May 17, 1966 R. B. RUSSELL 3,251,994

THERMOGRAPHIC COPYING MACHINE HAVING RELATIVELY MOVABLE, MATING HOUSING PORTIONS

Filed Sept. 22, 1964 3 Sheets-Sheet 1

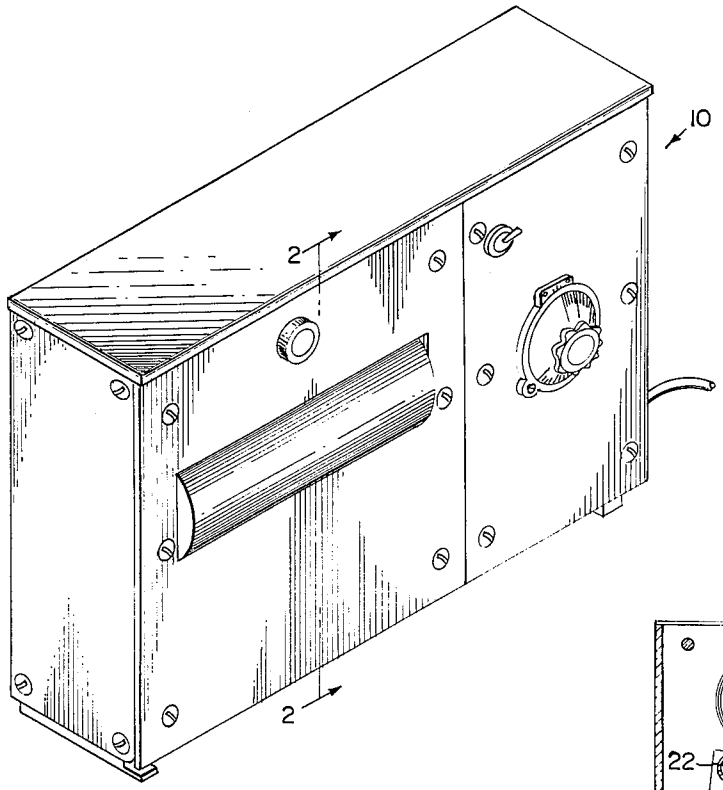

FIG. 1

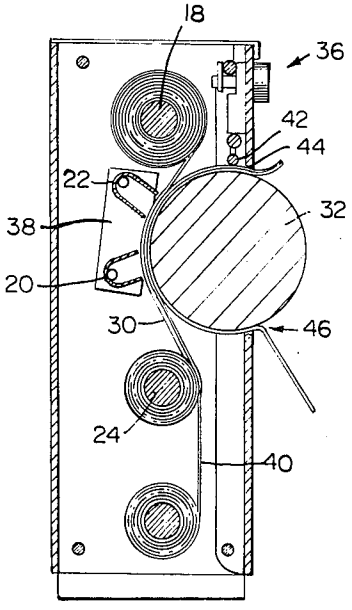

FIG. 2

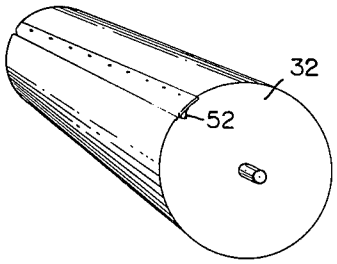

FIG. 3

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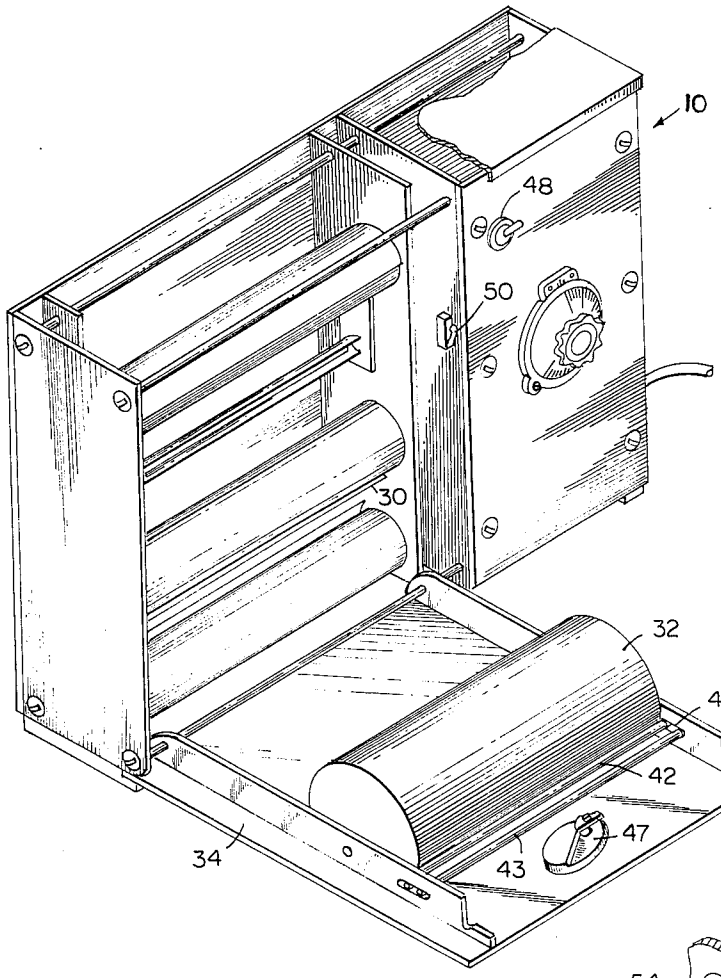

FIG. 4

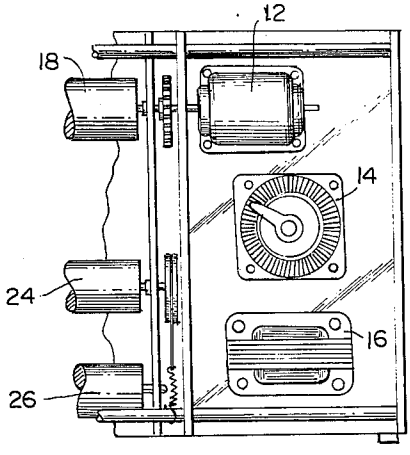

FIG. 5

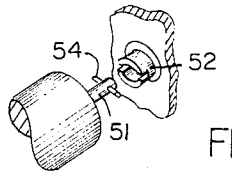

FIG. 6

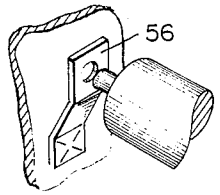

FIG. 7

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THERMOGRAPHIC COPYING MACHINE HAVING RELATIVELY MOVABLE, MATING HOUSING PORTIONS

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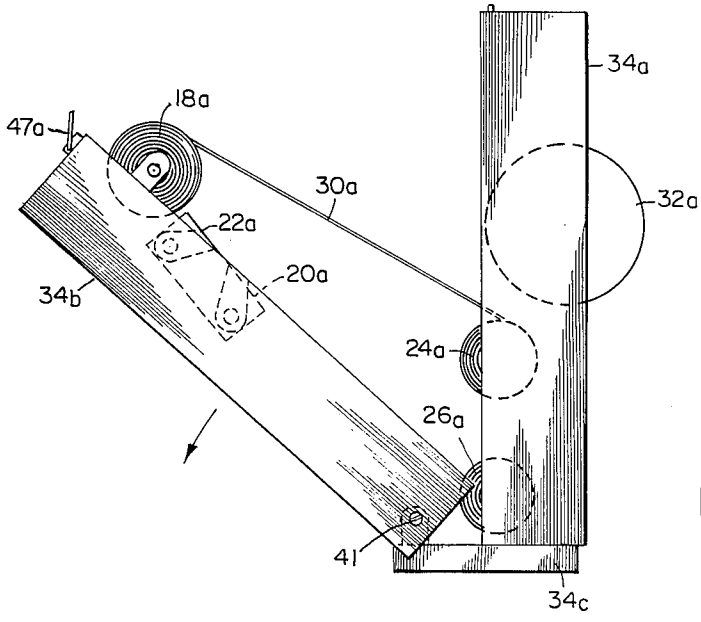

FIG. 8

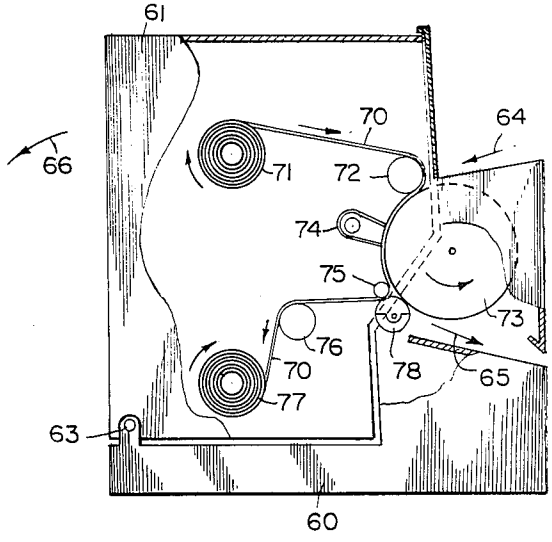

FIG. 9

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THERMOGRAPHIC COPYING MACHINE HAVING RELATIVELY MOVABLE, MATING HOUSING PORTIONS

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Filed Sept. 22, 1964, Ser. No. 398,158

5 Claims. (Cl. 250—65)

This invention is an improved thermographic copying machine adapted for radiant energy induced copying by front printing with a continuous transfer sheet. More specifically, this invention is concerned with such a copying machine that is so designed that it may be readily opened to facilitate threading up of the transfer sheet when it breaks or is replaced.

This application is a continuation-in-part of copending application, "Copying Apparatus and Method," Serial No. 56,482, filed September 16, 1960, now U.S. Patent No. 3,162,762 which in turn was a continuation-in-part application of and copending with Serial No. 37,669 filed June 21, 1960, for Thermotransfer Copy Process Wherein a Heat Sink Is Positioned Within the Composite, now U.S. Patent No. 3,121,791.

One of the primary objects of this invention is to provide a thermographic copying apparatus utilizing a continuous transfer sheet which apparatus will be at one end and the same time simple in operation and easy to thread up. The paper transfer sheets in previous machines of this type were hard to insert into the machine and if they broke during operation, a substantial down time occurred because of the difficulty of threading up the transfer sheet. The present copying machine is designed for simplicity of operation and requires little or no skill to attach and position the paper elements.

In brief compass, this invention is a thermographic copying machine adapted for radiant energy induced thermographic copying by front printing. It comprises a housing having two relatively movable mating portions and a transfer sheet supply roll and a transfer sheet take-up roll, both of which rolls are mounted for rotation in the housing. A radiant energy source is mounted for rotation in one portion of the housing and a print roll is mounted for rotation in the other portion of the housing. The radiant energy source and the print roll define between them a printing station which is intermediate the supply and take-up rolls. The transfer sheet is so positioned as to contact the print roll over a portion of its circumference, when the transfer sheet is passing them from the supply roll to the take-up roll. The radiant energy source is adapted to direct radiant energy through the transfer sheet as it passes over the print roll at the printing station. The thermographic copying machine has means for supplying a copy sheet between the print roll of the transfer sheet along with an indicia-bearing original to be copied and also has means for removing the copy sheet and the indicia-bearing original after they have passed through the printing station.

The improvement in this invention resides in the fact that the two mating portions of the housing are adapted for relative motion from a first position where the print roll and the radiant energy source or lamp are closely adjacent at the printing station to a second position where the print roll and the radiant energy source are remote from one another and the supply and take-up rolls are exposed. This exposure of the rolls and separation of the printing station and radiant energy source permits ready threading up of the transfer sheet when a new roll is inserted or when there has been a breaking of the transfer sheet in operation.

The transfer sheet supply roll and take-up roll can be positioned in the same portion of the housing as either

the print roll or the light source, or the supply roll can be in one portion and the take-up roll in the other.

The take-up roll, the supply roll and/or the print roll are suitably driven so that the continuous transfer sheet passes readily through the machine.

In one embodiment, the take-up roll and print roll are parallel with the axis of the print roll and are so positioned when the two portions of the housing are together that the outer edge of the print roll extends inwardly of the line of tangency between the supply and take-up rolls on the transfer sheet side of the rolls but does not exceed the line of tangency on the other side.

Further objects and features of this invention will best be understood from a detailed description of preferred embodiments thereof selected for the purpose of illustration, as shown in the accompanying drawings in which:

FIG. 1 is a view in perspective of one form of the apparatus of my invention;

FIG. 2 is a cross-sectional view in side elevation taken along the lines 2—2 of FIG. 1;

FIG. 3 is a view in perspective of the print roll machine shown in FIG. 1;

FIG. 4 is a view in perspective of the machine showing the front door in opened position with the internal elements of the machine exposed to view;

FIG. 5 is a view in front elevation of the right hand end of the machine, the cover being removed to show the internal elements;

FIG. 6 is a fragmentary perspective exploded view of one form of roll support mechanism;

FIG. 7 is a fragmentary perspective exploded view showing the other end of the roll of FIG. 6 and its mount;

FIG. 8 illustrates one side view of a copying machine quite similar to the one shown in FIGURES 1–7, but with the difference that the portion of the housing containing the light source is the movable portion and the position of the print roll is fixed relative to the transfer sheet supply roll; and

FIG. 9 schematically depicts another embodiment of this invention wherein the supply roll, take-up roll, printing station and light source are arranged in a different manner but still in such a manner that by separating two portions of the housing the light source can be placed in a position remote from the printing station and a transfer sheet is exposed for ready threading up.

FIGS. 1 through 7 illustrate one embodiment of my invention. This embodiment includes in its general organization a box indicated generally at **10** in which the various elements are mounted. At the right hand end of the box as seen in FIG. 5, is mounted a constant speed motor **12**, a variable resistance **14**, and a transformer **16**. The motor is used to drive a transfer sheet take-up roll **18** at a constant rate of about one revolution per second in this instance. Resistances **14** and transformer **16** supply power to a radiation lamp **20** or in one embodiment of the invention to radiation lamps **20** and **22**.

The left hand side of the apparatus houses the copying elements which include the transfer sheet take-up roll **18** already mentioned, a transfer sheet supply roll **24**, and a copying sheet supply roll **26**. The transfer sheet supply roll **24** is provided with a spring loading braking arrangement **28** which can be adjustable if desired, and it will be appreciated that when transfer sheet **30** is threaded from roll **24** to roll **18** and the motor **12** is operated this braking arrangement tensions the transfer sheet **30** between the two rolls.

The foregoing elements are mounted within housing **10** and the printing combination is completed by means of a print roll **32** mounted on a pivoting door **34** on the front of the machine. When door **34** is closed and locked by a latch mechanism **36**, print roll **32** is brought into

position at a printing station between rolls 18 and 24. The outer edge of the print roll extends inwardly of the line of tangency between the supply and take-up rolls and in this embodiment does not exceed the line of tangency on the other side thereof. In this way the transfer sheet 30 is tensioned over the circumference of the print roll 32. In this position the print roll 32 is located in front of the lights 20 and 22 being separated from the edge of shield 38 surrounding the lights by a clearance sufficient to permit free access of the manifolded sheets which are placed on print roll 32.

Thus, it will be seen that the operation of the motor 12 with a transfer sheet 30 connected between rolls 18 and 24 tensions the transfer sheet 30 across the face of the print roll 32 and causes the same to rotate. A copy sheet 40 is also threaded across the face of the roll 32 under a take-off roll 42 and out through an opening 44 in door 34. The original to be copied is inserted through an opening 46 in door 34 below roll 32. Motor 12 serves to draw the copy sheet and the original copy sheet and the original through the printing area, under the lights, out of the front of the machine under the take-off roll 42, and through opening 44.

The print roll is preferably a hollow, thin-walled aluminum tube machined to provide a smooth substantially true cylinder. The ends may be perforated to permit air circulation. When this is done no fans are necessary for continuous operation.

Take-off roll 42 is held under light spring force against print roll 32 by means of a spring rod 43 operating against sliding journal blades 45. A cam 47 attached to latch 36 contacts rod 43 when latch 36 is closed. This provides an automatic release for the take-off roll when door 32 is opened and facilitates threading up the copy paper.

Rolls 18, 24 and 26 are mounted for quick change with their shafts 51 fitting at their drive ends into slotted hubs 52 with pins 54 ensuring fixed driving relation therewith. At their other ends shafts 51 fit into spring loaded bearings 56.

The electrical arrangement herein employed is arranged with an on-off switch 48 operating both motor 12 and lights 20 and 22. A door switch 50 is located in the light circuit so that the lights do not go on when door 34 is opened. Thus transfer sheet 30 may be threaded up and smoothed out without the inconvenience of having the lights on. The lights employed are the commercially available 1000 T3 bulbs of G.E. and Sylvania designed to operate at 230 to 250 volts. In this instance, transformer 16 doubles the voltage, and resistance 14 serves the purpose of reducing the voltage to accommodate variations in the printing intensity requirements. While the output of the bulb is probably more than 2000 watts, transformer 16 and resistance 14 may have a capacity of 500 watts and still function properly. This is because operation of the copying machine is relatively brief and intermittent.

As best can be seen from FIG. 4 when door 34 with the print roll in place is pivoted downwardly the interior of the copying apparatus is exposed and threading up of the transfer sheet from roll 26 to roll 18 can readily be carried out.

The apparatus illustrated in FIG. 8 is quite similar to that previously described and the view shown is the same as that illustrated in FIG. 2. The same numbers have been used to identify like parts with the numbers in FIG. 8 being given the distinguishing sub-script *a*.

The only difference between the two embodiments is that the housing of the machine has been split in a different manner such that the print roll remains fixed while the radiant energy source is moved relative thereto to facilitate threading up.

As illustrated the housing is divided vertically at about the middle into two portions, front portion 34*a* and a movable rear portion 34*b*, pivotally connected at 41 to frame 34*c* which also carries front portion 34*a*. Print roll 32*a*, transfer sheet supply roll 24*a* and copy sheet supply roll 26*a* are mounted in front portion 34*a*. Lights 20*a* and 21*a* and transfer sheet supply roll 18*a* are mounted in back portion 34*b*. Latch 47*a* is used to hold the two portions together in operation. Lights 20*a* and 21*a* connect with the power source through a suitable contact (not shown) that permits the lights to be disconnected and pivoted away from the main housing, and a gear on roll 18 removably engages a drive gear in the appropriate position in the main housing. The machine of this embodiment operates in the same manner as previously described. When it is necessary to thread the transfer sheet 30*a*, the two portions of the housing are opened as illustrated and the various rolls are conveniently exposed. When the two portions are closed there will be some looseness in the transfer sheet but this is removed almost instantaneously when the machine is turned on.

FIG. 9 shows another embodiment of this invention. Illustrated is a side view of a copying machine in part broken away to show the internal arrangement of the components. The sketch is in part schematic. The division line between the two portions of the housing has been exaggerated to show more clearly their relative positions. In FIG. 9, 71 is the transfer sheet supply roll, 72 is a transfer sheet guide roll that presses the transfer sheet against print roll 73, 74 is the light source, 75 is a take-off roll designed to cause the transfer sheet to bend abruptly away from the print roll so that the original and copy sheets separate therefrom, 76 is another guide roll for the transfer sheet and 77 is the transfer sheet take-up roll. A roll 78 presses against the printing roll 73. The copy sheet and the indicia-bearing original fall into the nip of roll 78 and are ejected from the machine as indicated by direction arrow 65. Roll 78 can be driven and be used to cause rotation of print roll 73. Roll 71 and 77 may likewise be driven with roll 77 preferably being driven at a slightly greater rate than required to take up the transfer sheet with a slip-clutch being incorporated in the drive mechanism so that tension can be maintained on the transfer sheet 70.

The housing consists of two main portions, a base 60 which holds the print roll 73 and the drive wheel 78 and an upper portion 61 which contains the rest of the elements of the thermographic copying machine, as shown. To expose the continuous transfer sheet for threading up, portion 61 of the housing is rotated to the left around pin 63 connecting it to base 60, as indicated by direction arrow 66. This takes the tension off of the thermographic transfer sheet because it is removed from contact with print roll 73 and exposes the interior portions of the machine so that the transfer sheet can be readily passed from roll 71 over rolls 72, 75 and 76 and then to roll 77.

In operation, a cut copy sheet is superimposed on an indicia-bearing original and the two sheets are passed into the machine under the thermographic transfer sheet 70 in the nip formed by roll 72 as indicated by direction arrow 64. The transfer sheet holds the copy sheet and the original tightly against the print roll 73 and the three sheets pass under the radiant energy source 74 to roll 75. At roll 75 the transfer sheet makes an abrupt bend which causes the copy sheet and the original to separate and fall into the nip formed by roll 78 which then passes them from the machine.

In certain designs the print roll, the transfer sheet take-up roll and the transfer sheet supply roll can be mounted in the same portion of the housing with the light source being in the other portion of the housing such that when the two portions of the housing are separated the printing station is exposed and the transfer sheet can be readily threaded therethrough.

In one embodiment of my invention the circumference of the print roll 32 is designed to coincide precisely with the length or width of the original to be copied. When this is done the original can be inserted under a spring loaded clip 52 in the print roll 32 and the machine can

then be operated to produce continuously successive copies.

Having described this invention, what is sought to be protected by Letters Patent is succinctly set forth in the following claims:

What is claimed is:

1. A thermographic copying machine adapted for radiant energy induced thermographic copying by front printing with a continuous thermographic transfer sheet, comprising in combination: a housing having two relatively movable mating portions; a transfer sheet supply roll; a transfer sheet take-up roll, both of said rolls being mounted for rotation in one of said housing portions; a radiant energy source mounted in the same housing portion as said transfer sheet rolls; a print roll mounted for rotation in the other portion of said housing, said radiant energy source and said print roll in operation defining between them a printing station intermediate said supply and take-up rolls, a transfer sheet positioned to contact said print roll over a portion of its circumference when said transfer sheet is passing from said supply roll to said take-up roll and said radiant energy source being adapted to direct radiant energy onto said transfer sheet on said print roll at said printing station; said transfer sheet and print roll being constructed and arranged to receive therebetween a copy sheet and an indicia-bearing original with the said original adjacent to said print roll and with the indicia of said original against said copy sheet; said two mating portions of said housing being adapted for relative motion from a first position where said print roll and said radiant energy source are closely adjacent at said printing station to a second position where said print roll and said radiant energy source are remote from one another and said supply and take-up rolls are exposed whereby threading up of said transfer sheet is facilitated.

2. The thermographic copying machine of claim 1 wherein said supply, take-up and print rolls are parallel with said print roll being so positioned in said first position that the outer edge of said print roll extends inwardly to a location intermediate of the lines of tangency between said supply and take-up rolls.

3. The thermographic copying machine of claim 1 wherein said two relatively movable mating portions are pivotally mounted relative to each other and said print roll swings in an arc in going from said first position to said second position while the portion of said housing containing said radiant energy source remains in a fixed position.

4. The thermographic copying machine of claim 1 wherein said two relatively movable mating portions are pivotally mounted relative to each other and said radiant energy source swings in an arc in going from said first position to said second position while the portion of said housing containing said print roll remains in a fixed position.

5. A thermographic copying machine adapted for radiant energy induced thermographic copying by front printing with a continuous thermographic transfer sheet, comprising in combination: a housing having first and second relatively movable mating portions; a transfer sheet supply roll mounted for rotation in said first housing portion; a transfer sheet take-up roll mounted for rotation in said second housing portion; a radiant energy source mounted in said second portion of said housing; a print roll mounted for rotation in said first portion of said housing, said radiant energy source and said print roll in operation defining between them a printing station intermediate said supply and take-up rolls, a transfer sheet positioned to contact said print roll over a portion of its circumference when said transfer sheet is passing from said supply roll to said take-up roll and said radiant energy source being adapted to direct radiant energy onto said transfer sheet on said print roll at said printing station; said transfer sheet and print roll being constructed and arranged to receive therebetween a copy sheet and an indicia-bearing original with the said original adjacent to said print roll and with the indicia of said original against said copy sheet; said two mating portions of said housing being adapted for relative motion from a first position where said print roll and said radiant energy source are closely adjacent at said printing station to a second position where said print roll and said radiant energy source are remote from one another and said supply and take-up rolls are exposed whereby threading up of said transfer sheet is facilitated.

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