United States Patent

Bianchi

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[54] HYDRAULIC DEVICE FOR MOVING IN TRANSLATION THE PRESSING ELEMENT OF A PRESS OR THE LIKE

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Dec. 17, 1969 France 181043

[52] **U.S. Cl.** **100/258**, 100/269

[51] **Int. Cl.** **B30b 15/24**

[58] **Field of Search** ..... 100/46, 269, 270, 258 A, 257, 100/256

[56] **References Cited**

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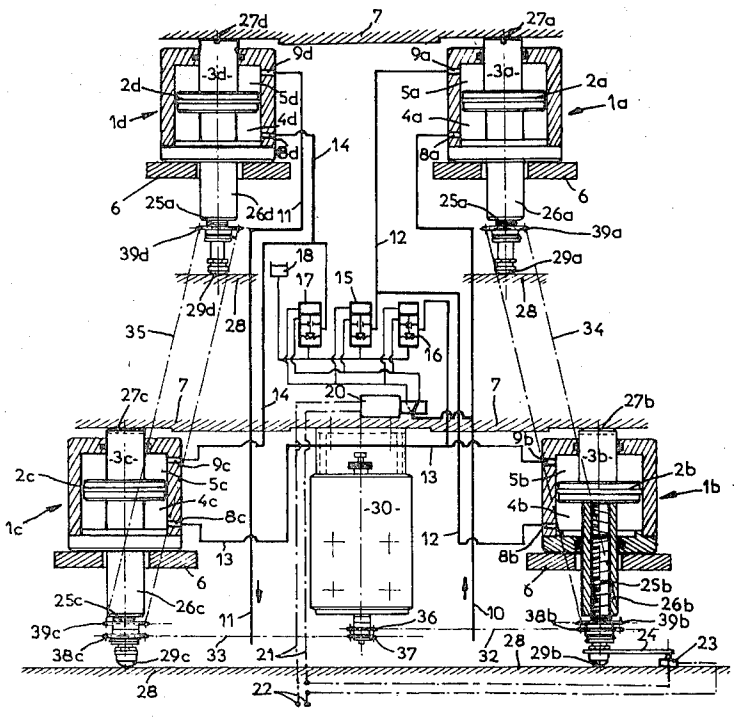
[57] **ABSTRACT**

A device for driving in translatory motion the pressing element of a press, comprising a plurality of double-acting rams having their rods operatively connected to said pressing element said rams being hydraulically connected in series to each other, so that the driving of the piston of the first ram by a pressure fluid causes the rams to be fed by each other and the simultaneous sliding motions of their pistons, and means to keep constant the volume of hydraulic fluid contained in the front chamber of a ram and in the rear chamber of another ram with which it is connected.

5 Claims, 3 Drawing Figures



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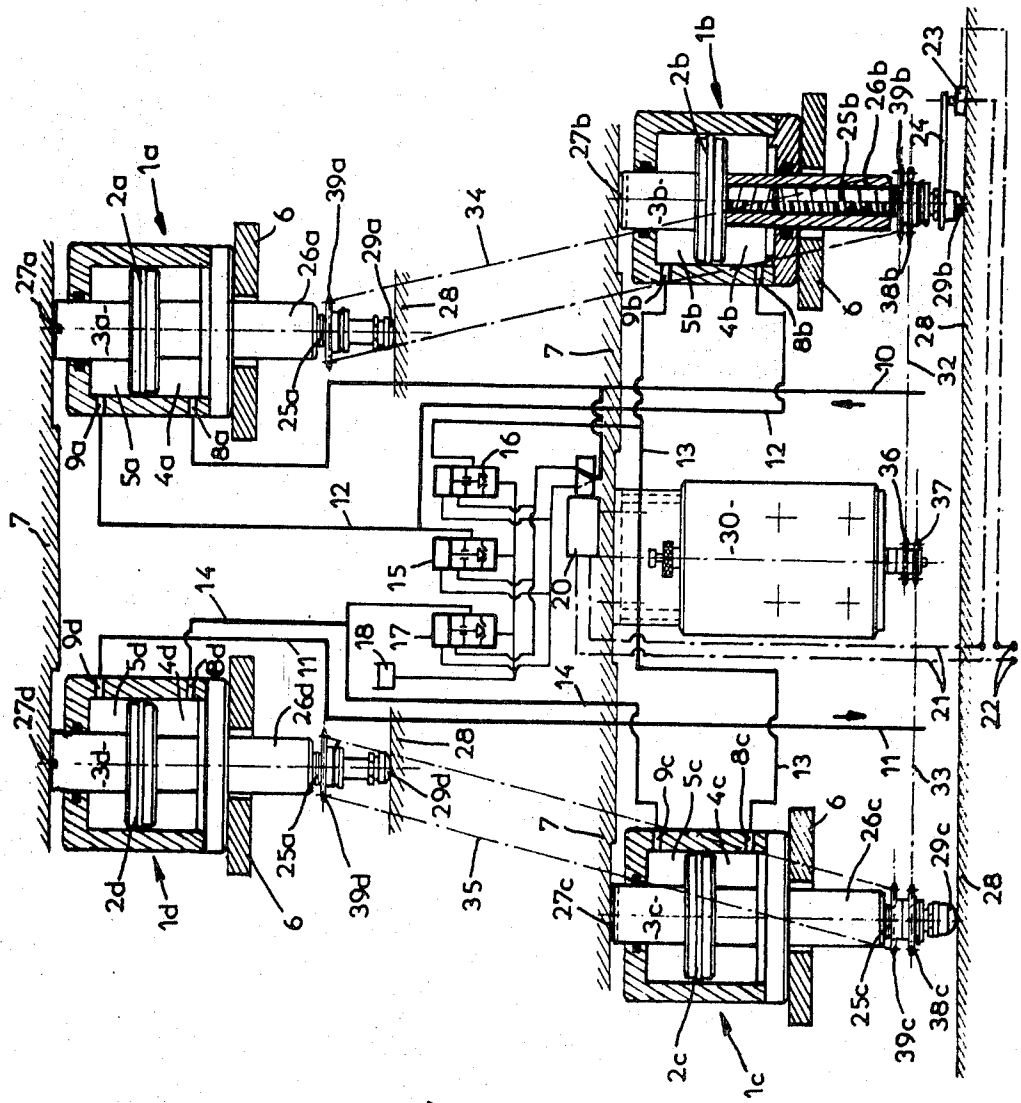

Fig. 1.

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Fig: 2.

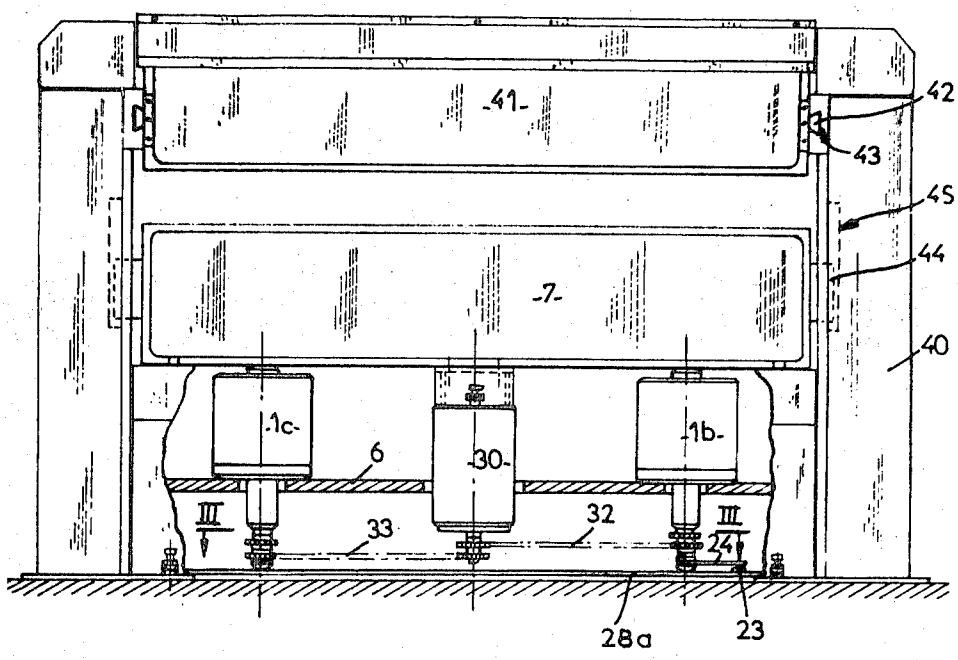
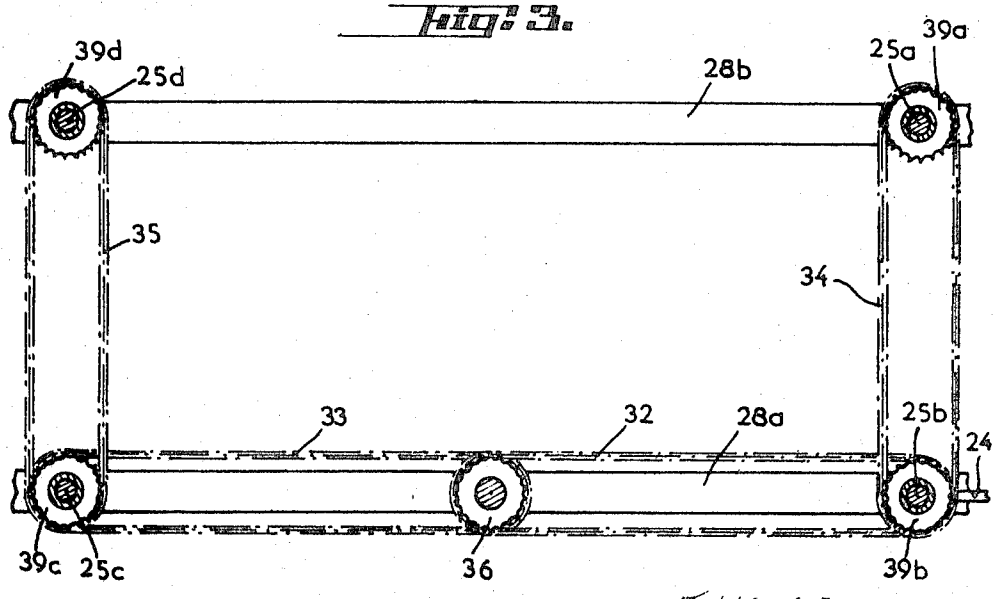


Fig: 3.



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HYDRAULIC DEVICE FOR MOVING IN TRANSLATION THE PRESSING ELEMENT OF A PRESS OR THE LIKE

The present invention relates essentially to a hydraulic device for moving in translation the pressing element of a press, shear or the like.

It is known that presses such as folding presses, punching or cutting presses, and so on, comprise a pressing member or element, movable in translation which is adapted to act upon a piece or part for example a metal sheet or foil or a shaping, forming or cutting tool, such a piece and such a tool bearing against or coming into engagement with a stationary member.

In particular in some punching presses, this pressing element consists of a table mounted on the frame of the press so as to be vertically slidable upwards and downwards and on this table is placed the material to be punched or cut, for example a leather sheet and upon this material is placed the cutting or punching tool. The machine comprises at its upper portion a carriage movable in substantially horizontal translation and adapted to assume a working position wherein it is located above said table. To punch or cut the material, the table is driven in translation upwards until the tool abuts against the carriage in working position and moves into the material. To achieve a perfect cutting or punching operation, it is necessary that the movable table remains, during its displacement, strictly parallel to the carriage so that the cutting or punching pressure be uniformly distributed whatever the location of the tool on said table may be that is regardless of the place where the table and carriage receive the load.

The object of the present invention is to provide a device for driving such a pressing element, table or the like while keeping its parallelism strictly during the displacement thereof.

The device according to the invention is characterized in that it comprises *n* ram or jacklike actuators of the double-acting type comprising each one a front chamber and a rear chamber separated from each other by the piston, said actuators having their rods operatively connected to said pressing element and being hydraulically connected in series to each other, each actuator having its front chamber and its rear chamber connected to the rear chamber and to the front chamber, respectively, of the two actuators with which it is associated, the first and last actuators being connected to the hydraulic pressure circuit, the one by its front chamber and the other by its rear chamber, so that when the first actuator is fed with pressure fluid, each actuator feeds the following actuator, the pistons moving simultaneously.

The hydraulic connection between the actuators provides a strictly synchronous operation of the latter and therefore the parallelism of the table is maintained during its displacement.

According to another characterizing feature of the invention, means are provided for keeping constant the volume of hydraulic fluid contained within each front chamber of an actuator and the rear chamber of the actuator to which it is connected.

According to another feature of the invention, each piping or line connecting the front chamber of an actuator to the rear chamber of another actuator is connected to a hydraulic fluid tank through the medium of a valve provided to establish the communication between said line and said tank when said table reaches the end of its stroke.

This supply of makeup or replenishment fluid is intended to compensate for the leakages hence to maintain constant the mass of fluid which is moving between an actuator and its associated actuator and consequently to keep constant the strokes of the actuators. The invention therefore enables to maintain a strict parallelism of the table during its displacement even in the case of a leakage of fluid in one or several actuators.

Another object of the invention consists in the various applications of said driving device to presses, shears or the like.

The invention is also directed by way of new industrial products to the punching presses provided with vertically movable working tables cooperating with a horizontally movable carriage, said table being driven by said hydraulic device.

Further characterizing features and advantages of the invention will appear as the following description proceeds.

In the accompanying drawings given by way of examples only:

FIG. 1 diagrammatically shows a driving device according to an embodiment of the invention, this device comprising four actuators shown partially in section;

FIG. 2 is an elevational view with parts broken away of a punching press fitted with the driving device shown in FIG. 1;

FIG. 3 illustrates at a greater scale a section taken upon the line III—III OF FIG. 2.

According to the form of embodiment shown in FIG. 1, the device according to the invention comprises four identical, double-acting ram or jacklike actuators designated by the reference numerals 1*a*, 1*b*, 1*c*, 1*d*, respectively. Each actuator is provided inside with a sliding piston 2*a*, 2*b*, 2*c*, 2*d*, respectively, comprising a rod 3*a*, 3*b*, 3*c*, 3*d*, respectively, secured to its top face (or rear face). Each piston divides the inner enclosed space of the actuator wherein it is sliding into a pair of independent chambers, one of which 4*a*, 4*b*, 4*c*, 4*d*, respectively, lying on the side of the bottom or front face of the piston and called front chamber, whereas the other one 5*a*, 5*b*, 5*c*, 5*d*, respectively, is located on the side of the top or rear face of the piston and called rear chamber. The actuators are mounted on a common support or holder 6 and drive in vertical translation a common pressing element 7.

Each one of the front and rear chambers of each actuator is provided with an orifice 8*a*, 9*a*; 8*b*, 9*b*; 8*c*, 9*c*; 8*d*, 9*d*. The orifice 8*a* of the front chamber 4*a* of the actuator 1*a*, which forms the first actuator of the assembly or unit shown, communicates with a line 10 connected to a source of fluid pressure (not shown) whereas the rear chamber 5*d* of the actuator 1*d* which forms the fourth actuator of the unit shown, is connected to the return pipe or line 11 for the pressure fluid.

The rear chamber 5*a* of the actuator 1*a* is connected through a duct 12 to the front chamber 4*b* of the actuator 1*b*. Similarly the rear chamber 5*b* of the actuator 1*b* is connected through a conduit 13 to the front chamber 4*c* of the actuator 1*c*. Finally the rear chamber 5*c* of the actuator 1*c* is connected through a duct 14 to the front chamber 4*d* of the actuator 1*d*.

Each one of the ducts 12, 13 and 14 is connected through the medium of a valve 15, 16 and 17, respectively, to a pan or like tank 18 containing hydraulic fluid for makeup or replenishment. The valves 15, 16 and 17 of conventional type and consisting for example of a sliding element, are operated by an electromagnetic or solenoid valve 20 also of conventional type, hydraulically connected to the line 10 so as to control the displacement of the sliding element of each one of the valves 15, 16 and 17, to provide or not the communication between the tank 18 and the ducts 12, 13 and 14. The electrovalve 20 comprises, within its electrical supply circuit 21 connected to the terminal 22 of a source of electric current, a switch 23 adapted to open or break or to close or complete said supply circuit as a function of the position of the pressing element 7 as will be explained hereinafter.

The device operates as follows: the front and rear chambers of each one of the actuators being assumed to be filled with hydraulic fluid, the supply of the front chamber 4*a* of the actuator 1*a* through the line 10 results in the upward sliding of piston 2*a* which delivers fluid from the chamber 5*a* into the front chamber 4*b* of the actuator 1*b*. It results therefrom that the piston 2*b* also slides upwards and delivers fluid from the chamber 5*b* thereby causing likewise the upward motion of said piston 2*c* and of the piston 2*d* which delivers, into the return line 11, the fluid contained within the rear chamber 5*d* of the actuator 1*d*.

The actuators hydraulically connected to each other are therefore operated simultaneously and they carry along therewith the pressing element 7 in upward translation.

When the direction of feed of the actuators is reversed that is when the hydraulic pressure fluid is admitted through the line 11, the four pistons 2*a*, 2*b*, 2*c*, 2*d* are driven in the same manner but in the reverse direction, that is downwards and the line 10 forms in this case the return line for the hydraulic fluid.

The electromagnetic valve 20 is provided for operating the valves 15, 16 and 17 so as to cut off the communication

between the tank 18 and the lines 12, 13 and 14 during building up of pressure within the hydraulic circuit, that is during the operation of the actuators and to establish such a communication when said actuators have reached one of their stroke end positions, for example the position at the end of the downward stroke. For this purpose, the switch 23 completes the feed circuit for the electromagnetic valve 20 at said position at the end of the downward stroke, this switch being actuated by an arm or the like 24 rigidly connected for translatory motion with one of the actuators (and therefore with the pressing element 7).

Each actuator may desirably be provided with a member for adjusting the stroke of its piston, this member consisting of a threaded rod 25*a*, 25*b*, 25*c*, 25*d*, respectively. This threaded rod is screw-threaded into a hollow sleeve, threaded inside, 26*a*, 26*b*, 26*c*, 26*d*, respectively, rigidly connected to the piston 2*a*, 2*b*, 2*c*, 2*d*, respectively, and secured to its bottom face or front face. Each piston rod 3*a*, 3*b*, 3*c*, 3*d* is provided at its upper portion with a groove 27*a*, 27*b*, 27*c*, 27*d* receiving a cog or rib of the pressure element and preventing said sleeve from being rotated by the threaded rod. Each threaded rod is provided at its lower portion with a head 29*a*, 29*b*, 29*c*, 29*d* adapted to abut upon downward motion of the pistons against a stationary member 28, for example a cross member or the like.

The rotary drive of each threaded rod with respect to the sleeve with which it is associated results in a variation in its useful length, that is the distance between its lower head and the piston, so that it forms an adjustable stop enabling to selectively set at will the bottom position of the pistons with respect to the stationary member 28 hence the strokes of these pistons.

The simultaneous rotary drive of the threaded rods 25*a*, 25*b*, 25*c*, 25*d* of the four actuators 1*a*, 1*b*, 1*c*, 1*d* is carried out by a single motor 30 rigidly connected to the pressing element 7. The motor 30 comprises sprocket wheels 36 and 37 which directly drive the rods 25*b* and 25*c* by means of sprocket chains 32 and 33, respectively, these sprocket chains meshing with sprocket wheels 38*b* and 38*c* rigidly connected to said rods 25*b* and 25*c*. The rods 25*b* and 25*c* drive the rods 25*a* and 25*d*, respectively, by means of the sprocket chains 34 and 35 which mesh with sprocket wheels 39*b*, 39*a* and 39*c*, 39*d* rigidly connected to the rods 25*b*, 25*a*, 25*c* and 25*d*, respectively.

The motor 30 may be an electric motor or a hydraulic motor.

It should be pointed out that these devices for adjusting the strokes of the pistons, which enable to push said pistons back upwards or downwards, may be used for operating the actuators which are operated mechanically in such a case.

FIGS. 2 and 3 show a punching or cutting press provided with the driving device shown in FIG. 1.

Said press comprises a stationary frame 40 provided at its upper portion with a carriage or slide 41 provided sidewise with lugs or the like 42 sliding in substantially horizontal and parallel slideways or like guides 43 rigidly secured to the stationary frame 40, so that said carriage 41 slides horizontally. The pressing element 7 consists of a working table also provided with lugs or the like 44 adapted to slide within vertical and parallel slideways or like guides 45 of the stationary frame.

The holder for the actuators consists of a crossmember 6 rigidly affixed to the frame 40 whereas the stationary member which limits the downward motions of the threaded rods 25*a*, 25*b*, 25*c*, 25*d*, hence the strokes of the pistons of the actuators, consists of a pair of crossmembers 28*a*, 28*b* also rigidly connected to the frame and lying in a common horizontal plane.

The switch 23 is secured to the crossmember 28*a* and is operated by the arm 24 rigidly connected for translatory motion (but rotatably) to the rod 25*b* of the actuator 1*b*, this switch closing the feed circuit for the electromagnetic valve 20 as soon as the four threaded rods come into engagement with the cross members 28*a* and 28*b*.

Instead of four actuators as in the case illustrated, any number of actuators higher than four could of course be provided or said number could be reduced within the device to three or even two associated actuators.

Likewise, although the actuators have been assumed to operate one single pressing element, it is obvious that several sets of actuators all hydraulically connected to each other according to the general principle of the invention and possibly fitted with adjustable stops mechanically connected to each other could be provided, each one of these sets of actuators driving a pressing element or the like.

It should be understood that the invention is not at all limited to the forms of embodiments described and shown which have been given by way of example only. In particular it comprises all the means forming technical equivalents to the means described as well as their combinations if the latter are carried out according to the gist of the invention.

What is claimed is:

1. In a hydraulic press having a reciprocally movable pressing element, a plurality, greater than two, of hydraulic power devices of the double-acting type for driving said pressing element in translatory motion, each one of said hydraulic power devices having an internal cavity with a reciprocally moving piston therein, said piston dividing said cavity into a front chamber and a rear chamber independent from each other, and a rod secured to said piston on one side thereof, said rod being operatively connected to said pressing element, a supply circuit for delivering a pressure fluid to said hydraulic power devices, hydraulic ducts hydraulically connecting said hydraulic power devices in series each intermediate hydraulic power device having its front chamber and its rear chamber connected to the rear chamber and to the front chamber, respectively, of the two hydraulic power devices with which it is associated by one of said ducts, the first and last hydraulic power device being connected to said supply circuit, said first by its front chamber and said last by its rear chamber, so that the driving of the piston of the first hydraulic power device by said pressure fluid causes the hydraulic power devices to be fed by each other and causes simultaneous sliding motion of their pistons, and makeup means for keeping constant the volume of hydraulic fluid contained in the front and rear chambers of each pair of series-connected hydraulic power devices, said makeup means including a makeup fluid tank and for each of said ducts a makeup valve means for controlling communication between each duct and said tank, and electromagnetic valve means operatively connected with each of said makeup valve means for establishing communication between said tank and each duct when the hydraulic power devices are not under pressure.

2. A hydraulic press according to claim 1, wherein said electromagnetic valve means has an electric feed circuit comprising a switch means for operating said electromagnetic valve means for placing each duct in communication with said tank when said pressing element reaches the end of its stroke.

3. A hydraulic press according to claim 1, wherein each one of said hydraulic power devices comprises a member for adjusting the stroke of its piston, said member consisting of a rotary threaded rod received in a likewise threaded sleeve rigidly connected to said piston and forming a stop member of adjustable length.

4. A hydraulic press according to claim 3, where a common motor means is rigidly connected to said pressing element and is operatively connected with said threaded rods for rotating the latter.

5. A hydraulic press according to claim 3, wherein said electromagnetic valve means has an electric feed circuit comprising a switch means for operating said electromagnetic valve means to place each duct in communication with said tank when said pressing element reaches the end of its stroke, said switch means including an arm connected nonrotatably to one of said rotary threaded rods for translatory motion therewith, and said arm of said switch means placing said switch means in a closed position when said pressing element reaches the end of its stroke.

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,640,211 Dated February 8,1972

Inventor(s) Vittorio Louis Bianchi

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Directly under the heading "Foreign Application Priority Data" the date should be --December 27,1968--.

Signed and sealed this 22nd day of August 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents