Feb. 16, 1943. E. M. PFAUSER 2,311,468

HYDRAULIC PUMP ASSEMBLAGE

Original Filed Oct. 21, 1939

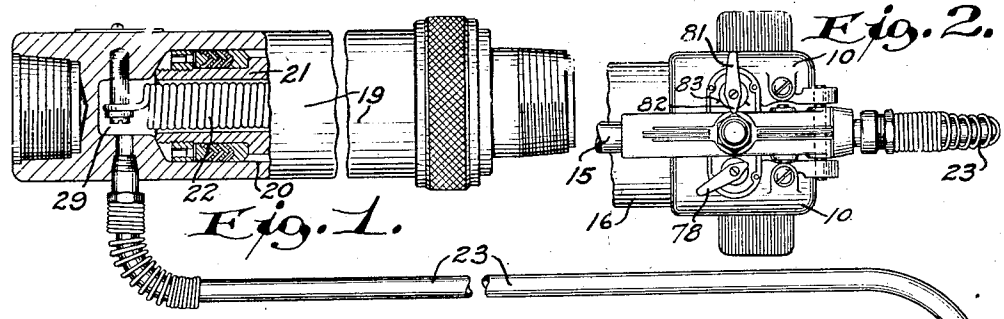
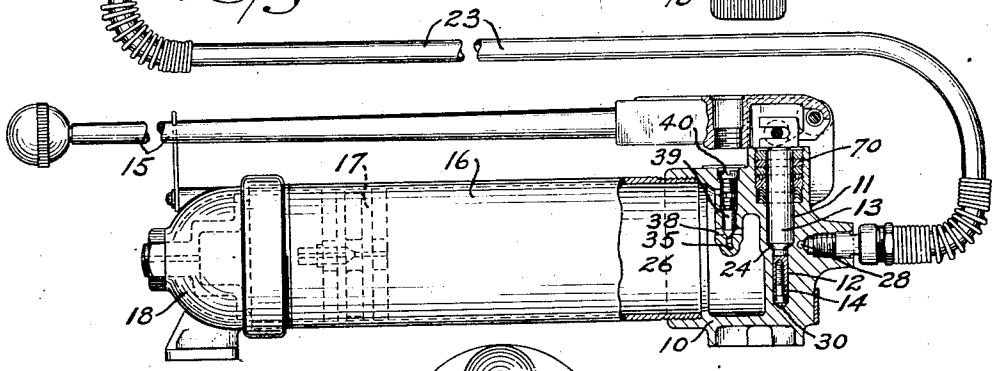


Fig. 1.

Fig. 2.



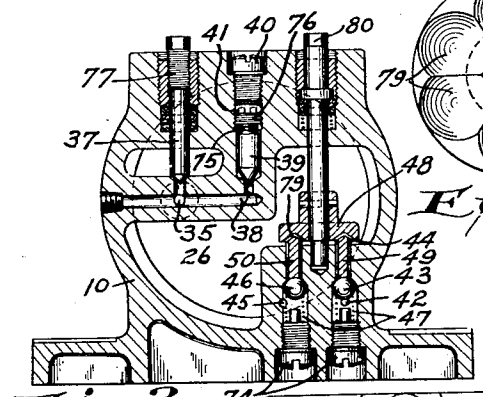


Fig. 3.

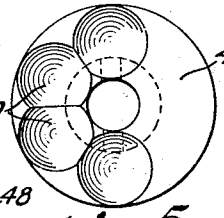


Fig. 5.

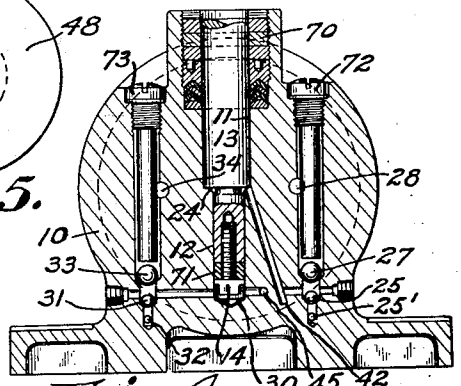


Fig. 4.

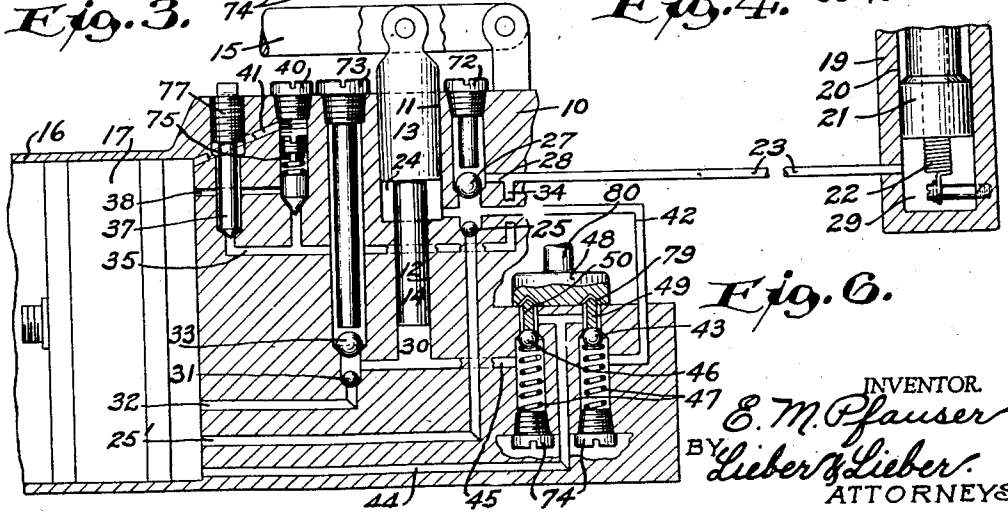


Fig. 6.

INVENTOR.
E. M. Pfauser
BY Lieber & Lieber.
ATTORNEYS.

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HYDRAULIC PUMP ASSEMBLAGE

Edward M. Pfauser, Elm Grove, Wis., assignor to Blackhawk Mfg. Co., Milwaukee, Wis., a corporation of Wisconsin

Original application October 21, 1939, Serial No. 300,501. Divided and this application August 6, 1941, Serial No. 405,664

6 Claims. (Cl. 103—41)

The present invention relates generally to improvements in hydraulic systems of the type having a pump operable to withdraw liquid from a reservoir and to deliver the liquid under pressure to a hydraulically actuated device, and also embodying control means for effecting direct return of the liquid from the device to the reservoir; and this application is a division of my application Serial No. 300,501, filed October 21, 1939, now Patent No. 2,255,984, granted September 16, 1941.

An object of the present invention is to provide an improved hydraulic pump assemblage which is simple and compact in construction, and which is also highly efficient and flexible in use.

It has heretofore been common practice to utilize hydraulic power systems, each comprising a portable pump and supply reservoir unit, connected by flexible tubing to an independently portable ram or jack assemblage, for the purpose of performing various operations with the jack. In this type of portable power equipment, the liquid supply reservoir is usually associated directly with the pump which is ordinarily manually operable and is adapted to withdraw liquid from the reservoir and to deliver the same under pressure through the connecting tubing to the remotely located jack; and the pump is customarily provided with a by-pass valve for permitting return of liquid directly from the ram or jack to the reservoir independently of the pump displacement chamber. In these prior power systems, it has heretofore been customary to provide for only one speed or uniform displacement by the pump when the piston was being operated at any predetermined speed, and this feature is objectionable when operating the device in cramped quarters, since it does not permit most effective delivery of liquid at the desired pressure to the ram or jack, with minimum effort on the part of the operator.

It is therefore a more specific object of my present invention, to provide various improvements in the construction and operation of hydraulic jack or ram systems, whereby the pump may be readily operated or manipulated to produce the best results under varying conditions of operation.

Another specific object of this invention is to provide an improved combined pump and jack assemblage wherein the operation of the pump may be quickly and effectively varied to actuate the jack plunger or ram at different selected speeds, and with different predetermined pressures acting thereon.

A further specific object of the present invention is to provide a new and useful reciprocable hydraulic pump, and improved means for controlling the operation thereof.

Still another specific object of my invention is to provide various improvements in portable hydraulic pump and jack systems, whereby the construction thereof is simplified, the operation is facilitated, and the utility is enhanced to the maximum.

These and other specific objects and advantages of the invention will appear in the course of the following description.

A clear conception of the several features constituting the present improvement, and of the mode of constructing and of utilizing pump-jack hydraulic systems built in accordance with the invention, may be had by referring to the drawing accompanying and forming a part of this specification wherein like reference characters designate the same or similar parts in the various views.

Fig. 1 is a somewhat fragmentary and part sectional view of a complete hydraulic pump actuated jack system, partial central longitudinal central sections having been taken through the pump, supply reservoir, and jack.

Fig. 2 is a top view of the pump and of a fragment of the liquid supply reservoir of the system of Fig. 1;

Fig. 3 is an enlarged transverse vertical section through the pump, taken centrally of the by-pass and system filling valves;

Fig. 4 is another enlarged transverse section through the pump, taken centrally through the pump displacement chambers;

Fig. 5 is a further enlarged plan view of the rotary control cam for the hydraulic system; and

Fig. 6 is a diagram showing the various elements of the system disposed in a common plane.

While the improvement has been shown and described herein as being specifically embodied in a three-speed hydraulic pump and jack system wherein the liquid supply reservoir is directly connected to the pump, it is not my desire or intent to thereby unnecessarily restrict the scope or utility of the invention.

Referring to the drawing, the improved portable hydraulic power unit or system comprises in general, a manually operable three-speed liquid pump having a casing 10 provided with large and small adjoining bores 11, 12 respectively within which large and small integrally united alined pistons 13, 14 are simultaneously reciprocable by means of a common actuating handle 15; a liquid

supply reservoir consisting of a tubular casing 16 secured to one side of the pump casing 10 and having therein a floating wall 17, the reservoir also being provided with a closure cap 18; a hydraulic ram or jack having a cylinder 19 provided with a bore 20, and a plunger 21 movable in one direction within the bore by liquid under pressure and being returnable by means of a helical tension spring 22; a flexible conduit 23 connecting the ram cylinder 19 with the opposite side of the pump casing 10; and valves for controlling the flow of liquid from the reservoir to the pump, from the pump to the jack, and from the pump and jack back to the reservoir.

The improved pump is of the three-speed type, adapted to either actuate the jack at high speed with minimum power, or at moderate speed with greater than minimum but less than maximum power, or at low speed with maximum power. This pump assemblage is shown diagrammatically in Fig. 6, and it is to be noted that the large diameter piston 13 has a displacement chamber 24 which is communicable past a suction valve 25 and through a conduit or suction port 25' with the liquid chamber 26 of the supply reservoir casing 16, and which is also communicable past a discharge valve 27 and through a port 28 with the flexible conduit 23 leading to the plunger displacement chamber 29 of the jack. The small diameter pump piston 14 has a displacement chamber 30 which is communicable past a suction valve 31 and through another conduit or suction port 32 with the liquid supply chamber 26, and which is also communicable past a discharge valve 33 and through a port 34 with the flexible conduit 23 and chamber 29. The jack displacement chamber 29 and flexible conduit 23 are communicable through the port 34 and a passage 35 and past a manually operable relief valve 37, through another passage 38 directly with the supply chamber 26, and the passage 38 connects with the passage 35 in advance of the relief valve 37, and has an automatic safety release valve 39 located therein. Above the safety valve 39 is located a removable filler plug 40 upon removal of which fresh liquid such as oil may be introduced into the system through a conduit 41.

The piston displacement chamber 24 and the space between the suction and discharge valves 25, 27 of the larger pump section, is communicable through a passage 42 and past a check valve 43, with a conduit 44 which is in open communication with the supply chamber 26. The piston displacement chamber 30 and the space between the suction and discharge valves 31, 33 of the smaller pump section, is likewise communicable through a passage 45 and past a check valve 46 with the supply chamber 26 through the conduit 44. The by-pass or check valves 43, 46 are pressed toward their seats by springs 47 but may be positively lifted against the spring and fluid pressure acting thereon by means of a manually adjustable rotary cam disk or block 48 coacting with lifting pins 49, 50 which are engageable with the by-pass valves 43, 46 respectively. The by-pass assemblage is obviously such that either of the valves 43, 46 may be open, or both valves may be closed. When both valves 43, 46 are closed as in the diagram of Fig. 6, and with the relief valve 37 also closed, operation of the pump pistons 13, 14 will cause liquid to be delivered from the supply chamber 26 to the jack by both pistons thus producing maximum speed; whereas if the valve 43 alone is open, the large piston 13 will be inactive thus producing minimum speed; while opening of the valve 46 alone will make the small piston 14 inactive thus producing intermediate speed. When the relief valve 37 is open so as to connect the conduit 23 with the chamber 26 the spring 22 acting upon the plunger 21 will cause this plunger to force the liquid from the chamber 29 into the chamber 26 thereby causing the wall 17 to move away from the pump, regardless of the position of the jack or of the pump.

The large piston 13 may be packed by means of sealing rings 70 as shown in Figs. 1 and 4, and the small piston 14 may be sealed against leakage by a packing ring 71, so that no liquid can ordinarily escape from the chamber 24 to atmosphere, or from the chamber 30 to the chamber 24. The valves 25, 27, 31, 33, 43, 46 are all of the ball type, but need not necessarily be of this specific type, and the pump valves 25, 27 are confined within their zone of action and are accessible by means of a removable spacer 72, while the pump valves 31, 33 are similarly confined by a removable spacer 73, see Figs. 2, 4 and 6. The valves 43, 46 and springs 47 are normally confined by removable plugs 74 shown in Figs. 3 and 6; and the safety relief valve 39 is normally held to its seat by a spring 75 the tension of which is adjustable by means of a screw plug 76, see Figs. 3 and 6. The by-pass or pressure release valve 37 has a spindle provided with a threaded portion 77 coacting with threads on the casing 10, and is operable from the exterior of the pump casing by a handle or lever 78, see Fig. 2. The by-pass valve actuating disk cam 48 is located directly within the liquid supply chamber 26 as indicated in Fig. 3; and has a series of detents 79 on one face thereof, which are adapted to coact with the valve lifting pins 49, 50 when the cam 48 is rotated, so as to either open one valve 43, 46 only, or to open both of these valves, or to permit the springs 47 to close both valves. The circular cam 48 is secured to a central actuating stem 80 which is journalled in and extends outwardly of the casing 10, and is provided with a handle or lever 81 having a pointer 82 adapted to cooperate with indications 83 as shown in Fig. 2.

During normal use of the improved hydraulic apparatus, the reservoir chamber 26, pump displacement chambers and ports, conduit 23, and jack displacement chamber 29 should first be completely filled with suitable liquid such as oil, which may be admitted to the system upon removal of the plug 40 and through the port 41. When the system is being thus filled with oil, the reservoir tube 16 should be so positioned that the central passage through the floating wall 17 is at the highest point, and a vent plug in this wall should be opened so as to permit free escape of all air from the hydraulic chambers, passages and conduits. If the plug 40 has been restored and the vent has been closed, and with the jack plunger 21 in retracted position as shown in Fig. 1, the floating wall 17 should assume a position substantially as shown in Fig. 1 and the chamber 26 should contain an abundance of liquid sufficient to fully expand the jack. The jack plunger 21 may then be moved outwardly within the cylinder 19 at three different speeds and with correspondingly different powers. Assuming the rotary cam 48 to be set as shown in Fig. 6 wherein both relief valves 43, 46 are in closed position, oscillation of the handle 15 to reciprocate both pump pistons 13, 14, will cause both of these pistons to be effective to withdraw liq-

uid from the chamber 26 and to discharge the same through the conduit 23 to the jack displacement chamber 29, thereby causing the plunger 21 to move outwardly at maximum speed. The reciprocating large piston 13 will during its outward stroke, draw liquid through the passage 25' past the suction valve 26, and during the return stroke of the piston the liquid previously introduced into the displacement chamber 24 will be discharged past the valve 27 and through the passage 28 and conduit 23 to the jack chamber 29. During the outward stroke of the piston 14, liquid will be withdrawn from the chamber 29 through the passage 32 and past the suction valve 31, and upon the return stroke the liquid thus admitted to the chamber 30 will be discharged past the valve 33 through the passage 34 and conduit 23 to the chamber 29. During such reciprocation of the pump pistons, the return valve 37 will, of course, be closed, and the safety valve 39 will also remain closed unless the pressure in the chamber 29 becomes excessive, whereupon the valve 39 will automatically open and will permit liquid to escape through the passage 38 to the chamber 26. With both pistons 13, 14 thus reciprocating, the jack plunger 21 will be moved outwardly at the maximum speed due to the combined action of both the large and small pump.

If the disk cam 48 is rotated so as to remove the valve 46 from its seat, reciprocation of the two pistons 13, 14 will cause the large piston 13 alone to become active in delivering liquid under pressure to the chamber 29. The small piston 14 will not under such conditions of operation withdraw liquid from the chamber 26, and if liquid should enter the displacement chamber 30, this liquid will merely be returned to the chamber 26 past the open valve 46 and through the passages 45, 44. If the other relief valve 43 is opened by manipulation of the disk cam 48, and the valve 46 remains closed, then the piston 14 alone will be effective in delivering liquid to the jack displacement chamber 29. The large piston 13 will not under such conditions withdraw liquid from the chamber 26, and any liquid which may be confined in the displacement chamber 24 will be returned to the chamber 26 through the passages 42, 44. When the large piston 13 is active alone, then the jack plunger 21 is being moved outwardly at an intermediate speed and with somewhat reduced power; but when the small piston 14 alone is active, then the jack plunger 21 is being moved outwardly at minimum speed but with maximum power. If the rotary cam 48 is adjusted so as to open both valves 43, 46, operation of the pump will produce no movement of the jack plunger 21. If the return valve 37 is opened, the spring 22 of the jack will immediately become effective to return the plunger 21 to retracted or inactive position, and the plunger 21 will then force liquid from the chamber 29 through the conduit 23 and passages 34, 35 into the chamber 26.

From the foregoing detailed description it will be apparent that the improved pump is conveniently manipulable and operable to cause the jack plunger 21 to move outwardly at three different speeds. During the suction stroke of each pump piston 13, 14 liquid is, of course, withdrawn from the chamber 26, and the reduced pressure caused by these suction strokes, combined with the atmospheric pressure acting upon the side of the wall 17 remote from the chamber 26, will cause the movable wall 17 to constantly advance toward the pump and to maintain an abundant supply of liquid for the pump regardless of the disposition thereof. However, when the return valve 37 is opened the spring 22 which positively returns the jack plunger 21 to retracted position, immediately becomes effective to force the excess liquid back into the chamber 26, thereby forcing the wall 17 away from the pump in opposition to the atmospheric pressure acting thereon. This action of the jack plunger 21 is positive and takes place regardless of the disposition of the jack, thereby insuring return of the liquid to the chamber 26 irrespective of the position of any of the elements. Both the cam 48 and the return valve 37 are conveniently manipulable from the exterior of the pump casing 10, and all parts of the assemblage while being well protected during normal use, are readily accessible for inspection. The relief valve 39 prevents damage to delicate parts in case the jack is overloaded, and the entire unit is obviously simple and compact in construction and can be readily manipulated by a novice, and the combined pump and jack system has proven highly successful in actual commercial use.

It should be understood that it is not desired to limit this invention to the exact details of construction or to the precise mode of use, herein shown and described, for various modifications within the scope of the claims may occur to persons skilled in the art.

I claim:

1. In a hydraulic pump, a casing having alined concentric bores of different diameters disposed centrally of said casing, a pair of alined pistons snugly coacting with said bores to provide independent displacement chambers of different capacity, a liquid supply reservoir for said chambers rigidly attached to said casing and projecting laterally from one end of the casing and away from said bores, a lever pivotally suspended from said casing and being swingable toward and away from said reservoir to simultaneously reciprocate said pistons, a liquid discharge and return line connected to the other end of said casing remote from said reservoir, a set of inlet and outlet valves for controlling the admission of liquid from said reservoir to each of said chambers and from said chambers to said discharge line, a liquid by-pass valve confined within said casing on one side of said bores and being operable to return liquid directly from said line to said reservoir, and a pair of control valves confined within said casing on the other side of said bores and being co-operable with said sets of inlet and outlet valves to cause either or both of said pistons to deliver liquid to said line.

2. In a hydraulic pump, a casing having alined concentric bores of different diameters disposed centrally of said casing, a pair of alined pistons snugly coacting with said bores to provide independent displacement chambers of different capacity, a liquid supply reservoir for said chambers rigidly attached to said casing and projecting laterally from one end of the casing and away from said bores, a lever pivotally suspended from said casing and being swingable toward and away from said reservoir to simultaneously reciprocate said pistons, a liquid discharge and return line connected to the other end of said casing remote from said reservoir, a set of inlet and outlet valves for controlling the admission of liquid from said reservoir to each of said chambers and from said chambers to said discharge line, a liquid by-pass valve confined within said casing on one side of said bores and being operable to return liquid directly from said line to said reservoir, a pair of

similar control valves confined within said casing on the other side of said bores, and cam means for either independently or simultaneously opening said control valves to cause either or both of said sets of inlet and outlet valves and the corresponding plungers to deliver liquid from said reservoir to said line.

3. In a hydraulic pump, a casing having alined concentric bores of different diameters disposed centrally of said casing, a pair of alined pistons snugly coacting with said bores to provide independent displacement chambers of different capacity, a liquid supply reservoir for said chambers rigidly attached to said casing and projecting laterally from one end of the casing and away from said bores, a lever pivotally suspended from said casing and being swingable toward and away from said reservoir to simultaneously reciprocate said pistons, a liquid discharge and return line connected to the other end of said casing remote from said reservoir, a set of inlet and outlet valves for controlling the admission of liquid from said reservoir to each of said chambers and from said chambers to said discharge line, a liquid by-pass valve confined within said casing on one side of said bores and being operable to return liquid directly from said line to said reservoir, a control valve interposed between each of said displacement chambers and said reservoir for controlling the opening of said outlet valves by pressure created by said plungers, and cam means for independently opening said control valves or for permitting simultaneous closure thereof to cause either or both of said valve sets and the corresponding plungers to deliver liquid from said reservoir to said line.

4. In a hydraulic pump, a casing having alined concentric bores of different diameters disposed centrally of said casing, a pair of alined pistons snugly coacting with said bores to provide independent displacement chambers of different capacity, a liquid supply reservoir for said chambers secured to one end of said casing, a lever pivotally suspended from said casing and being swingable to simultaneously reciprocate said pistons, a liquid discharge and return line connected to the other end of said casing remote from said reservoir, a set of inlet and outlet valves for controlling the admission of liquid from said reservoir to each of said chambers and from said chambers to said discharge line, a manually operable liquid by-pass valve operable to return liquid directly from said line to said reservoir, a manually operable control valve interposed between each of said displacement chambers and said reservoir for controlling the opening of the corresponding outlet valves, and means for selectively opening said control valves.

5. In a hydraulic pump, a casing having alined concentric bores of different diameters disposed centrally of said casing, a pair of alined pistons snugly coacting with said bores to provide independent displacement chambers of different capacity, a liquid supply reservoir for said chambers secured to one end of said casing, a lever pivotally suspended from said casing and being swingable to simultaneously reciprocate said pistons, a liquid discharge and return line connected to the other end of said casing remote from said reservoir, a set of inlet and outlet valves for controlling the admission of liquid from said reservoir to each of said chambers and from said chambers to said discharge line, a manually operable liquid by-pass valve operable to return liquid directly from said line to said reservoir, a manually operable control valve interposed between each of said displacement chambers and said reservoir for controlling the opening of the corresponding outlet valves, and a single manually rotatable cam for independently opening said control valves or for permitting simultaneous closure thereof to cause either or both of said valve sets and the corresponding plungers to deliver liquid from said reservoir to said line.

6. In a hydraulic pump, a casing having alined concentric bores of different diameters disposed centrally of said casing, a pair of alined pistons snugly coacting with said bores to provide independent displacement chambers of different capacity, a liquid supply reservoir for said chambers secured to one end of said casing, a lever pivotally suspended from said casing and being swingable to simultaneously reciprocate said pistons, a liquid discharge and return line connected to the other end of said casing remote from said reservoir, a set of inlet and outlet valves for controlling the admission of liquid from said reservoir to each of said chambers and from said chambers to said discharge line, a manually operable liquid by-pass valve operable to return liquid directly from said line to said reservoir, a manually operable control valve interposed between each of said displacement chambers and said reservoir for controlling the opening of the corresponding outlet valves, and a single manually rotatable cam for independently opening said control valves or for permitting simultaneous closure thereof to cause either or both of said valve sets and the corresponding plungers to deliver liquid from said reservoir to said line, said by-pass valve being confined within said casing on one side of said chambers and said control valves being confined within the casing on the opposite side of said chambers.

EDWARD M. PFAUSER.