Dec. 15, 1970 NOBUYUKI YANAGAWA 3,547,538

PHOTOGRAPHIC COPYING MACHINE

Filed Jan. 31, 1968 2 Sheets-Sheet 1

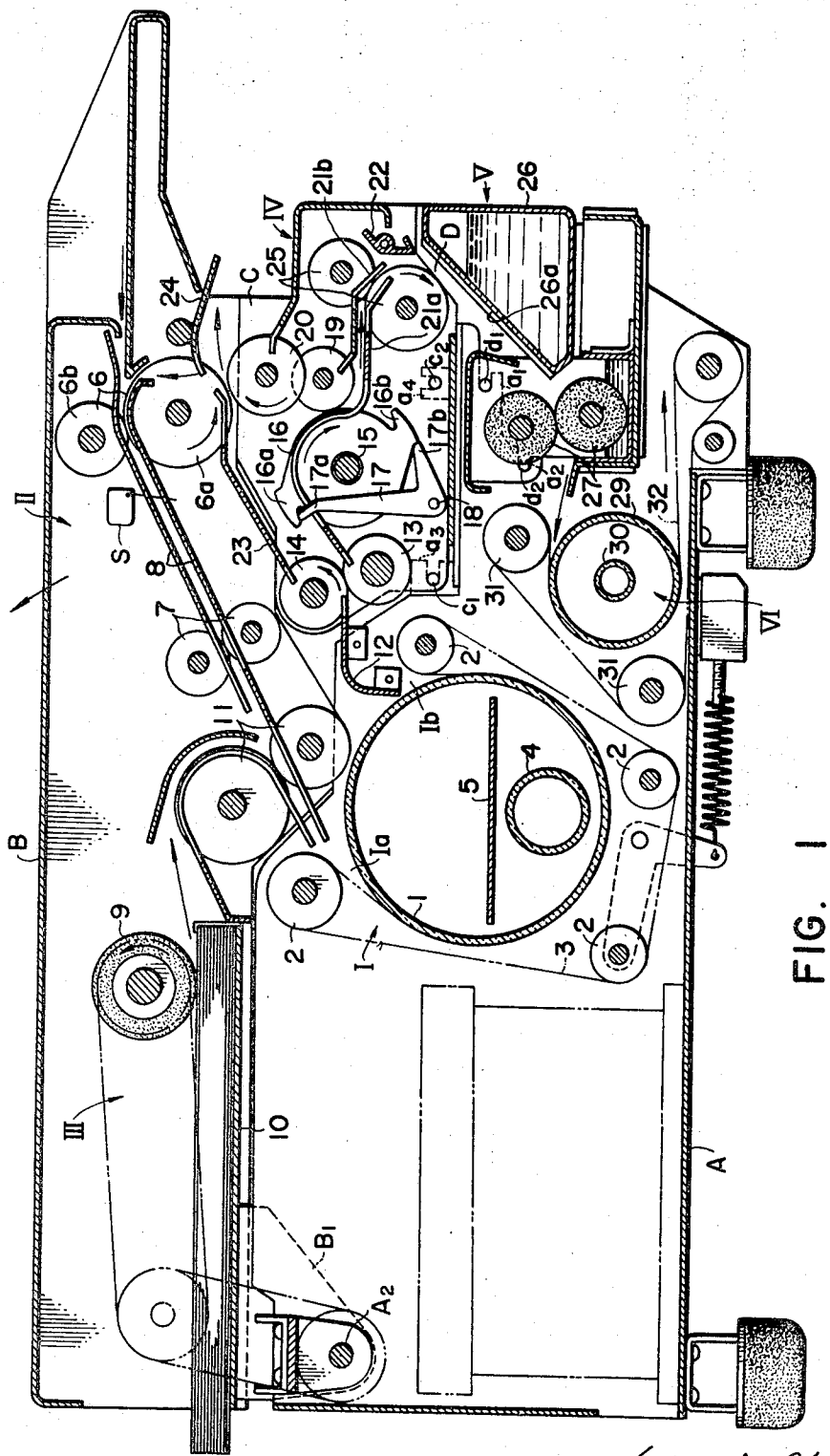


FIG. 1

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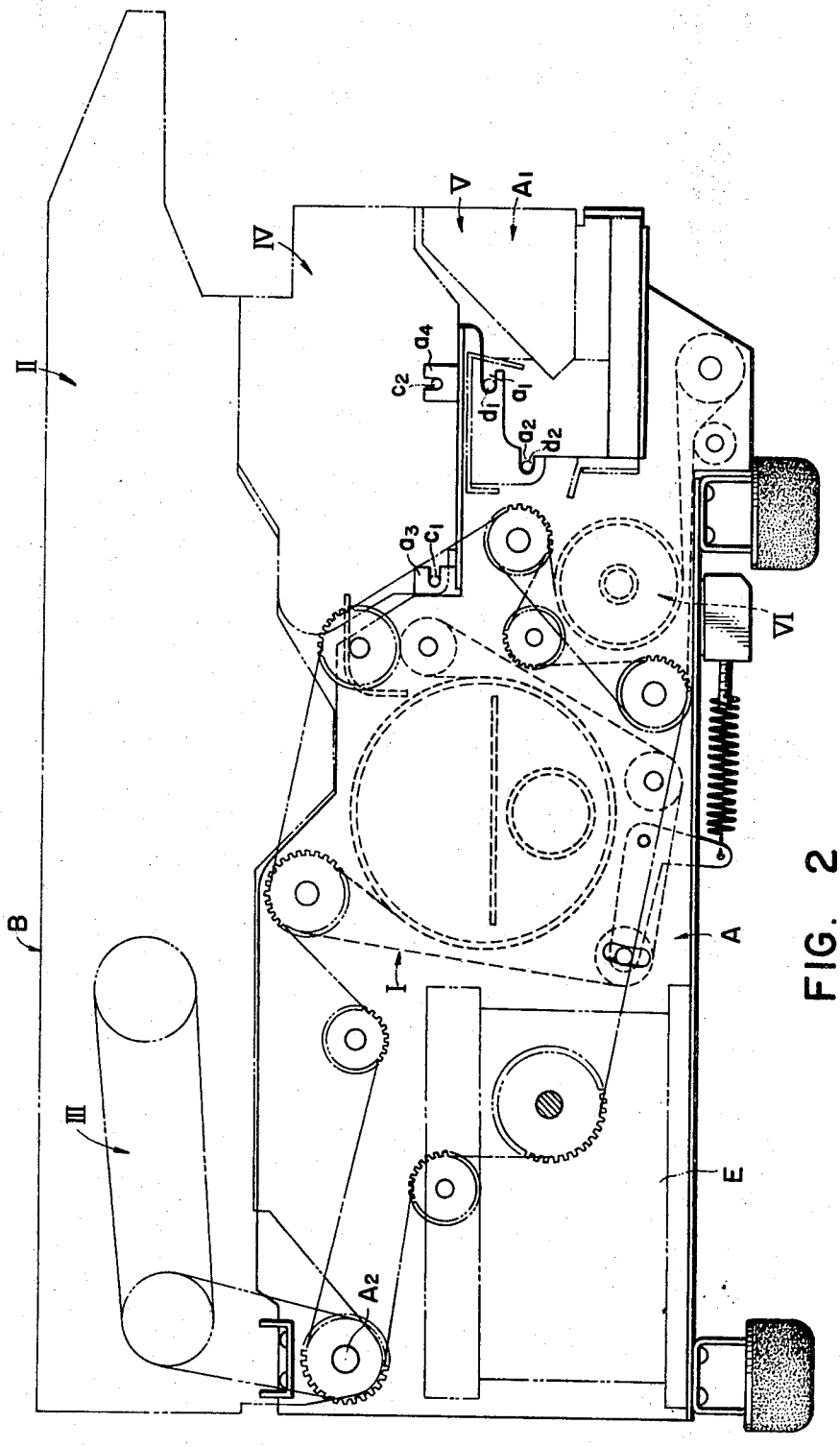


FIG. 2

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United States Patent Office 3,547,538
Patented Dec. 15, 1970

3,547,538

PHOTOGRAPHIC COPYING MACHINE

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Filed Jan. 31, 1968, Ser. No. 702,066
Claims priority, application Japan, Mar. 3, 1967, 42/18,021
Int. Cl. G03b 27/30
U.S. Cl. 355—106 4 Claims

ABSTRACT OF THE DISCLOSURE

A photographic copying machine has a hinged top, on the underside of which is mounted a copy paper storage and feeding device and an original paper feeding device for superimposing an original paper and a copy paper. The superimposed papers are fed through an exposure device to a removable separating device where they are separated, the copy paper (if of the type requiring wet development) being fed through a removable wet development device which has been filled with suitable developer, or (if of the type requiring dry development), through a dry development device and thence from the machine. The removable wet development device is provided at the front of the machine where it is easily removed and where the fluid level in its transparent fluid reservoir is visible to the machine operator.

DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

FIG. 1 is an elevation partly in section of applicant's copying machine.

FIG. 2 is a diagramatic side elevation in section of applicant's copying machine.

BRIEF SUMMARY OF THE INVENTION

The invention comprises a desk-top photocopying machine having a top or lid hinged at the rear of the machine. Attached to the underside of the top are devices for storing and feeding copying paper and for accepting an original to be copied. These devices feed the copying paper and the original together in a channel and superimpose one on the other. The superimposed papers are then fed downwardly substantially at the center of the machine into a loop of belting which passes around a rotatable transparent drum. An intense light within the drum radiates the superimposed paper sheets and they are then passed forwardly and upwardly through a removable separating device which separates the original from the copy sheet. By making this portion of the machine removable, repair and cleaning thereof is facilitated.

If the copy paper being used requires moistening by a developer, it passes downardly through a removable developing device located in the front of the machine near the bottom thereof. This device has a transparent reservoir which is visible to the operator of the machine from the outside thereof, enabling him to monitor the level of developer in a convenient fashion. By making the wet developing device removable, cleaning and repair thereof is facilitated, as is refilling of the reservoir. If the copy paper requires no moistening, the application of wet developer may be omitted. Finally a drying device comprised of a heated drum and an endless carrier belt accepts the copy paper and heats the surface thereof, drying said paper and completing the development thereof. The finished copy is ejected at the bottom of the front of the machine.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The invention will be described with reference to FIG. 1 illustrating one embodiment thereof, wherein reference numeral **1** designates a well known transparent cylinder provided near the central portion of the photographic copying machine body A. Said transparent cylinder is suspended rotatably within the loop of the endless transmitting belt **3** which extends between the peripheries of the four rollers **2**.

Within said transparent cylinder **1** a stationary lighting tube lamp **4** and deflecting plate **5** are provided, mounted on the stationary portion of said body. The above described parts compose an exposure device I of the photographic copying machine.

As shown in FIG. 2, one set of forward facing slots a_1 and a_2 are formed beneath the edge of the top of the front opening A_1 of said body A and one set of horizontal, laterally extending pins d_1 and d_2 project from both side walls C (see FIG. 1) of the automatic separating device IV described later below. Said slots and pins are positioned to engage with each other.

Above the top of the front opening A_1 one set of ears a_3 and a_4 are formed and positioned to engage with the horizontal, laterally extending pins C_1 and C_2 which extend from both side walls C of the automatic separating device IV described below.

Furthermore, on the rear portion of said body A_1 a prime mover E is provided and enabled to drive each device of the whole photographic copying machine through a suitable sprocket wheel and drive chain (see FIG. 2).

Inside of the top plate B of said exposure device I the transmitting device II is comprised of two sets of guide rollers **6** and **7** (see FIG. 1). Guide plate **8** guides the original paper to the exposure device I, and the paper feeding device III feeds a sheet of the printing paper located on the printing paper table **10** by means of the roller **9**, said feed being at a rate synchronized with the speed of the original paper. On the rear portion of said top plate B one pair of ears B_1 are formed and said ears are rotatably positioned on the spindle A_2 mounted laterally at the top rear position of said body A.

Therefore, by pivoting the top plate B on the spindle A_2 in FIG. 1, cleaning of the transparent cylinder **1** or replacement of the lighting tube lamp **4** can be easily accomplished.

While the original drawing paper and each end of the printing paper are superimposed, one set of rotatable transmitting rollers **11** are provided, and said transmitting rollers are adapted to feed superimposed original paper and the printing paper toward the entrance port I*a* of said exposure device I.

Above the discharge port I*b* of said exposure device I, the guide plate **12** bent at right angle is adapted to guide the superimposed original paper and the printing paper paper at said guide plate between a set of rollers **13** and **14** having different peripheral speeds. As said roller **13** is rotating at a higher peripheral speed than the roller **14** which is positioned above said roller **13**, the leading edge of the printing paper is advanced slightly relative to the leading edge of the original paper.

On the exit side of said rollers **13** and **14** the separating plate **16** is located. Said plate has a pair of bill shaped pawls **16***a* in diametrically opposed position on its periphery and is pivoted loosely to the supporting spindle **15**.

Below said separating plate **16**, a bellcrank lever **17** biased counter clockwise on the supporting spindle **18** through a spring or weight not shown in drawing. One arm end portion **17** of said lever **17** is extending to the pawl **16***a* of said separating plate **16**, and the end of the

other arm **17***b* of said lever is engaged with the shoulder of the other pawl **16***b* to prevent said separating plate from rotation.

Therefore, when one arm end portion **17***a* of the lever **17** is pushed by the advancing edge of the printing paper, the lever **17** is turned clockwise on the spindle **18** resisting its own bias in clockwise direction at the same time releasing restriction of the separating plate **16** with the other arm of thus said lever **17**, said separating plate is enabled to rotate on the supporting spindle **15**.

On the front side of said separating plate **16**, rollers **19** and **20** having different peripheral speeds are rotatably mounted. At one location adjacent the periphery of said separating plate **16**, one passage is formed by a curved guide plate **21***a* and an auxiliary guide plate **21***b* provided slightly above **21***a*.

Therefore, one roller **19** transmits the printing paper along the guide plates **21***a*, **21***b*, and **22**, while other roller **20** discharges the original drawing paper to the outside of the machine along the guide plates **23** and **24**.

When the lapped papers enter between the rollers **13** and **14**, the leading end edge of printing paper is advanced slightly over the leading edge of the original paper by the roller **13** having higher peripheral speed. As the leading edge of the advanced printing paper pushes one arm end **17***a* of the lever **17**, said lever rotates in the right along the spindle **18**, and releases restriction between bent portion **17***b* of the other arm end of said lever and the separating plate **16**. The leading edge of the printing paper is transmitted along the guide plate **21***a* and **21***b* around the supporting spindle **15** while engaged with the pawl **16***a* of said separating plate **16**, and transmitted to the developing device V through the roller **25** described below.

On the other hand, leading edge of the original paper which advances slightly behind the leading edge of the printing paper is transmitted forwardly and slides over the periphery of the separating plate without engaging with a pawl of said separating plate.

The original drawing paper is advancing in the direction shown in arrow by rotating roller **20** and discharged to the outside of the machine.

Guide plate **24** is a curved type which cooperates with the peripheral surface of roller **6***a*, so the original drawing paper can be transmitted again to the passage **8** by turning said guide plate clockwise about 90° on the supporting spindle by operation from outside of the machine, and thus may be obtained a plurality of copies from one sheet of original paper.

One pair of transmitting rollers **25** are pivoted on both side plates C in the direction of movement of said printing paper, and to the parts extending from rollers **13** and **14** to transmitting roller **25** comprise the automatic separating device IV.

Below the transmitting roller **25**, a transparent developing reservoir **26** having a triangular cross section is provided, the inclined surface **26***a* of said reservoir serving as a guide plate, along which the printing paper is transmitted to the developing process described below.

As the reservoir **26** formed by said transparent material is visible from the front of the photographic copying machine, the operator will be aware of the quantities of the developing liquid therein at any time.

Behind reservoir **26**, one pair of liquid applying rollers **27** is pivoted on the side plates D. The lower portion of one of said applying roller is dipped with the developing liquid. The wet developing device V is comprised of these above described parts.

The drying and at the same time dry developing device VI is located between said wet developing device V and said exposure device I, said drying and at the same time dry developing device is constructed from parts such as heat producing piping **30** provided within the heating cylinder **29** and endless belts **32** which runs over the outside periphery of several of rollers **31**, and said endless belt **32** transmits the dried printing paper to the front of the lower portion of the photographic copying machine.

The printing paper transmitted from one pair of developing rollers **27** is discharged to the outside of the machine in dry state after being heated while passing between said heating cylinder **29** and the endless belt **32**.

Now, when the operator inverts the original paper and feeds it into the feeding port of the transmitting device II, it will be advanced by the guide rollers **6***a* and **6***b*.

Then, when the leading edge of the orginal drawing paper pushes the contact point of the switch S, an electromagnet not shown in the drawing is activated and a clutch mechanism is engaged, so the roller **9** of the paper feeding device III is rotated, and delivers one sheet of printing paper in the direction shown in arrow, and transmits it to the exposure device I by the rollers **11** after the printing paper has been superimposed on the original paper.

Said papers are carried between the peripheral surface of the transparent cylinder I and the endless transmitting belt **3** under pressure, and after a latent image has been formed upon the printing paper by the light from the lighting tube lamp **4**, are discharged from the discharge port I*b* of the exposure device I through the guide plate **12**.

Subsequently, when said superimposed papers pass through rollers **13** and **14**, said papers are separated individually by the automatic separating device IV as described above, and the printing paper is forwarded through the guide plates **21***a* and **22***b*, and transmitted to the wet developing device V through the roller **25**.

The developing process down the slope of said reservoir **26**, and carried between one pair of applying rollers **27**, subsequently being discharged to the outside of the machine in dry state after passing over heating cylinder **29** of the developing device VI under pressure.

Above description apply where the wet type sensitive paper is used, however, if said wet developing device V is removed by being drawn out at the front, said photographic copying machine will make copies promptly for dry sensitive papers.

As described above the photographic copying machine is assembled with the exposure device I and the developing device of drying VI assembled in one body, while the automatic separating device and the wet developing device are arranged to remove easily, and the paper feeding device and the original drawing paper feeding device and are assembled on the top plate. As said top plate can be opened just as a hinged cover operates, mass production can be accomplished for each device, and allowing easy assembling and repair, and exchange for damage will be easy as it has good interchangeability, furthermore, as cleaning within the photographic copying machine can be performed simply also, this invention is exceedingly practical.

What I claim is:

1. In a photographic copying machine having a hinged top, the combination of transmitting means on the underside of said top for accepting an original paper and feeding it to the interior of the machine; storage means on the underside of the top for storing printing paper sheets; printing paper feeding means for feeding a sheet of printing paper from the storage means and superimposing said sheet of printing paper on the original paper in the transmitting device; an exposure means near the center of said machine to which the original paper and the superimposed sheet of printing paper are fed for exposure; separating means at a separating station near said exposure means for separating the original paper and the printing paper, a dry developing device and a wet developing device; means for feeding the separated printing paper from said separating station to either said dry developing station or to said wet developing station, means for removably securing said developing stations in said machine, near the front end thereof.

2. A photographic copying machine wherein are pro-

vided an exposure device, a dry developing device, a wet developing device, a copy paper feeding device, a sensitive paper feeding device, each of said feeding devices being set inside of a top plate whose end portion is pivoted loosely to rotate on the axis located on the upper rear portion of the body of the copying machine; and, moreover, there are provided a front opening at the front portion of said body, and a pair of mounting members above said opening, a wet developer member and a separating member being removably installed in said mounting members.

3. A photographic copying machine according to claim 1 wherein said wet developing device has a transparent storage bath for developing solution which is visible from the outside of the machine.

4. A photographic copying machine according to claim 1, comprising means in the form of a movable guide plate for recycling into the transmitting device means, original papers which have been fed out by the separating means.

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U.S. Cl. X.R.

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