Dec. 6, 1955 R. L. FRIEL ET AL 2,726,174

SPOT CARBON PRINTING MACHINE

Filed July 19, 1952 3 Sheets-Sheet 1

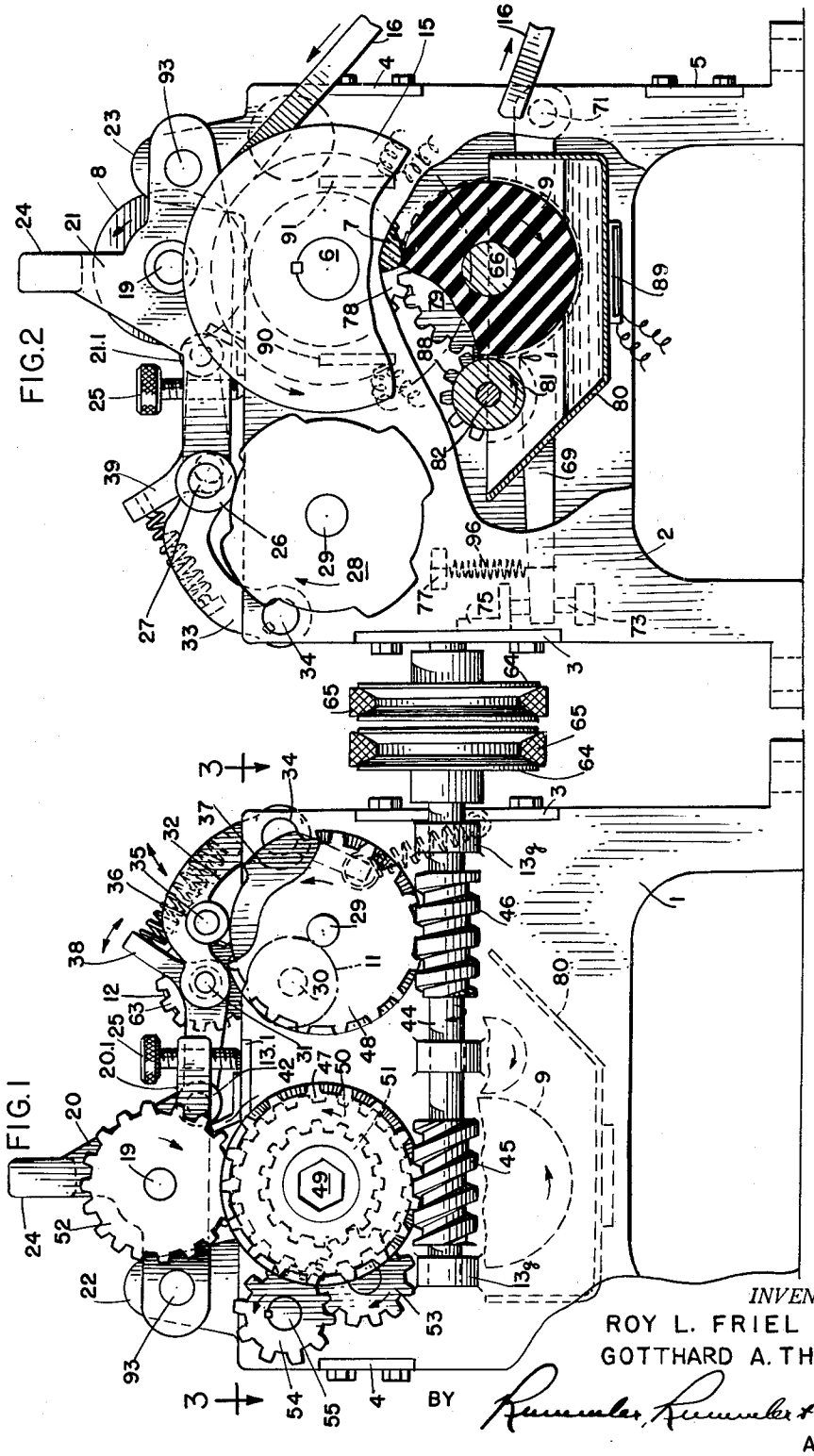


FIG. 2

FIG. 1

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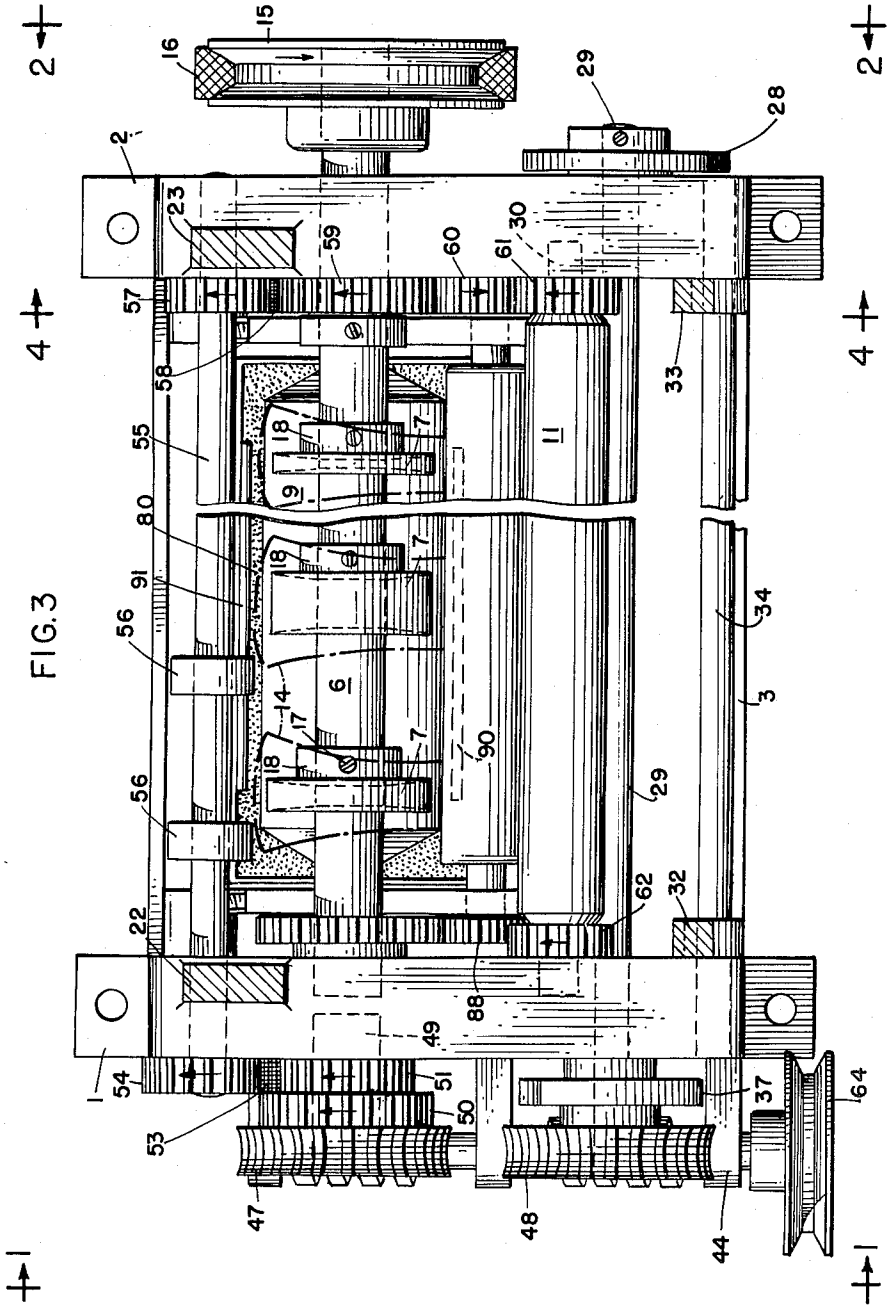


FIG. 3

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SPOT CARBON PRINTING MACHINE

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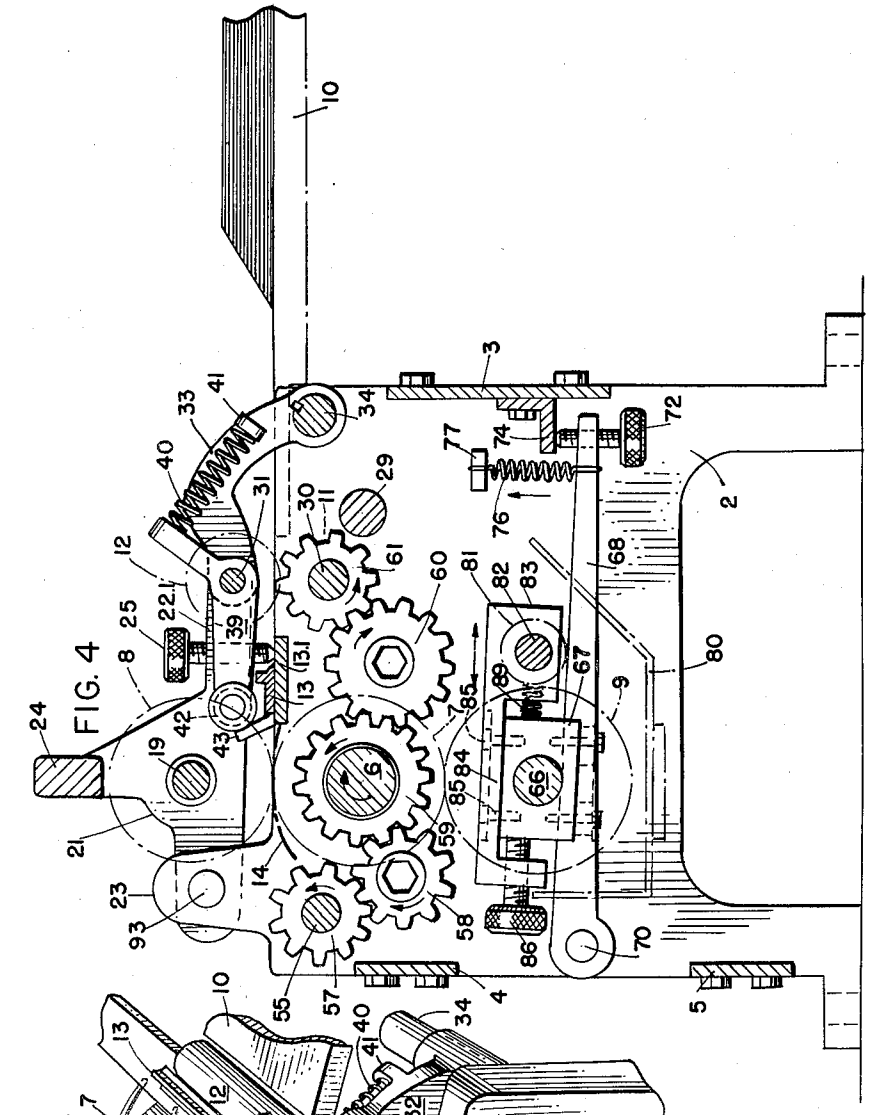


FIG. 4

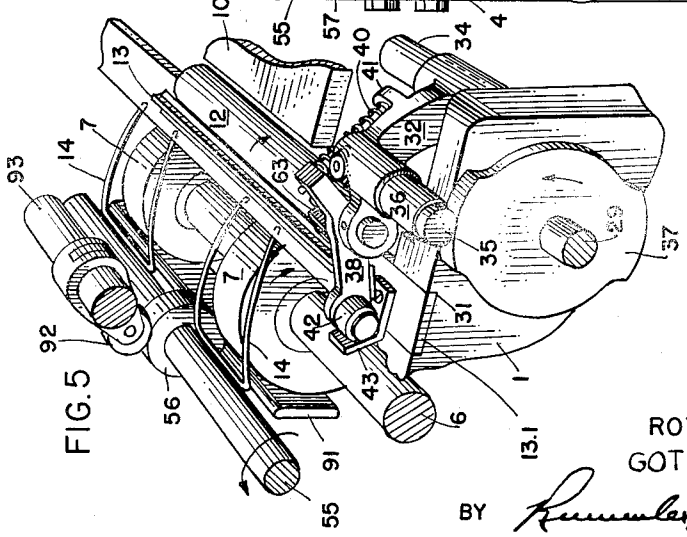


FIG. 5

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2,726,174

SPOT CARBON PRINTING MACHINE

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Application July 19, 1952, Serial No. 299,892

10 Claims. (Cl. 117—111)

This invention relates to carbon printing machines and particularly to improvements in spot carbon printing machines employing rotary printing elements and capable of operation on either individual sheets or a continuously moving web.

The main objects of this invention are to provide an improved carbon printing or coating machine for applying a carbon taransfer material onto a sheet or a continuously moving web of paper or other suitable carrier material; to provide such a machine of simplified construction and capable of either continuous or intermittent printing operations; to provide an improved spot carbon printing machine capable of rapid and easy adjustment to apply a coating of carbon transfer material over any predetermined area of the sheet or web to be imprinted; to provide such a machine capable of automatic operation for imprinting carbon spots of various size and spacing, in the direction of paper travel, in any predetermined sequence of size and spacing; and to provide such a machine capable of carbon printing on substantially any practical thickness or weight of sheet or web material.

Further objects of this invention are to provide a spot carbon printing machine capable of applying a coating of carbon transfer material of uniform density and predetermined thickness onto substantially any type of sheet or web material surface; to provide such a device which will apply a uniform coating of carbon transfer material onto the surface of a carrier medium without leaving beads or ridges of the coating material at the edges of the coated areas; to provide such a machine capable of printing carbon spots of varying lengths without change or adjustment of the printing roll; to provide such a device wherein the sequence of various size carbon spots can be quickly and easily adjusted and controlled; to provide such a machine in which carbon spots of any predetermined size and of varying lengths may be imprinted on a moving sheet or web automaticaly in precise registry with printed matter carried by the sheet or web; and to provide an improved method of applying a coating of carbon transfer material onto a moving sheet or web whereby a coating of uniform density and substantially any practical predetermined thickness may be obtained.

A specific embodiment of this invention is shown in the accompanying drawings in which:

Figure 1 is an end view in elevation of the improved spot carbon printing machine showing the drive for the paper feed rolls and the paper feed control cam, the parts being shown in sheet feeding and printing position.

Fig. 2 is a similar view in elevation showing the opposite end of the machine with parts broken away to show the arrangement of the inking roll and the ink reservoir and also showing the drive for the printing roll.

Fig. 3 is a top plan view of the spot carbon printing machine, as on line 3—3 of Fig. 1, with the upper feed roll, the impression roll, and the supporting arms therefor removed to show the roll driving mechanism.

Fig. 4 is a sectional elevational view of the machine, as on line 4—4 of Fig. 3, showing the adjustable mounting

of the inking roll and ink reservoir, and the gear train for transmitting power to the sheet feeding rolls, and

Fig. 5 is a fragmentary perspective view of the upper left-hand corner of the machine as viewed from the side shown in Fig. 1 and in the general direction of paper travel, the operating parts being shown in non-feeding position.

In the form shown in the drawings the improved spot carbon printing machine comprises a unitary frame structure, having vertical end members 1 and 2, suitably connected by rigid transverse tie plates 3, 4 and 5, on which the entire operating mechanism of the machine is mounted. The printing roll shaft 6, extends horizontally between the end members 1 and 2, at the upper rear portion of the machine, and this shaft carries one or more printing rolls 7 which are of uniform diameter and of a width equal to the width of the area, transversely of the sheet, to be carbon coated. A vertically movable impression roll 8 is mounted directly above the printing rolls, and parallel therewith, and an inkling roll 9, together with a suitable carbon ink reservoir, is disposed directly below the printing rolls.

The paper feed mechanism is mounted at the upper front portion of the frame structure and includes a table 10, disposed with its top surface substantially in the plane of the upper surfaces of the printing rolls, feeding rollers 11 and 12, a gate 13 for regulating the paper feed, and a plurality of resilient guide fingers 14 which normally support the paper sheets above and out of contact with the printing rolls as the sheets pass through the machine.

Spot carbon printing is accomplished by intermittently moving the impression roll 8 toward and away from the printing rolls 7, so as to cause the paper sheet to engage and disengage the inked surface of the printing rolls, and this operation of the impression roll is timed with the movement of the paper through the machine to determine the length of the printed area and the location of the printed area with respect to the leading edge of the sheet. The location of the printed areas transversely of the sheet is determined by the axial spacing of the printing rolls 7 along the shaft 6.

The impression roll is normally held in raised position so that sheets fed through the machine by the feeding mechanism are held out of contact with the printing rolls by the resilient guide fingers 14 and printing occurs only when and while the impression roll is lowered to press the sheet toward the printing rolls. Thus by merely raising and lowering the impression roll in timed relation to the paper movement the length and location of the carbon printed areas on the sheet may be accurately determined and varied. As shown, all of the rotating elements of the improved machine are positively driven, by suitable drive mechanism which will be hereafter described, and thus all operational factors which influence the final result may be precisely adjusted and controlled.

Three features of the construction and operation of the improved machine are of particular novelty and importance in the improvement in the spot carbon printing art that the present invention affords. The first of these features is that the printing members or rolls are driven in the opposite direction from that of the paper travel; and at a greater lineal speed than the paper so that the carbon ink material is not only applied with more uniform density but is also given a burnishing action which fills out any porosity or irregularity of the paper surface and provides a harder, quicker drying coating.

The second feature resides in the arrangement and operation of the impression roll whereby its movement toward the printing rolls is regulated to move the paper sheet only so far as to engage the ink carried by the printing rolls, and without pressure, so that the coating

material is transferred to the paper with a wiping, or brushing action. And the third feature is an improved arrangement and operation of the inking roll whereby an ink coating of regulated thickness and uniformity is applied to the printing rolls for transfer to the sheet areas to be printed.

The improved method of spot carbon printing which the present machine is designed to perform, consists in moving a traveling sheet or web into brushing engagement with a layer of fluid carbon transfer material of predetermined thickness carried on the surface of rotating printing member which is turning, on an axis parallel with the surface to be printed, so that its peripheral surface adjacent the sheet or web is moving in the opposite direction than the sheet or web travel.

As shown in the drawings, and particularly in Fig. 3, the printing roll shaft **6** is removably journaled in suitable bearings, not shown, in the frame members **1** and **2**, and the shaft extends through the frame member **2** where, on its outboard end, it carries a drive pulley **15** which is driven by a belt **16** from a suitable motor, not shown. The printing rolls **7**, which are of uniform diameter but may be of any desired width, are removably and slidably mounted on the shaft **6**, and each printing roll is suitably secured to the shaft **6** as by a set screw **17** threaded in a collar **18** integral on the printing roll.

As shown in Figs. 1, 2 and 4, the impression roll **8** is carried by a shaft **19** which extends between and is journaled in horizontal bracket arms **20** and **21**, which in turn are pivotally mounted on and extend forwardly from supporting lugs or ears **22** and **23** integral with and project upwardly from the rearward portions of the frame end members **1** and **2** respectively. The pivot connections of the bracket arms **20** and **21** with the ears **22** and **23**, are located rearwardly of the axis of the impression roll shaft **19** so that the impression roll is vertically movable or swingable toward and away from the printing roll. Also, the bracket arms **20** and **21** are rigidly connected by an integral crossbar **24**, which extends above and parallel with the impression roll **8**, so that upon any movement of the bracket arms the axis of the impression roll shaft **19** will always be parallel with the axis of the printing roll shaft **6**. As shown, each of the bracket arms **20** and **21** has a forwardly extending portion **20.1** and **21.1**, respectively, in which an adjusting screw **25** is threaded for engagement with the upper surface of the respective frame end members for adjustably limiting the downward movement of the impression roll **8** toward the printing rolls **7**.

As shown in Fig. 2, the bracket arm extension **21.1** is longer than the extension **20.1**, and carries a laterally projecting cam follower **26**, rotatably mounted on a stub shaft **27**, which cam follower extends outwardly from the machine to engage a cam **28** mounted on one end of and driven by a cross shaft **29** extending beyond each end of the machine and suitably journaled in the frame members **1** and **2**. The cam **28**, through its engagement with the cam follower **26** on the bracket arm extension **21.1**, raises and lowers the impression roll **8**, and by suitable design and angular arrangement of the cam lobes, the movement of the impression roll towards and away from the printing rolls can be precisely controlled.

The lower feed roll **11** is mounted on a shaft **30**, which extends between and is journaled in the frame end members, and is disposed so that its peripheral surface will be substantially tangential with the upper surface of a feed table **10**, shown in broken lines in Fig. 4, adjacent the forward part of the machine. The upper feed roller **12** is mounted on a shaft **31** disposed vertically above and parallel with the lower feed roller shaft **30**, and the shaft **31** is journaled in suitable bearings at the rearward ends of upwardly and backwardly extending pivot arms **32** and **33** which have their forward ends secured fast to a rock shaft **34** extending between and journaled in the frame end members **1** and **2** at the upper front corners thereof. As shown in Figs. 1 and 5, the pivot arm **32** is provided with an outwardly projecting stub-shaft **35** extending parallel with the axis of the rock-shaft **34** and carrying a roller **36** disposed for engagement with the periphery of a radial cam **37** having angularly spaced lobes and mounted fast on the projecting portion of the shaft **29** at the left-hand side of the machine. Thus, upon rotation of the cam **37**, and through its engagement with the roller **36**, the pivot arm **32** is caused to oscillate intermittently about the axis of the rock-shaft **34**, and since both pivot arms **32** and **33** are fast on the rock shaft, the upper feed roller **12** is caused to move up and down relative to the lower feed roller **11**.

The pivot arms **32** and **33** also carry bell cranks **38** and **39** respectively which are pivotally mounted on the upper feed roller shaft **31** adjacent the pivot arms, and each of these bell cranks has a rearwardly extending arm attached to the gate **13**. The other arm of each bell crank extends upwardly and forwardly from the axis of the shaft **31** and is acted upon by a compression spring **40** which bears between the upwardly projecting arm and a lug **41** on the respective pivot arm so as to normally urge the bell crank to rotate in the rearward direction to press the gate **13** against the upper surface of a support plate 13.1 which is located between the feed rolls and the printing roll.

The bell cranks **38** and **39** function to lift the gate **13**, from the support plate 13.1, when the upper feed roller **12** is lowered to feeding position by the pivot arms **32** and **33** under the action of the cam **37**, and the operation is accomplished by providing a roller bearing **42**, on each rock arm **38** and **39**, and a pair of rearwardly and upwardly inclined tracks **43** with which the respective bearings **42** are engaged. As indicated in Figs. 4 and 5, the axis of the bearings **42** is normally at a lower elevation than the shaft **31** on which the bell cranks are pivoted, and thus upon lowering of the shaft **31** to bring the upper feed roller **12** into engagement with the sheet to be fed through the machine, the bearings **42** are forced to ride upwardly along the tracks **43** so as to lift the gate **13** and permit the sheet to pass under the gate and between the printing roll **7** and the impression roll **8**. Conversely lifting of the upper feed roller **12** and its shaft **31** will cause the bearings **42** to move downwardly on the tracks **43** and close the gate **13**, this last movement being actuated by the compression springs **40**.

The drive for the cam shaft **29**, the upper and lower feed rollers **11** and **12**, and the impression roll **8**, is shown in Figs. 1, 3, and 4, and comprises a main drive shaft **44** mounted in suitable bearings along the outer side of the frame end member **1**. The shaft **44** extends horizontally in the fore and aft direction of the machine and carries a pair of worms **45** and **46** which mesh with worm gears **47** and **48** respectively. The worm gear **47** is journaled on a fixed stub-shaft **49** extending outwardly from the frame end member **1**, and is axially aligned with and directly connected to a pair of spur gears **50** and **51**. The spur gear **50** meshes with a gear **52** fast on the impression roll shaft **19** and thereby drives the impression roll; and the spur gear **51** meshes with an idler gear **53** which in turn drives a gear **54** fast on a cross shaft **55**, which extends between and is journaled in the frame end members **1** and **2**.

As shown, the cross shaft **55** also carries a plurality of take-out rollers **56** which are in the same plane, and of the same size, as the lower feed roller **11**. The take-out rollers **56** transport the printed sheets after they have passed between the printing roll and the impression roll.

The cross shaft **55** carries a gear **57** mounted fast on the shaft at the inner side of the frame end member **2**, and as shown in Fig. 4, this gear drives an idler

gear 58 which in turn meshes with a gear 59 rotatably journaled on the printing roll shaft 6. The gear 59 in turn drives an idler gear 60 which is meshed with a gear 61 mounted fast on the shaft 30 of the lower feed roll 11. The idler gears 58 and 60 are journaled and secured on suitable stub-shafts fixedly mounted on and extending inwardly from the frame end member 2, and their purpose is merely to transfer the drive from the gear 57 on the cross shaft 55 to the gear 59 and thence to the gear 61 on the feed roller shaft 30 so that the shafts 55 and 30 will turn in the same direction and at the same speed. The upper feed roller 12 is driven directly from the lower feed roller 11 by means of a gear 62, located at the opposite end of the lower feed roller shaft 30, which meshes with a life gear 63 mounted fast on the upper feed roller shaft 31.

The main drive shaft 44 is provided with a pulley 64 at its front end driven by a belt 65 from a suitable power source, not shown, and the drive train from the shaft 44 to the feed rollers is thus positive and at a speed determined directly by the speed of the power source. The drive for the impression roll is taken directly from the worm gear 47 through the spur gear 50 to the gear 52 mounted on the impression roll shaft 19. The impression roll speed is thus directly related to the feed roller speed so that the peripheral speed of these rolls will always be the same.

As before-mentioned both the impression roll 8 and the upper feed roll 12 are movable vertically, and in order to maintain driving connection between the impression roll drive gears 50 and 52 and the feed roll drive gears 62 and 63, when the impression roll and the upper feed roll are in raised position, these gears are made with deep cut teeth sufficient to permit limited radial movement of one gear away from the other without the teeth of the meshing gears becoming disengaged. In this manner the movable rollers may be operated by the cams 28 and 37 and yet at all times be directly and positively driven.

The cam shaft 29, on which the cams 28 and 37 are mounted, is driven by the worm 46 on the main drive shaft 44 through the medium of the worm gear 48 which is mounted fast on the outwardly projecting end of the cam shaft 29 on the outer side of the cam 37. Thus the operation of the upper feed roller 12 and the impression roll 8 may be precisely timed with respect to each other and according to the speed at which the sheet to be printed is fed through the machine. The lobes of the feed roll cam 37 are angularly spaced to permit lowering of the upper feed roller 12 and raising of the gate 13 at the time that a sheet to be printed is to be fed through the machine, and thus the angular spacing of the lobes on this cam may be uniform and the angular distance between the lobes will be in accordance with the length of the sheet to be printed and the rate at which the sheet to be printed is fed. This operation of the feeding roll and the gate is substantially the same as that employed in hand fed perforating machines and is well-known in that art.

The cam 28, however, which operates the impression roll must be specially designed for each pattern of spot carbon printing that is desired, since printing occurs only when the impression roll is in its lowered position. Thus the angular length of each lobe on the cam 28 will be in accordance with the distance between the carbon spots lengthwise of the sheet being printed, and the angular spacing between successive lobes will be in accordance with the length of the printed spot in the direction of sheet travel. Also, the angular position of the impression roll cam 28 relative to the feeding roll cam 37 must be precisely set in accordance with the spacing that the printed carbon spots are to have relative to the leading edge of the sheet being printed.

As shown in Figs. 2 and 4, the inking roll 9 is mounted on a shaft 66 which is journaled adjacent its ends in bearing blocks 67. These bearing blocks are mounted on respective pivoted carrier arms 68 and 69, mounted on and extending forwardly from fixed stub-shafts 70 and 71 which project inwardly from the frame end members 2 and 1 respectively at the rearward side of the machine. The bearing blocks are located on the arms 68 and 69 so as to position the shaft 66 directly below the print roll shaft 6 and the carrier arms are arranged to swing vertically to adjust the distance or spacing of the surface of the inking roll 9 with respect to the surfaces of the print rolls 7. This vertical adjustment of the inking roll 9 is obtained by means of thumb screws 72 and 73, which are threaded vertically through the forward ends of the pivoted arms and engage fixed brackets 74 and 75 secured at the forward side of the machine, the arms 68 and 69 being held and continuously urged in the upward direction by means of springs 76 which are connected between the forward ends of the arms and suitable attaching lugs 77 on the frame end members. Thus, by adjustment of the thumb screws 72 and 73, the inking roll 9 can be precisely set with respect to the surfaces of the printing rolls 7 to supply ink to the printing rolls at the desired rate and with the desired thickness.

As shown in Figs. 2 and 3, the inking roll 9 is driven directly from the print roll shaft 6 by means of a spur gear 78 mounted fast on the print roll shaft near the end adjacent the frame end member 1, which gear is meshed with a gear 79 mounted fast on the inking roll shaft 66. The gears 78 and 79 are also provided with deep cut teeth to permit limited movement of the gears toward and away from each other while maintaining a positive driving connection between the gears.

An ink reservoir 80, in which the inking roll 9 runs to transfer ink to the printing rolls, is removably mounted on and suspended between the pivot arms 68 and 69, by suitable means, not shown, and an ink gaging roller 81 is mounted parallel with the inking roll 9 on the side thereof which is lifting ink from the reservoir 80. The ink gaging roll limits the amount of ink lifted from the reservoir by the inking roll and determines the thickness of the ink layer on the inking roll which is carried to the periphery of the printing rolls.

As shown in Figs. 2 and 4, the gaging roll 81 is mounted on a shaft 82 which is journaled at its ends in shiftable bearing blocks 83 carried by the bearing blocks 67. Each of the bearing blocks 83 depends from a rearwardly extending arm 84 which rests on top of the respective bearing blocks 67 and which is slidably secured thereto by bolts 85 which extend through a vertical T-slot in the arm 84, and each arm 84 at its rearward end has a depending portion through which an adjusting screw 86 is threaded to engage the rearward side of the respective bearing block 67. Each slidable bearing block 83 is normally urged in a forward direction, relative to the respective bearing block 67, by means of a compression spring 87 disposed between the rearward face of the block 83 and the forward face of the block 67. Thus by adjustment of the screw 86 the bearing block 83 can be shifted horizontally relative to the bearing block 67 to vary the lateral spacing of the gaging roll 81 and the ink roll 9.

The gaging roll shaft 82 is directly driven by the inking roll shaft 66 through a gear 88 fast on the shaft 82 and meshed with the inking roller gear 79. Thus, the gaging roll 81 and the inking roll 9 turn together in opposite direction so that the gaging roll 81 will act to remove excess ink from the surface of the ink roll 9 as it lifts from the ink supply contained in the reservoir 80. The lateral spacing of the gaging roll from the ink roll, as set by the adjusting screw 86, determines the quantity of ink transferred by the inking roll to the printing rolls 7.

As will be understood by those skilled in this art, the carbon transfer material used for carbon printing machines is substantially a solid at normal room temperatures, and must be heated when used in order to have

the proper fluid characteristic for the printing operation. Thus the ink reservoir must be heated and the ink transfer and printing rolls must be kept warm. For this purpose an electric heater **89** is mounted on the bottom of the ink reservoir **80** and suitable radiant heaters **90** and **91** are suitably suspended in the machine on either side of the printing rolls. This is a common and well-known expedient for heating purposes.

Preferably the temperature of the ink reservoir is kept at 200 to 250 degrees in order to provide sufficient fluidity for the ink, and the printing rolls are warmed by the heaters **90** and **91** to substantially the same temperature so that the ink will be maintained in the desired fluid condition until it is laid on the sheet or web to be printed. In the present apparatus, the ink solidifies almost instantly upon contacting the cold surface of the sheet or web being printed, and hence cooling rolls for the printed sheet are not necessary.

In the operation of the improved machine, the feeding rolls, take-out rolls, and the impression roll are driven at the same constant speed by means of the pulley **64**, and the printing rolls are driven independently and preferably at a greater speed, by means of the pulley **15**. The direction of rotation of the feeding rolls and the impression roll is the same as that of the sheet or web traveling through the machine, and the sheet or web is driven through the machine, between the impression rolls and printing rolls, by means of the forward feed rolls **11** and **12**. The direction of rotation of the printing rolls is opposite to the direction of movement of the sheet or web being printed, and thus the printing surfaces of the printing rolls are moving against the sheet travel and the carbon ink is driven onto the surface of the sheet being printed with substantially a brushing action, at a relatively high speed with respect to the speed of sheet travel.

The quantity of ink applied to the sheet being printed is determined by the adjustment of the inking roll **9** with respect to the surface of the printing rolls and by the adjustment of the inking gaging roll **81** with respect to the surface of the inking roll **9**. The adjustment of the gaging roll **81** determines the thickness of the ink layer carried on the surface of the inking roll **9** as it travels toward the print roll surfaces, and the adjustment of the inking roll **9** relative to the printing roll determines the thickness or amount of ink which is carried by the printing rolls **7** for application to the sheets or web being printed.

It will be understood that the adjustment of the inking roll and of the gaging roll together with the speed of rotation of the printing rolls may be varied according to the nature of the surface of the sheet or web being printed, and according to the weight or density of the ink layer desired in the carbon printed areas. The printing rolls are therefore preferably driven by a variable speed drive or motor so that their speed of rotation can be quickly and easily adjusted to suit the particular needs of the printing job to be done. Variation of the printing roll speed is one means by which the character of the printed spots or coating applied to the sheets or web can be adjusted. The adjustment of the inking roll and of the gaging roll is another factor by which the character of the printed area is controlled and such adjustment is accomplished by means of the adjusting screws **72** and **86** as before described.

Initiation of the paper feed is controlled by the feeding cam **37**, which, upon lowering the upper feed roll **12** and simultaneously raising the gate **13**, causes the feed rolls **11** and **12** to cooperate to drive the sheet over the spring fingers **14** and between the printing roll and the impression roll. This drive of the sheet to be printed is positive and direct, and the speed at which the sheet is fed is sufficient to carry the sheet entirely through the machine, regardless of the thickness or weight of the sheet, even though there may be a printing operation at the rearward end of the sheet after it has left the feed rolls. The take-out rolls **56** serve to deliver the printed sheet and, if desired, cooperating spring loaded rollers **92**, mounted on a cross rod **93** extending between the ears **22** and **23**, may be provided as shown in Fig. 5, to facilitate straight line sheet delivery.

The spring fingers **14**, which are mounted on and extend forwardly from the support plate **13.1**, normally hold the sheet above and out of contact with the printing rolls **7**, and printing occurs only when the impression roll **8** is lowered to press the sheet, against the resistance of the spring fingers **14**, into engagement with the ink layer carried on the surfaces of the printing rolls. Operation of the impression roll **8** is accomplished by means of the cam **28** which lifts the impression roll by means of the pivot arms **20** and **21** when printing is not desired and lowers the impression roll at the time printing is desired. The limit stops or screws **25** determine the extent of downward movement of the impression roll and, by adjustment, accommodate various sheet thicknesses without causing pressure against the printing rolls. The width of the printed area is determined by the width of the respective printing roll and the length of the printed area is determined by the time, in relation to sheet travel, that the impression roll is a its lowered positions. Thus by variation of the lobes of the radial cam **28** the printed spots or areas may belong or short and of any desired spacing in the direction of sheet travel.

In accordance with our improved method of spot carbon printing, the sheet to be printed is brought into brushing contact only with the ink layer carried by the printing rolls; and the relatively high speed brushing action in the reverse direction of sheet travel, without pressure, produces the greatly improved result which we obtain in continuous high speed spot carbon printing operations. By this method the carbon ink material is laid on the sheet surface with a uniform density and thickness throughout the entire printed area, regardless of its size, and the ink material is driven onto the surface of the printed sheet so that uniformity of density is maintained regardless of the nature of the sheet surface. Also, the ink layer applied to the sheet is burnished by the printing action so that a smooth, quality appearance is had and bubbles, blisters, or edge beading, so common in pressure printing operations, is completely obviated.

The material for all of the rolls, except the inking roll, is preferably polished steel. The inking roll, however, is made of rubber, or has a rubber inking surface, as such material has been found to be the best carrier for the ink, in its highly fluid state, to obtain a uniform coating of the printing rolls.

It will be understood that although a mechanical cam system has been herein shown and described for operation and control of the feeding means and the impression member, these components of the machine may be actuated and controlled electrically, as by solenoids and commutators, and that if desired the actuation of the impression roll may be controlled by an electric eye to obtain automatic registry of the printed spots with other printed matter previously applied to the sheets. The method and means for actuating and controlling the feed and impression roll operations are not a part of the present invention and therefore other means, than the mechanical one shown, have not been herein shown and described.

The main advantages of this invention reside in simplified construction and operation of the improved machine whereby high quality, high speed, spot carbon printing may be done on either a continuous or job-lot basis without the costly and tedious set-up and warm-up procedures heretofore required; and in the simple construction of the machine which permits its manufacture and sale at a greatly less cost than the machines heretofore available for the same kind of work.

Other advantages are to be found in the compact arrangement of the machine whereby a spot carbon printing apparatus of greatly reduced size is provided for high quality work; and in the fact that the machine can be

quickly adjusted and set up for various printing patterns with a minimum loss of operating time.

Although but one specific embodiment of this invention is herein shown and described it will be understood that numerous details of the construction shown may be altered or omitted without departing from the spirit of the invention as defined by the following claims.

We claim:

1. The method of applying a coating of carbon-transfer material onto the surface of a carrier sheet which consists in brushing the sheet surface with a continuously moving film of the coating material while supporting the sheet independently of the film so that it has substantially no pressure contact therewith in the direction normal to the sheet surface, and while moving the sheet in the direction opposite the movement of the coating material film and at a constant speed.

2. The method of coating the surface of a carrier sheet with carbon transfer material which consists in brushing the sheet surface with a rotating annular fluid film of the coating material turning about an axis parallel with the said sheet surface while supporting the sheet independently of the film so that it has substantially no pressure contact therewith in the direction normal to the sheet surface, and while moving the sheet at a constant speed less than the speed of film movement and in the direction opposite the direction of film movement at the plane of sheet and film engagement.

3. The method of coating the surface of a carrier sheet with a uniform thickness of heat softened normally solid coating material which consists in brushing the sheet surface with an annular fluid film of melted coating material supported on the surface of a rotating carrier while moving the sheet at a constant speed in the direction opposite the direction of film movement at the plane of sheet and film engagement, and maintain a constant predetermined spacing between the film carrier surface and the sheet surface so that there is substantially no radial pressure engagement of the sheet with the film.

4. The method of coating the surface of a carrier sheet which consists in forming a uniformly thick fluid film of the coating material on the peripheral surface of a rotating annular member, moving the carrier sheet at a constant speed across the surface of the rotating member in the direction normal to the axis thereof and opposite the direction of rotation, and simultaneously supporting the moving sheet at a predetermined distance from said rotating member while slidably engaging the adjacent sheet surface with said film and so that there is substantially no pressure between the sheet and film radially of the rotating member.

5. The method of spot coating the surface of a carrier sheet which consists in forming a fluid film of the coating material on the peripheral surface of a rotating annular member, moving the carrier sheet at a constant speed across the surface of the rotating member in the direction opposite the direction of rotation thereof and in a predetermined spaced relation therewith, intermittently shifting the moving sheet toward said rotating member for momentary brushing engagement of the adjacent sheet surface with said film, and, varying the period of engagement of the moving sheet and film according to the lengths of the sheet areas to be coated and in accordance with a predetermined repetitive pattern.

6. A sheet coating machine comprising an annular rotatable coating member, means for forming a fluid film of coating material on the periphery of said coating member, feeding means for transporting a sheet to be coated at a constant speed across the surface of said coating member, means for normally supporting said sheet in radially spaced relation with said coating member, shiftable means for urging the moving sheet toward the coating member and into brushing surface contact with the fluid film thereon and with substantially no pressure between the sheet and film radially of the coating member, and means for rotating said coating member in the direction opposite the movement of said sheet and at a greater speed than the speed of said sheet.

7. A spot coating machine comprising a rotatable annular coating member, means for forming a fluid film of coating material on the periphery of said coating member, feeding means for driving a sheet to be coated across the surface of said coating member, yieldable means for normally supporting the sheet in radially spaced relation with said coating member, shiftable means operable for pressing the sheet toward said coating member into sliding contact with the fluid film thereon and for releasing the sheet from engagement with the film, means for rotating said coating member in the direction opposite the travel of said sheet thereacross, and means for operating said shiftable means.

8. A spot coating machine comprising a rotatable annular coating member, means for forming a fluid film of coating material on the periphery of said coating member, feeding means for driving a sheet to be coated across the surface of said coating member, yieldable means for normally supporting the sheet in radially spaced relation with said coating member, means for rotating said coating member in the direction opposite the travel of said sheet thereacross, an impression member shiftable toward and away from the surface of said coating member and operable to move said sheet into surface engagement with fluid film on said coating member, means for operating said impression member, and means for limiting the movement of said impression member toward said coating member to maintain a predetermined minimum spacing therebetween.

9. A spot coating machine comprising a rotatable annular coating member, means for forming a fluid film of coating material on the periphery of said coating member, feeding means for driving a sheet to be coated across the surface of said coating member at a constant speed, yieldable means for normally supporting the sheet in radially spaced relation with said coating member, shiftable means operable for pressing the sheet toward said coating member into sliding contact with the fluid film thereon and for releasing the sheet from engagement with the film, means for rotating said coating member in the direction opposite the travel of said sheet thereacross, and means for operating said shiftable means in timed relation with the travel of said sheet.

10. A sheet coating machine comprising a rotatable annular coating member, means for forming a fluid film of coating material on the periphery of said coating member, feeding means for transporting a sheet to be coated across said coating member at a constant predetermined speed and in radially spaced relation with the fluid film on the surface thereof, a rotatable cylindrical impression member disposed in axially parallel relation with the coating member, said sheet passing between said members and said impression member being radially shiftable toward and away from said coating member, means for rotating said impression member in the direction of sheet travel, means for rotating said coating member in the direction opposite the sheet travel, and means for shifting said impression member a predetermined distance toward said coating member sufficient to move the sheet to be coated into brushing surface engagement only with the fluid film on said coating member and substantially without radial pressure thereagainst.

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