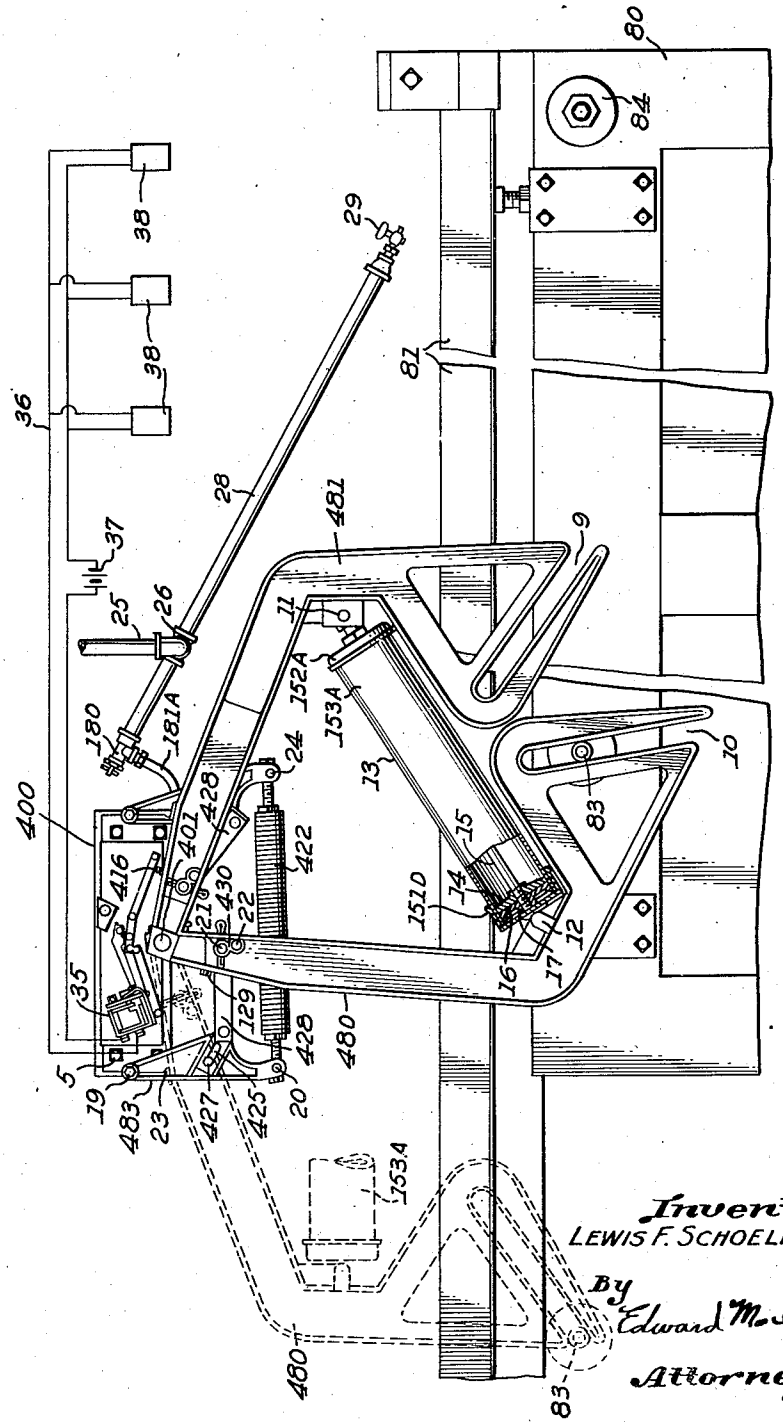
July 10, 1945. L. F. SCHOELKOPF 2,380,334

INERTIA DOOR OPERATING DEVICE

Filed June 7, 1941 2 Sheets-Sheet 1

Fig. 1



Inventor.
LEWIS F. SCHOELKOPF
By Edward M. Shealy
Attorney.

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Fig. 2

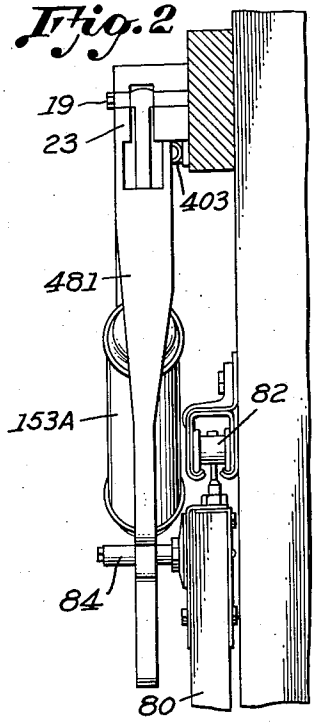


Fig. 3

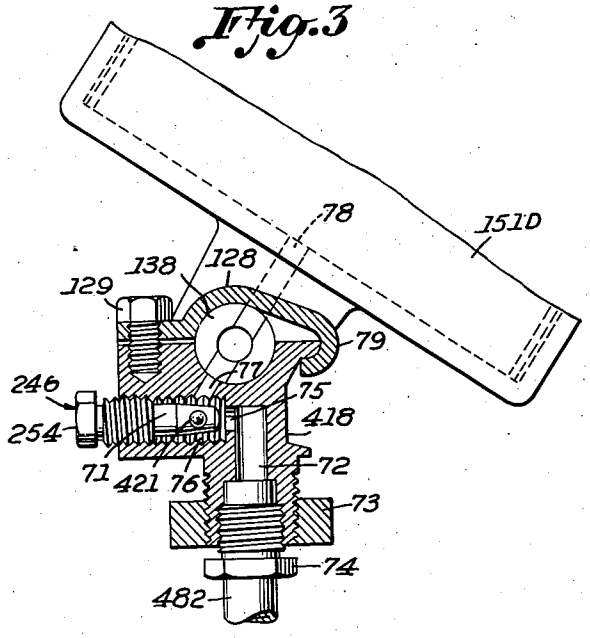
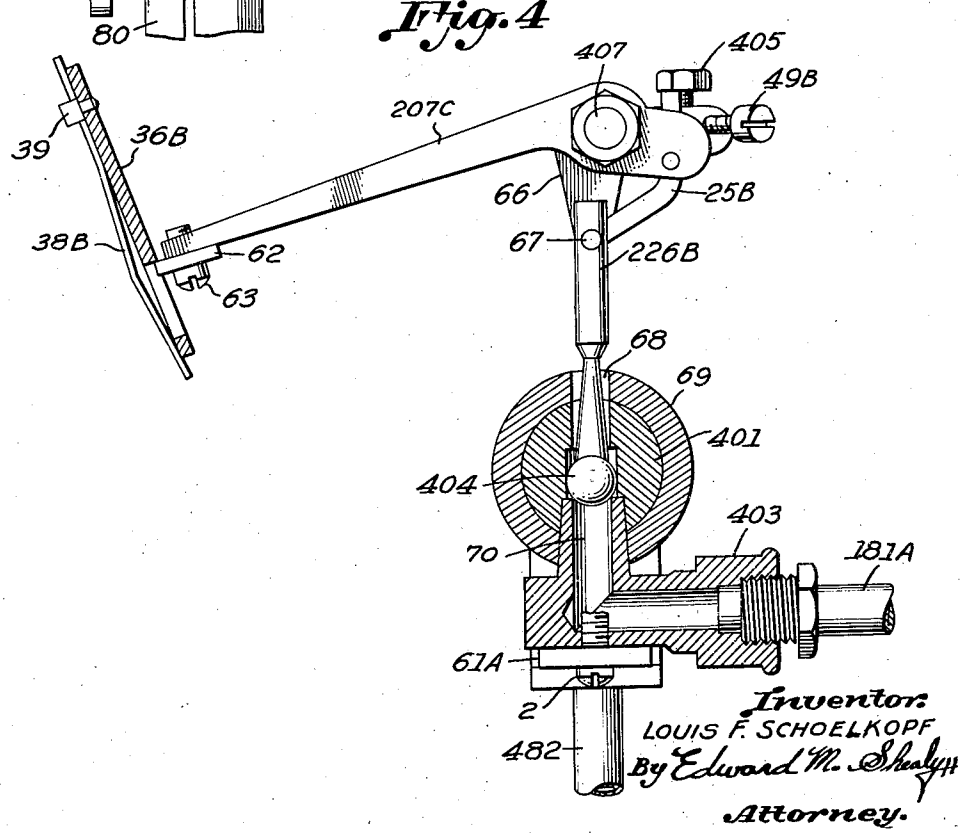


Fig. 4



Inventor:
LOUIS F. SCHOELKOPF
By Edward M. Shealy III
Attorney.

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INERTIA DOOR OPERATING DEVICE

Louis F. Schoelkopf, Madison, Wis.

Application June 7, 1941, Serial No. 396,991

7 Claims. (Cl. 268—50)

This invention relates generally to door operating devices and more specifically to door operating devices of the inertia type.

One of the objects of the present invention is to provide a door operating device having a remote control which may be easily operated to open or close doors, especially those of the sliding type.

A further object of the invention is to provide a sliding door operating device which is actuated pneumatically and mechanically, and controlled electrically from one or more remote points.

A further object of the invention is to provide a sliding door operating device which, while operating to open or close the door automatically, does not prevent the manual opening or closing of the door when desired.

A further object of the invention is to provide a sliding operating device with an air check which may be easily adjusted to cushion the opening and closing of the door and to prevent slamming thereof.

A further object of the invention is to provide a door operating device which may be used for other purposes than for opening and closing doors.

A further object of the invention is to provide a sliding door opening and closing device which is positive and safe in operation and which will be economical to operate and maintain.

A further object of the invention is to provide a door operating device in which the air control mechanism, electro-magnets, etc., are mounted upon portions of the frame of the machine.

A further object of the invention is to provide a sliding door operating device in which the application of force to open and close the door is direct and in which such force is applied for only a small fractional part of the door travel, that is, at the start and finish of the travel of the door.

A further object of the invention is to provide a door operating device which is of simple construction, is strong and durable and is well adapted for the purposes described.

With the above and other objects in view, the invention consists of the improved door operating device and its parts and combinations as set forth in the claims, and all equivalents thereof.

In the drawings which accompany and form a part of this specification and in which like parts throughout the several views are indicated by the same reference numerals:

Figure 1 is an inner side view of a sliding door and track with the improved door operating device of my invention in operative position, the starting position of the door operating device being shown in full lines and the disengaging position of the lever being shown in dotted lines, the view also showing the pneumatic connections, and in diagrammatic form the electrical circuit connections to the battery and remote control switches;

Figure 2 is an end view of Figure 1, showing in addition to the sliding door the track and door operating device, the door frame and one method of connecting the improved door operating device to a door.

Figure 3 is a detailed view in section of the door check valve assembly; and,

Figure 4 is a detailed view partly in section, of the door trip mechanism and inlet elbow.

Referring to the drawings in detail, the improved door operating mechanism shown throughout the several views comprises a main supporting bracket **400** which is designed for installation either against a wall or ceiling by any suitable means such as bolts or lag screws **5**.

Pivotally mounted on the bracket **400** is a pair of door engaging levers **480** and **481** secured to a main bearing pin **401** which in turn is secured in any suitable manner to the bracket **400**. Each door engaging lever terminates in post roller receiving slots **9** and **10**.

The levers **480** and **481** are interconnected with each other by means of an air cylinder **153A** pivotally mounted to the lever **481** at **11** and to the lever **480** at **12**, as is most clearly shown in Figure 1.

The air cylinder **153A** comprises a casing **13** closed at the ends by means of cylinder cap **152A** and cylinder head **151D**. A piston **14** is threadedly secured to the free end of a piston rod **15**, said piston rod extending through the cylinder cap **152A** and being pivotally secured to the lever **481** in any suitable manner as by means of pivot **11**. A flexible leather head **16** is provided adjacent the piston **14** and is secured in place by means of a nut **17**. The leather head provides an air tight joint within the casing **13**.

The lever **480** is connected to a main spring **422** through a spring lever **483** which comprises a main arm pivoted adjacent one end of the bracket **400** at **19** and pivotally connected to the main spring **422** at **20**. A secondary link **428** is pivotally connected to the lever **480** by means of a spring link main lever bearing pin **430**, which pin may be received in one of two holes **21** and **22**. The tension on the spring **422** is adjusted by connecting the secondary arm **428** to the lever

arm 480 in either of the two holes 21 or 22 provided therefor. The other end of the secondary link 428 is secured to a plate 425, which plate is adjustably held on the main arm 483 by means of a clamp screw 427. A lever stop 23 is cast integral with the main bracket 409 and acts to limit the clockwise movement of the lever 480 about the pin 401. The lever 481 is connected to the other end of the main spring 422 at 24 through a spring lever 483 comprising similar parts and operating in the same manner as heretobefore described with reference to lever 480, with the exception that the parts are arranged in mirrored image relationship to the lever 480.

A pipe line 25 extending to a source of air (not shown), is connected through a pipe T and elbow at 26 to a settling chamber 28 which is provided at the lower end with a blow-off cock 29, and at the upper end with an air adjusting valve or inlet valve 180. A pipe 181A made of any suitable material which may be readily bent, for example, copper tubing, extends from the inlet valve 180 to an inlet elbow shown most clearly in Figure 4 and indicated generally by the reference numeral 403. An electro-magnetically operated connecting valve indicated generally by the reference numeral 404 is operated by means of an electro-magnet 35 which is connected to an electric circuit 36 provided with a battery 37, or a transformer or other source of electrical energy, as a source of power, and a series of switches 38 which may be conveniently located throughout the building whereby the door operating mechanism may be easily operated from a plurality of remote points.

The electro-magnet 35 is provided with a magnet catch 36B. The magnet catch spring 38B located between the magnet catch and the magnet is held in position by means of a pin 39, the spring being of sufficient strength to hold the catch back against its stop (not shown) at all times. A magnet lever 207C is pivotally supported on the housing 400 by means of a threaded bearing stud 407 and is provided at the free end with a magnet catch engaging portion or trip catch 62 which is held in place by means of the bolt 63. If due to wear the trip catch 62 fails to lock behind the magnet catch 36B when both main levers 480—481 are in top position it may be adjusted by means of the adjusting screws 416 and 129.

Adjustably attached to magnet lever 207C is a spring 25B positioned by adjusting screw 405 and spring set screw 49B. The lower end of the spring forms a pivot which at 67 connects with a ball push rod 226B, the spring providing a yielding pressure on same. The lower end of the push rod 226B extends through an opening 68 in a housing 69 within which is positioned the main bearing pin 401.

The inlet elbow 403 is held in place with the main bearing pin 401 in the opening 68 by the inlet elbow clamp 61A and the screw 2. In this manner the inlet elbow 403 may be positioned to extend in any direction convenient for connection with the copper tubing 181A.

A connecting valve 404 is seated at the upper end 70 of the inlet elbow 403 and is held in place by the lower end of the push rod 226B, which is magnetically operated. The air is directed through a portion of main bearing pin 401 and through a tube 482 to the cylinder valve assembly 418 located adjacent one end of the cylinder 153A.

The valve assembly comprises a valve body 71 having a main air passageway 72 extending forwardly from a threaded pipe seat 73, to which seat the pipe 482 is secured by a means of a compression screw 74. Extending to one side of the air passage 72 is an aperture 75 opening into a threaded recessed portion 76 receiving the valve assembly 246.

The valve assembly 246 comprises a tapered lower end 254 which operates as a cage in which is received the air control ball 421. An air passage 77 extends from the recessed portion 76 to the vent pin 138 and is aligned with the transverse opening 78 under predetermined conditions of operation. The lower end of the cylinder head 151D carries a vent pin 138 which is held pivotally to valve assembly 418 by a vent pin clamp 128 which is locked to valve body 418 with a hook portion 79 and a screw 129, all as is most clearly shown in Figure 3. The air passage 78 extends from vent pin 138 through cylinder head 151D to inside of cylinder.

As is shown most clearly in Figures 1 and 2, a sliding type door indicated generally by the reference numeral 80, moves on a track 81 by means of the wheels 82. When the door operating mechanism is in the position shown by the solid lines in Figure 1, door rollers 83 and 84 are positioned on the door at a height sufficient to permit them being received in the door roller receiving slots 9 and 10.

The door operating device functions by closing any one of the switches 38 which causes the magnet catch 36B to move toward the electro-magnet 35, thereby releasing the trip catch 62 and lever 207C which is biased upwardly by means of the spring 25B. As the lever 207C moves upwardly the biasing energy of the spring 25B is released and the rod 226B allows the ball 404 to move away from the seat at 70, thus allowing air to enter the tube 482 and thence into the cylinder 153A through the valve assembly 418.

The air enters the passage 72 from the pipe 482 and then through the opening 75 into the valve assembly air regulating means 246, where under predetermined conditions of setting the air is permitted to enter the cylinder through the passageway 77, the opening 78 and into the cylinder 153A where the piston 14 is moved in such a manner as to move the door to the left relative to Figure 1 by means of the arm 480 acting on the door roller 83.

The door roller 83 disengages the slot 10 at the moment the arm 480 reaches the position indicated in broken lines, thereby allowing the door 80 to move in disengaged relation to the door operating mechanism. The inertia imparted to the door by means of arm 480 actuated by means of the cylinder 153A containing piston 14, is sufficient to move the door to the other end of its travel, and to permit engagement of the door roller 84 with the door roller receiving slot 9 in the lever arm 481.

As the door roller 84 engages the slot 9, the lever arm 481 which is connected to the piston rod 15, moves to the left relative to Figure 1, thus causing the piston 14 to also move to the left in the cylinder casing 153A. The valve assembly 246 regulates this last portion of the door travel and prevents slam. As the piston 14 moves to the left in the cylinder casing 153A the air is compressed due to the fact that it must pass through the relatively small opening 78 into the chamber 254 which is partially closed by means of the ball 421. While this ball 421 allows power air to pass freely, it is seated against the cage

254 for a cushioning action during the exhaust stroke, all as is most clearly shown in Figure 3 which shows the valve assembly 246 in exhaust stroke position. Thus the air confined in the cylinder 153A does not escape freely and as a result considerable pressure is built up in the cylinder 153A, the confined air acting as a cushion which allows the arm 481 to move into final position slowly, thus preventing the door from slamming. As the final air slowly escapes from the cylinder 153A, the door 80 gently comes to rest and the door operating mechanism is then in position to start the door operation in reverse direction. This reverse direction operation occurs when a switch 38 is closed and is exactly the same as that just described for the door moving to the left except that the door 80 moves from left to right relative to Figure 1. Thus, the same power stroke occurs when the switch 38 is closed, whereby the arm 481 moves the door roller 84 to the right where it is disengaged and the door continues to move to the right freely by its own inertia until the door roller 83 engages door roller receiving slot 10 in lever arm 480, whereupon the same cushioning action of confined air in the cylinder 153A is employed to gently check the movement of the door until it finally comes to rest in the position shown by solid lines in Figure 1. The parts are then once more in position to again operate door 80.

After door roller 83 has left door roller receiving slot 10 of main lever 480 this lever is held in the "up" position by the main spring 422 exerting its pull against spring lever 483, the link 428 pivoted in hole 21 or 22 being just slightly over dead center. The same is true with respect to door roller 84, door roller receiving slot 9 and lever 481 in the "up" position being held up, by the spring and the over dead center position of the links. This condition makes it possible for a slight downward pressure of door roller 83 in slot 10, or door roller 84 in door roller receiving slot 9, to push the main lever 480 or 481 easily off the dead center position after which the main spring 422 takes hold and carries either main lever downward to the end of its travel, with the entire force of the main spring 422, the motion being controlled by valve assembly 246 regulating the escape of exhaust air and thereby the inward motion of the piston 14.

By the foregoing description it will be readily apparent that the invention provides a simple and unique inertia door operating mechanism providing means for opening and closing sliding doors, as desired, from points remote from said door. While preferred and practical embodiments of the invention have been shown and described, it will be readily apparent to those skilled in the art to which this invention pertains that various changes may be made in the precise structures shown without departing from the spirit of my invention or from the scope of the appended claims.

It is also apparent that my inventive concept may be applied to other and further uses without departing from the spirit of my invention or scope of the appended claims.

Having thus described and shown my invention, what I claim and desire to secure by Letters Patent is:

1. In an inertia door operating device, an air engine, lever arms connected to the opposite ends of said air engine, said lever arms being pivotally connected together at one end, the opposite end of each lever arm terminating in a door roller receiving slot adapted to receive door rollers affixed to a sliding door, the operation of said air engine moving said door through the aforesaid lever arms and door rollers thereby imparting inertia to said door to enable it to open or shut.

2. In an inertia door operating device, an air engine, lever arms connected to the opposite ends of said air engine, said lever arms being pivotally connected together at one end, the opposite end of each lever arm terminating in a door roller receiving slot adapted to receive door rollers affixed to a sliding door, the operation of said air engine moving said door through the aforesaid lever arms and door rollers thereby imparting inertia to said door to enable it to open or shut, and a ball check on said air engine preventing the said door from slamming by means of a door roller engaging the door roller receiving slot of the other lever arm

3. In an inertia door operating device for opening and closing sliding doors, the combination of a door, door rollers on said door, oppositely arranged lever arms pivotally connected together at one end and each terminating in a door roller receiving slot at the opposite end, an air engine, the opposite ends of said air engine being connected to the aforesaid lever arms, a source of air connected to said air engine by means of an electro-magnetically operated connecting valve which is actuated by means of electric switches placed at points remote from said door, whereby the said air engine imparts sufficient inertia to said door through the aforesaid lever arms to which it is connected, that said door is moved to open or shut position, and a ball check on said air engine to prevent said door from slamming by means of a door roller on said door engaging the other lever through its door roller receiving slot.

4. In an inertia door operating device for opening and closing sliding doors, the combination of a door having door rollers affixed thereto, an air engine, lever arms connected to the opposite ends of said engine, said lever arms being pivotally connected together at one end by means of a bearing pin attached to a frame member, the opposite end of each lever arm terminating in a door roller receiving slot adapted to receive the aforesaid door rollers, said lever arms also being connected to a main spring through a spring lever mechanism, a source of air connected to said air engine through a supply pipe and an electromagnetically operated connecting valve which is actuated by means of electric switches and which is adapted to pass air through to said air engine when one of the said electric switches is closed, said air engine thereupon operating to move one of said lever arms to which it is connected, said lever arm in turn moving said door by means of the said door roller received in the said door roller receiving slot of said lever arm, whereby inertia is imparted to said door to enable it to open or shut, and a ball check on said air engine to prevent said door from slamming by means of a door roller engaging the door roller receiving slot of the other lever arm.

5. An inertia door operating device comprising: an air engine, lever arms connected to the opposite ends of said engine said lever arms being pivotally connected together by means of a bearing pin attached to a frame member, the opposite end of each lever arm terminating in a door roller receiving slot, said lever arms also

being connected to a spring member by a spring lever mechanism, a source of air connected to said air engine by means of a connecting valve which is electromagnetically operated by means of electric switches placed at points remote from said door, said connecting valve being adapted to pass air therethrough when one of said switches is closed whereby said air engine actuates one of said lever arms thereby imparting inertia to said door to enable it to open or shut, and a ball check on said air engine to prevent said door from slamming by means of a door roller engaging the other lever arm through said door roller receiving slot.

6. An inertia door operating device comprising an air engine, lever arms connected to the opposite ends of said engine, said lever arms being pivotally connected together at one end by means of a bearing pin attached to a frame member, the opposite end of each lever arm terminating in a door roller receiving slot formed therein, said lever arms being also connected to a main spring through a spring lever mechanism, a source of air connected to said air engine and having an inlet elbow and connecting valve electromagnetically operated by means of an electromagnet adapted to be actuated when any one of a plurality of electric switches placed at points remote from said door operating device is closed to allow an electric current to pass through said electromagnet, said electromagnetically operated inlet elbow and connecting valve being adapted to pass air therethrough when one of said switches is closed, to operate said air engine, whereby inertia is imparted to said door through one of said lever arms to enable said door to open or shut under its own inertia, and a ball check on said air engine operating to prevent said door from slamming by means of a door roller engaging the other lever arm through the door roller receiving slot in said lever arm.

7. An inertia door operating device comprising: an air engine, lever arms connected to the opposite ends of said air engine, said lever arms being pivotally connected together at one end, the opposite end of each lever arm terminating in a door roller receiving slot adapted to receive door rollers affixed to a sliding door, the operation of said air engine moving said door through the aforesaid lever arms and door rollers thereby imparting sufficient inertia to said door to enable it to travel under its own inertia until the other door roller engages the door roller receiving slot of the opposite lever arm whereupon a spring swings that lever arm down thus completing the travel of the door to open or shut position while a ball check on said air engine prevents slamming of the door.

LOUIS F. SCHOELKOPF.