.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a longitudinal side view of a rotary screen printing machine with a device according to a first embodiment of the invention;

FIG. 2 is an enlarged view, partially in cross-section, of the gear box 11 of FIG. 1;

FIG. 3 is a cross-section taken along lines III—III in FIG. 2;

FIG. 4 is a longitudinal side view of a machine equipped with a device according to a second embodiment of the invention;

FIGS. 5 and 7 are partial cross-sectional views, similar to FIG. 3, but of the embodiment of FIG. 4; and

FIG. 6 is a cross-section taken along the lines VI—VI in FIG. 5.

DETAILED DESCRIPTION OF THE INVENTION

Each rotary screen 1 in FIG. 1 has a portion of the periphery thereof corresponding to sector 2 not perforated, but has at the remainder of the periphery thereof perforations corresponding to that portion of the overall pattern to be printed by each screen. In the drawings and in the description there are shown for purposes of clarity only two printing units, which at least must be present according to the invention, from a plurality of such printing units with which these machines can be equipped. Both printing units print the same color shade. Each of the rotary screens 1 have however only one part of the total overall pattern perforated on its peripheral surface, and the screens are alternately raised out of contact with the web of material 4 for the purpose of temporary interruption of printing by each screen, as required by the overall pattern. Such interruption can also be achieved by lowering the web of material to be printed, and the printing blanket 3 associated therewith. If one of the rotary screens 1 is lowered for the purpose of printing, then it is in contact with and rotates on the web of the material 4. The peripheral speed of the screen at such position is equal to the speed of travel of the web of material 4. The web 4 is adhered by means of a known device, not illustrated, to the printing blanket 3 for feeding of the web. The printing blanket 3 rotates about a forward guide roller 6 and a rearward guide roller 7. The latter guide roller 7 is generally constructed as a driving roller and draws the printing blanket 3 over the individual printing stations. The printing blanket 3 in turn drives the forward guide roller 6, which through a bevel wheel gear 8 and a universal joint shaft 9 rotates a main drive shaft 10. Main drive shaft 10 drives screen wheels or gears 13 fastened at the end of each rotary screen 1 through drive gearing 11 and screen drive wheels or gears 12, which wheels are essential in order to maintain the screens relative to one another in the same phase position. At the end of the main drive shaft 10 the rotary movement thereof is transferred through gearing 14 to a control shaft 15, such that (when two screens 1 are used) one complete revolution of the rotary screen 1, imparted thereto by shaft 10, drive gearing 11 and gear 12, corresponds to a half rotation of the control shaft 15. If three, four or n rotary screens are provided for the printing of a total overall pattern, then the ratio of the number of rotations between the control shaft 15 and the rotary screens 1 amounts respectively to 1:3, 1:4 or 1:n.

Shaft 15 has fixed thereon, for each rotary screen assembly, a cam 17 which rotates with shaft 15. The cam surface of each cam 17 is programmed such that, by contact with cam followers 19, each screen and screen support structure, including push rods 21 and guide rollers 18, is raised or lowered at precise times. The programming of the cam surfaces is such that for

each revolution of shaft **15**, each screen undergoes a complete cycle of raising and lowering. The precise times of raising and lowering are determined by the relative speeds of rotation of shaft **15** and screens **1** and by the relative sizes of the printing and non-printing portions of the screens.

Within the rotary screens **1** there are color application devices, not illustrated, for example a color reservoir with a scraper or roller squeegee.

The printing of a large overall pattern in accordance with the invention proceeds in the following manner:

As soon as the first rotary screen **1** with its perforated region rotates on the web of material **4** and has printed its portion of the overall pattern, it is then lifted upwardly by its cam **17** when its non-perforated sector **2** comes into contact with the web of material **4.** The web of material **4** remains unprinted over a succeeding portion thereof to be printed by the second screen. Briefly before the beginning of this unprinted portion of the web approaches a position directly under the second hitherto raised rotary screen, the second screen is then lowered by its cam **17,** whereby its rotary angular position is such that the beginning of its portion of the overall pattern, corresponding to its perforated sector, lines up exactly (as will be explained below) with the end of the first portion of the overall pattern printed by the first screen, thereby providing continuity of the overall pattern. The second screen rotates in contact with the web of material **4** and prints the second part of the total overall pattern. This raising and lowering of each of the screens is repeated for each full rotation of shaft **15.** While each of the rotary screens are in their raised condition and are being rotated at a speed corresponding to that of the web of material, an additional speed component is imparted thereto, in either the forward or backward directions, by a stepping motor **16** through an angle of rotation which will insure, that for a given number of rotations of each screen at the normal or lowered rotation speed, the screen will be additionally rotated such that the beginning of the printing portion of the screen is aligned at precisely that position where if lowered it will begin to print its respective partial portion of the overall pattern. That is, if the length of the overall pattern is not a whole multiple of the circumference of the screens, then as each screen rotates at its normal speed through a given number of whole revolutions and is then lowered, the beginning of the printing portion would not be in the proper position to begin its respective printing operation. To achieve this necessary alignment, when the screen is in its lifted position, an additional speed component is imparted thereto. It will be understood that the additional speed component may be in the same or in the reverse direction as the direction of the normal rotation. It will be further understood that the amount of the additional speed component will vary from installation to installation, dependent on the number and size of the screens and the length of the overall pattern.

So that such additional rotary movement can be transmitted to the rotary screen, the drive gearing **11** is constructed as a differential gearing (output speed being the difference between the two input speeds) or as integrated gearing (output speed being equal to the sum of the two input speeds). The raising or lowering is caused, as stated above, by the control shaft **15** and cams **17** mounted thereon. The cams **17,** through contact pieces **19** and push rods **20,** cause the entire support of each rotary screen and the respective squeegee device to be raised and then subsequently lowered when the support is raised, it contacts an upper position switch **21,** and actuates such switch which immediately starts stepping motor **16** (by an electrical connection which is not shown in the drawings). Stepping motor **16** for each screen causes additional screen rotation to be initiated, in a manner to be described below. It is necessary that the additional rotation be precisely controlled in all screens. In order to ensure this, there is provided a known type of control means such as a digital preselective counter which may be set to a desired number of steps to achieve the correct additional rotation and is actuated at the same time as the stepping motor. One known and commercially available digital counter device is the Decade Counter SN 7490 manufactured by Texas Instruments. When the counter (and the motor) has performed the preset number of steps, the counter stops the motor **16.**

The same reference numerals used in FIG. **1** are employed in FIGS. **2** and **3** which illustrate the manner in which stepping motor **16** imparts additional rotation to screen **1.** The drive gearing **11** with essential details is here illustrated in cross-section and vertical front elevation, respectively. A gear wheel **22** is fixedly connected to the main drive shaft **10.** This drives a pair of planetary spur gears **23** rotatably mounted in a planetary carrier **24.** If this planetary carrier **24** is held in a fixed position, i.e. when the screen **1** is lowered and stepping motor **16** is not actuated, the gear wheel **25,** which rotatably engages the main drive shaft **10,** is rotated and in turn drives a spiral gear **26** which through the shaft **27** drives the screen drive gear **12.** The screen drive gear **12** engages with the screen gear **13** and thus drives the rotary screen **1.** When the screen **1** is raised, the stepping motor **16** is activated by switch **21** as discussed above, and acts through the shaft **28** on a worm **29** which drives a spiral gear **30** which is rigidly connected with the planetary carrier **24.** If the rotary screen **1** is lowered and in the position for printing, then the stepping motor is not activated by switch **21,** and the planetary carrier **24** is held in a fixed position. All of the gearing operating to rotate screen **1** at the normal or lowered speed is selected and designed such that the peripheral speed of the rotary screen **1** is equal to the speed of travel of the web of material **4.** It will be understood that the depth of the teeth of gears **12** and **13** is such that when the screen is in the raised position, the gears **12** and **13** are still in meshing engagement.

On contact of the non-perforated sector of the periphery of the rotary screen **1** with the web of material, lifting of the total printing unit occurs, since cam **17** has been designed to achieve this purpose, and the raised rotary screen **1** is moved with greater angular speed. Specifically, stepping motor **16** causes rotation of the planetary carrier **24.** This causes additional rotary movement to be imparted to screen drive gear **12** through gears **23,** gear wheel **25,** and the spiral gear **26.** The direction of rotation of this superimposed additional rotary movement is dependent upon the direction of rotation of the stepping motor. Dependent upon the number of the preselected stepping commands operative to activate stepping motor **16** this additional rotation of the rotary screen **1** may be made to correspond to any desired angle necessary to insure that when the screen is lowered, the beginning of the printing portion is properly aligned to begin printing of its respective portion of the overall pattern.

In carrying out the present invention, it will be readily apparent that the amount of the additional speed component will vary from case to case, and will obviously depend upon the number and size of the screens and the length of the overall pattern.

With reference to the embodiment of FIG. **1**, and wherein there are two screens provided, when the additional rotation component is in the same direction as the normal rotation, then the total rotation of the screen during the lifted position must amount to the angle of the non-perforated sector **2**, plus an angle equal to the complete circumference of the screen. On the other hand, when the additional rotation component is in the opposite direction of the normal rotation, then the total rotation of the screen during the lifted position must be equal to the angle of the non-perforated sector **2**.

However, as stated above, the specific amount of the additional rotational component will vary dependent upon the dimensions and sizes of the given installation. A simple way for calculating the necessary amount of the additional rotation component for each installation is by using the formula:

$$k = iU - R$$

wherein k is the amount of additional movement, i is any whole number of screen rotations, U is the circumference of the cylinder, and R is the length of the total overall pattern. In selecting the value of i, it is desirable that the product of i times U be substantially near to the value of R. If the value of k is negative, then the additional rotary movement must take place in a direction opposite to the direction of the normal rotation. On the other hand, if k is positive, then the additional rotary movement must take place in the same direction as the normal rotation.

As a typical example if four screens each having a circumference of 64 cms. are used for printing an overall pattern having a total length of 200 cms., and if each cylinder has a printing portion of a circumferential length of 50 cms., it will be possible to design the installation such that each screen will perform only three revolutions during a given printing cycle, that is, while the web moves over a length of 200 cms. In this case, i in the above formula would equal 3 and the above formula will result in an additional rotational component of 8 cms. in a direction opposite to the direction of normal rotation.

It will be understood that various other means of imparting the additional rotary component may be employed, other than stepping motor **16**. Certain other such means will be described below with reference to FIGS. **4** through **7**.

In FIG. **4** the same reference numerals are used as in FIG. **1**. The drive of the drive gearing **11** is effected through gearing **31**, e.g. interchangeable gearing wherein varying rotational speeds may be achieved by changing the various gears of gearing **31**, such as would be necessary when changing to screens of differing size or printing periphery. The number of rotations of main drive shaft **10** however always remains in a constant ratio to that of the guide roller **6**. The number of rotations of an additional drive shaft **32** and likewise the number of rotations of the control shaft **15** can be adjusted by the interchangeable gearing **31**. The rotational speed of control shaft **15** is again so selected that, for example, on two rotations of the rotary screen **1**, one rotation of the control shaft **15** takes place. This is valid for a pattern, the total length of which is composed of the partial peripheries of two rotary screens. If three rotary screens are necessary for the total pattern length, then the control shaft **15**, during three rotations of a rotary screen makes one rotation, and so on. The number of rotations of the main drive shaft **10** and the additional drive shaft **32** are so adjusted that their ratio corresponds exactly to the ratio of the length of the engraved screen periphery to the unengraved screen periphery.

The following discussion will be with regard to one specific structural arrangement, including gear ratios. It is to be understood however, that the invention encompasses all other specific arrangements with differing gear ratios and numbers of screens, the specific design of which will be within the ability of those skilled in the art.

Thus for example, if 80% of each screen periphery has a printing portion and 20% of the screen periphery has no printing portion, then the ratio of number of rotations of the main drive shaft **10** to those of the additional drive shaft **32** is 4:1. The drive gearing arrangements are of the type described below in connection with FIGS. **5** and **6**. It is noted that two complete revolutions of screen **1** are obtained partly by the action of shaft **10** and partly by the action of shaft **32**, with the contribution of shaft **32** generally being much smaller than that of shaft **10**.

FIGS. **5** and **6** show cross-sections through a gearing arrangement or gear box of a machine according to FIG. **4**. Screen **1** is driven via gear **13** fixed to the end of the screen. This gear engages gear **12**, the ratio of number of teeth of gears **12** and **13** being **8** to **10**. Rotational movement is imparted to gear **12** via planetary carrier **33** and planet pinions **34** by rotation of bevel gear **36** which in turn is driven by shaft **10** via spiral gears **35** and **52**. Gear **12** performs one revolution for each two revolutions of bevel gear **36**, this being a known feature of planetary gearing with bevel gears as shown herein. Spiral gears **35** and **52** have the same number of teeth such that for each two revolutions of bevel gear **36** shaft **10** also performs two revolutions.

Thus, if the effect of shaft **32** is not transmitted to gear **12**, then gear **12** performs one revolution for each two revolutions of shaft **10**. Since the number of teeth of gear **12** is only 8/10 that of gear **13**, and since only 8/10 of the circumference of the screen has a printing portion, for each two revolutions of shaft **10** screen **1** is turned exactly over an angle which corresponds to circumferential printing portion thereof.

An additional rotary movement is imparted to the screen **1**, when the screen is lifted, by shaft **32** via bevel **38**, shaft **56**, gears **53** and **54** and spiral gears **39**. Gear ratios between spiral gears **39** as well as between spur gears **53** and **54** are 1:1. When the screen is lowered, bevel gear **38** is prevented from rotating by stop bolt **55** which is also lowered. The connection between screen **1** and bolt **55** is not shown in the drawings. However, bolt **55** is structurally connected to the screen or screen support to raise and lower therewith. On shaft **56** is fixed, not only bevel gear **38**, but also disc **46**. One or more bolts **47** are arranged in a circle on a face of disc **46**. If stop **55** is lowered, one of the bolts **47** abuts against this stop and shaft **56** is prevented from further rotation. Of course, in order to prevent damage to the elements, disc **46** is driven by disc **45** via interposed springs **50**. Disc **45** is provided at its periphery with

gear 54 which meshes with gear 53 which is driven by shaft 32 via spiral gears 39. Thus, if disc 46 is prevented from rotating by bolts 47 and stop 55, only disc 45 continues rotating and springs 50 are tensioned.

As described above, the rotational speed of shaft 32 is only one fourth of that of shaft 10. Thus, for each two revolutions of shaft 10, shaft 32 performs only half a revolution. Due to the gear ratios described above, disc 45 also performs half a revolution. Exactly during this time, i.e. during two revolutions of shaft 10, screen 1 was lowered on the web to be printed and, as described above, the 80% of its circumference comprising the printing portion has rotated on the web and printed thereon the pattern. In the meantime, disc 45 has made half a revolution and springs 50 have been tensioned. When its pattern has been printed, screen 1 and stop 55 are lifted by the action of shaft 15 and cam 17. Therefore, disc 46 will rotate freely under the influence of the tensioning springs 50 and disc 46 will catch up with disc 45 which had advanced in the meantime, until catch 51 of disc 45 contacts a further bolt on disc 46. The catch-up movement will amount to half a rotation of disc 46, this movement being in addition to the continued normal speed rotation of both discs 45 and 46. This half rotation of disc 46 and also of bevel gear 38 is reduced by the planetary gearing 33-38 to a quarter revolution of gear 12. This quarter revolution is added to the normal rotation caused by bevel gear 36 and shaft 10. This quarter revolution of gear 12 corresponds exactly to 1/5 revolution of gear 13 or to the 20% of the circumference of screen 1 having therein the non-printing portion.

When the screen 1 and stop 55 are lifted, bevel gears 38 and 36 turn in the same direction although at different speeds. Bevel gear 38 turns only at one fourth of the speed of bevel gear 36, i.e. if bevel gear 36 makes two revolutions, bevel gear 38 performs only half a revolution. Gear 12 therefore makes one complete revolution due to the rotation of bevel gear 36 and a quarter of a revolution due to the rotation of bevel gear 38. Thus, due to the combined action of both bevel gears 36 and 38, gear 12 performs 1.25 revolutions. This, in turn corresponds to exactly one complete revolution of gear 13 and screen 1.

Therefore, when screen 1 makes a total of two revolutions, 80% of the first revolution is performed when the screen is lowered and exclusively due to the shaft 10, while the movement of shaft 32 is stored in the storage device 45 and 46 such that the movement of shaft 32 is of no influence on the screen during the printing period. When the screen 1 is lifted the stored movement of shaft 32 is released, and thus the remaining 20% of the first rotation of the screen is immediately carried out during lifting of the screen. The second complete revolution of screen 1 takes place when the screen is lifted, and is achieved by the combined action of the movements of both shafts 10 and 32. It should be mentioned that the rotational speed imparted to the lowered screen by the sole action of shaft 10 is synchronized with the speed of the web to be printed. On the other hand, during lifting, the circumferential speed of the screen is considerably higher than the speed of the web, and when the screen is in the lifted position, the circumferential speed of the screen is 25% higher than the speed of the web.

FIG. 7 shows a further embodiment of a gearing arrangement or gear box. It comprises an automatic mechanical switch in the form of a Maltese cross mechanism. Gear 12 is connected to a planetary carrier 33 bearing planetary pinions 34. If the screen is lowered to its printing position, gear 12 is driven only by shaft 10 via spiral gears 35 and 52, bevel gear 36, planetary pinions 34 and planetary carrier 33. The circumferential speed of the screen is equal to the speed of advance of the web.

Subsequently, screen 1 is lifted by cam 17, rod 20, plate 41 and supports 42 and 43 immediately after the non-printing portion 2 of the screen has come in contact with the portion of the web not to be printed thereby. Immediately after the lifting movement has started, Maltese cross mechanism 37 imparts an additional movement to bevel gear 38 via spur gearing 57, 58, 59 and 60. Bevel gear 38 in turn drives gear 12 via planetary gears 34 and carrier 33. The Maltese cross mechanism 37 is activated exactly at the moment when the non-printing portion 2 of the screen faces the web. The Maltese cross mechanism 37 is driven by shaft 32 via spiral gears 39. It should be mentioned that shaft 32 has the same speed as shaft 15. For any one revolution of shafts 15 and 32 the Maltese cross mechanism 37 is activated once. One activation causes one fourth of a revolution of shaft 56 and will be transformed by gearings 57 to 60 to impart an additional rotation to the screen equal to twice the length of the non-printing section.

Thus, assuming the presence of two screens, during two revolutions of shaft 10, screen 1 undergoes two complete revolutions. The percentage of such revolutions corresponding to the percentage of the printing portion of the screen circumference are imparted by shaft 10 only. The remaining percentage of the two revolutions is imparted by shaft 32 and Maltese cross mechanism 37.

It will be understood that the scope of the present invention is not limited to the specific number and configuration of screens or the gear ratios discussed above. Rather, the scope of the present invention includes all modifications to the above specific configurations as set forth in the appended claims.

What is claimed is:

1. A printing machine for repeatedly printing relatively long overall patterns on a web of material, said machine comprising:

support means for continuously moving said web of material at a predetermined speed;

at least two printing units mounted on the side of said web of material opposite said support means, each of said printing units including a rotatably mounted cylindrical screen, each of said screens having on the periphery thereof a printing sector with leading and trailing edges in the direction of rotation for printing a separate portion of said overall pattern and a non-printing sector;

means operatively connected to each of said printing units to lower the screens thereof from a raised position into a lowered position in a predetermined sequence with the leading edge of each said printing sector in contact with said web of material for printing on said web of material the respective portions of said overall pattern when the respective printing sectors of said screens are rotatively aligned with said web of material, and for raising said screens out of contact with said web of material into said raised position after the trailing edge of each said printing sector has contacted said web of material;

first drive means operatively connected to each of said screens for continuously imparting a first rotary movement of said screens while said screens are in both said raised and lowered positions, said first rotary movement causing a circumferential rotation of each of said screens at a speed equal to said speed of said web of material; and

second drive means operatively connected to each of said screens for imparting a second rotary movement thereto, simultaneous to the application of said first rotary movement, each time said screens are in said raised position, and only when said screens are in said raised position, said second rotary movement being predetermined in accordance with system parameters including the size of said printing and non-printing sectors of said screens, the net of said first and second rotary movements when said screens are in said raised position being such that the leading edges of the printing sectors are in position to be engaged by said web when said screens are lowered by said means for raising and lowering.

2. A machine as claimed in claim **1,** wherein said second rotary movement is in the same direction of rotation as said first rotary movement.

3. A machine as claimed in claim **1,** wherein said second rotary movement is in a direction opposite to the direction of rotation of said first rotary movement.

4. A machine as claimed in claim **1,** wherein said first drive means comprises a main drive shaft rotatably mounted and extending longitudinally of said machine, and drive gearing means operatively interconnected between each of said screens and said main drive shaft for transferring rotation of said main drive shaft to said screens.

5. A machine as claimed in claim **4,** wherein said second drive means comprises an intermittently operable stepping motor operatively connected to each of said drive gearing means of each of said screens.

6. A machine as claimed in claim **4,** wherein said second drive means comprises an additional drive shaft operatively rotatably connected to said main drive shaft and extending longitudinally of said machine, and Geneva wheel mechanisms operatively connecting said additional drive shaft with said drive gearing means of each of said screens.

7. A machine as claimed in claim **6,** wherein said main drive shaft and said additional drive shaft are driven by gearing means for providing predetermined changeable speed ratios between the rotational speed of said main drive shaft and said additional drive shaft.

8. A machine as claimed in claim **4,** wherein said second drive means comprises an additional drive shaft operatively rotatably connected to said main drive shaft and extending longitudinally of said machine, and a rotary movement storage means operatively connecting said additional drive shaft with said drive gearing means of each of said screens for storing movement of said additional drive shaft when said screens are in said lowered position and transferring the thus stored movement to said screens when said screens are in said raised position.

9. A machine as claimed in claim **8,** wherein said main drive shaft and said additional drive shaft are driven by gearing means for providing predetermined changeable speed ratios between the rotational speed of said main drive shaft and said additional drive shaft.

10. A machine as claimed in claim **4,** wherein said means to lower and raise said screens comprises a control shaft operatively rotatably connected to said main drive shaft and extending longitudinally of said machine, and cam means connected to said control shaft and operatively engaged with said printing units for sequential raising and lowering contact therewith.

11. A machine as claimed in claim **10,** further comprising gearing means interconnecting said main drive shaft and said control shaft for providing a ratio between the rotational speeds of said control shaft to said main drive shaft corresponding to $1:n$, wherein n equals the number of said screens.

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