April 27, 1937. G. A. GAGE 2,078,322

OIL WELL PUMP

Filed Dec. 26, 1935

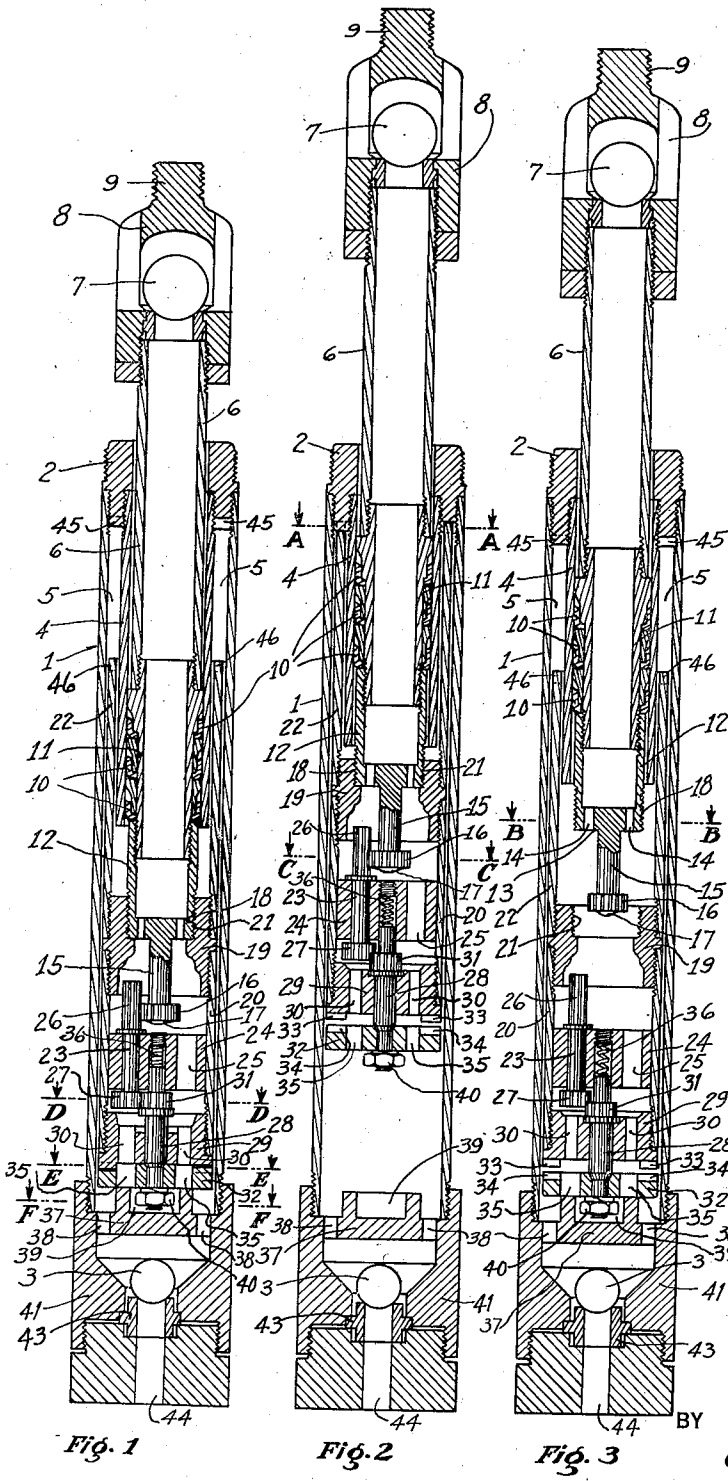


Fig. 1

Fig. 2

Fig. 3

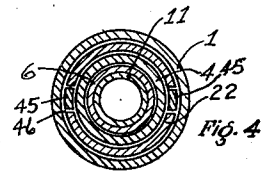


Fig. 4

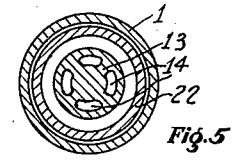


Fig. 5

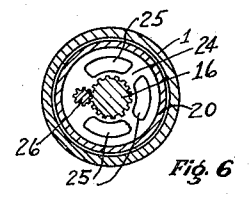


Fig. 6

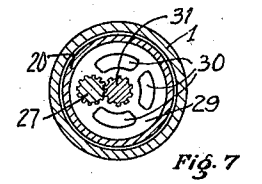


Fig. 7

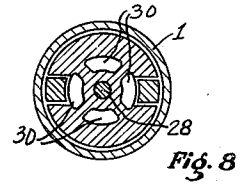


Fig. 8

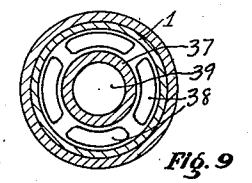


Fig. 9

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OIL WELL PUMP

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9 Claims. (Cl. 103—10)

My invention relates to new and useful improvements in oil well pumps and in pipe connecting and disconnecting mechanisms for said pumps which mechanism may also be used for tubing or rods or other devices in wells where the connection is a threaded connection, and has for its objects; to provide a sucker rod operated oil well pump capable of being changed while in position in the well to pump a large volume or a small volume of fluid with the same length stroke, with the change being made by operating the sucker rods; and to provide in such a pump or in any well device, a mechanism for screwing or unscrewing a threaded coupling with which either operation may be performed by turning one of the threaded connections in the same direction.

In pumping wells by the use of sucker rods it sometimes happens that it is desired for a short period of time to pump a large volume of fluid and then to continue pumping a smaller volume, and in such cases the present practice is to substitute a pump of one capacity for another of a different capacity, or to increase or lessen the speed of the stroke or the distance of its travel, any of which practices has its well known disadvantages, to obviate which I have provided a pump as aforesaid, a description of which is herein set forth in detail.

In making a pipe or rod or tool connection in a well thru a threaded coupling or screw joint which depends upon being turned by a string of threaded members screwed together in order to repeatedly couple and uncouple a connection, it has been possible to screw the connection together with certainty because the screw connections throughout the string run with each other, that is, would be all right hand threads, but in attempting to unscrew the connection by turning the string in the opposite direction, there would be no assurance that any coupling of the string might not be unscrewed, and nothing has heretofore been devised to prevent such an occurrence. In my pump I have devised means whereby such difficulty may be overcome, and make use of the device in screwing and unscrewing a threaded connection therein to change its pumping capacity as will hereinafter be disclosed.

With the above and other objects in view which will appear as the description proceeds, my invention consists in the novel features hereinafter set forth in detail, illustrated in the accompanying drawing and more particularly pointed out in the appended claims.

Referring to the drawing in which numerals of like character designate similar parts throughout the several views;

Fig. 1 is a view of my pump in longitudinal cross section and showing my coupling mechanism therein chiefly in elevation, although certain portions thereof are shown in cross section; and in which view the pump is shown in readiness to serve as a large volume pump with the pump plunger in position where the coupling actuated by said coupling mechanism is coupled or is capable of being coupled.

Fig. 2 is a view of said pump in longitudinal cross section with said coupling mechanism therein chiefly shown in elevation, although certain portions thereof are shown in cross section; and in which view the pump is shown in readiness to serve as a large volume pump with the pump plunger in position where the coupling actuated by said coupling mechanism is uncoupled or is capable of being uncoupled.

Fig. 3 is a view of said pump in longitudinal cross section with said coupling mechanism therein shown chiefly in elevation, although certain portions thereof are shown in cross section; and in which view the pump is shown in readiness to serve as a small volume pump with the plunger head of the large volume pump detached from the plunger of the small volume pump.

Fig. 4 is a view of the pump in cross section on line A—A of Fig. 2 and showing the uncoupling lock.

Fig. 5 is a view of the pump in cross section on line B—B of Fig. 3, and showing the spider on which the driving pinion for operating the coupling and uncoupling mechanism is rigidly affixed to the coupling member which serves as the driving member for actuating the aforesaid mechanism.

Fig. 6 is a view of the pump in cross section on line C—C of Fig. 2, and showing the driving pinion aforesaid in mesh with a driven pinion on a counter shaft gear rotably mounted in a spider.

Fig. 7 is a view of the pump in cross section on line D—D of Fig. 1, and showing the driving pinion of the aforesaid counter shaft gear in mesh with a driven pinion positioned on a shaft run through the plunger head of the larger capacity pump and rotable therein and which said shaft is rigidly affixed to a clutch member which coacts with said plunger head when the coupling aforesaid is to be coupled, and which otherwise is in disengagement with said plunger head.

Fig. 8 is a view of the pump in cross section on line E—E of Fig. 1, showing the clutch member aforesaid.

Fig. 9 is a view of the pump in cross section on line F—F of Fig. 1, showing the cooperative rest member wherewith said clutch member is brought into engagement with the aforesaid plunger head of the large capacity pump.

The pump or dual pump is a reciprocating sucker rod operated pump and consists generally of a complete large volume pump in which there is a large pump cylinder having therein a large pump plunger, and a complete small volume pump in which there is a small pump cylinder

having therein a small pump plunger, and with the complete dual pump structure being so arranged that it is possible to contain one pump within the other and to transfer the power transmitted thru the pump rods from one pump to the other without removing the pump from its operating position in the well. Certain parts of the structure are common to both pumps, and the power transferring mechanism and connections wherewith the power may be transferred from one pump to the other is located on the pump plungers.

The details of the pump structure more particularly appear in the drawing in which 1 represents the working barrel, 2 the pump head, and 3 the standing valve or foot valve, of the pump. 4 represents a stationary tube of predetermined length depending from pump head 2 concentric with working barrel 1 and spaced therefrom a predetermined distance to form a chamber 5 between working barrel 1 and tube 4 and pump head 2 and the sleeve of the hereinafter mentioned large volume pump plunger. 6 represents the traveling tube or plunger having a traveling valve 7 and a valve cage crown 8 which is adapted to be threadably connected by threads 9 to the sucker rods, which are not shown, wherewith said pump may be operated. All of the above mentioned parts of the pump structure, except chamber 5, are common to both pumps altho they may not all perform the same functions in one pump that they do in the other.

Directing attention first to the parts of the small volume pump, working barrel 1, pump head 2 and standing valve 3 all cooperate to form a closure for this pump, and in addition to said parts stationary tube 4 also serves in that capacity and in the further capacity of providing that part of the pump cylinder of said small volume pump wherein the plunger of said pump may work and wherein it may be packed off. The traveling tube 6 with its traveling valve 7 and cage or crown 8 with threaded connection 9, is slidably positioned in stationary tube 4 wherein it may be caused to reciprocate. The tube 6 carries thereon means of packing off said tube 6 from stationary tube 4, and in the drawing this packing means appears in the form of the conventional set of cups 10 positioned and held on said traveling tube 6 in the conventional manner with the cups located on a tubular coupler 11 threadably connected to and integral of said traveling tube 6, and secured on said coupler by a tubular follower 12 threadably connected to coupler 11 and integral of said traveling tube 6 of which said coupler is a part. The cups and their associate parts constitute the plunger head of the small volume pump in which traveling tube 6 is the plunger. The tubular follower 12 not only serves to hold cups 10 on the traveling tube, but also serves to form a connection between the traveling tube and the large volume pump plunger, as will later be explained. It is obvious that any other suitable packing means between traveling tube 6 and stationary tube 4 may be employed to seal the space between them. Fig. 3 shows the traveling tube 6, with cups thereon complete for operation in the pump as a small volume pump, and with said traveling tube 6 disassociated from the plunger of the large volume pump, and from said Fig. 3 the manner of operation of the small volume pump independently of the large volume pump may be readily discerned without further explanation. It is well to point out that in the form disclosed, the traveling tube 6 with its cups thereon may be withdrawn or pulled for re-cupping or reconditioning the same as with any ordinary common working barrel pump, for no part of the tubular follower 12 is of larger diameter than said traveling tube 6. However it is apparent that if it is desired to place a valve in the lower end of the traveling tube 6, a valve can be placed in the tubular follower 12 without enlarging its diameter, but in such case the valve so placed would constrict the passage of a large volume of fluid thru the traveling tube 6 when the large volume plunger is attached thereto, which would in some cases be objectionable while in others it would not, and the placing of a valve in said member 12 would be optional. If it is desired to place a large volume oversize valve in member 12, which in certain cases would be advisable, it is obvious that a valve and cage of diameter greater than traveling tube 6 and less than the diameter of the hereinafter mentioned sleeve of the large volume plunger, could be placed in member 12, but that would prevent the traveling tube 6 from being pulled out of the pump as aforesaid unless the pump head 2 is made to seat in working barrel 1 in the manner in which it is customary to seat liner barrels by providing a packing seat in the conventional manner nevertheless, in certain cases such an oversize valve in member 12 would be desirable even tho the plunger could not be pulled from the working barrel.

As has heretofore been stated, member 12 not only serves to hold the cups on the traveling tube, but serves as a connecting member between traveling tube 6 and the large volume plunger, and with relation to its later function it is constructed with a spider 13 therein integral thereof and having ports 14 therein, and with said spider having in axial alignment therewith a projection or shaft 15 which is integral of said spider and of said member 12. The shaft 15 bears at its end, in axial alignment with said member 12, a pinion 16 of predetermined pitch diameter beveled at its lower end as with the beveled surface 17. The tubular coupler 12 is also provided with a threaded end the threads 18 of which are in opposite spiral from those of any of the other threads in the connections in traveling tube 6 and in the sucker rods to which said tube may be connected; that is, if all of the other aforesaid threaded connections except those of threads 18 are right hand threads, thread 18 would be a left hand thread.

Turning our attention now to the parts of the large volume pump, the same includes the heretofore mentioned working barrel 1, pump head 2, standing valve 3, stationary tube 4 and traveling tube 6 together with the parts carried thereon, such as the valve 7, crown 8 and connection 9, and the heretofore mentioned means for connecting the traveling tube 6 to the large volume pump plunger such as the tubular coupler 11 and the tubular follower 12 with spider 13, shaft 15, pinion 16 and threads 18, thereon. The packing cups 10 might also be considered a part of the large volume pump inasmuch as it serves to further pack off the plunger of the larger volume pump, as will later be explained.

In addition to the aforenamed parts, the large volume pump has a large plunger head which works in the working barrel 1, and means for connecting and disconnecting it to traveling tube 6; all of which will be described in detail by reference to the drawing in which members 19 and 20 constitute the plunger head of the large

volume pump with said members rigidly affixed to or integral of each other. 19 represents a coupling having a threadable connection 21 the threads of which correspond to threads 18 on the tubular follower 12. This coupling carries the plunger head sleeve 20 of the large volume pump wherein is located the connecting and disconnecting mechanism between the plungers of the two pumps, which mechanism is operable thru pinion 16 as will hereafter appear. The coupling 19 also carries integral thereof or rigidly affixed thereto, an upwardly extending sleeve 22 which constitutes a part of the plunger of the large volume pump, and which is slidably telescoped between working barrel 1 and stationary tube 4. When attached to the traveling tube 6, these parts 19, 20 and 22 together with said traveling tube constitute the primary moving plunger parts of the large volume pump.

Now considering the heretofore mentioned connecting and disconnecting mechanism between the plungers of the two pumps, the same consists of the traveling tube 6, and its operating sucker rods, which are not shown, with the pinion 17 and threads 18, in all of which the threads of any threaded connections therein are run opposite to threads 18. The additional means, as disclosed in drawing consist of the following mechanism. A pinion countershaft 23 is rotatably mounted in a spider 24 which is rigidly held in plunger sleeve 20. The spider has passageways 25 therethru. A driven pinion 26 of predetermined pitch diameter is located at one end of said countershaft and is engageable with pinion 16, and a driving pinion 27 also of predetermined pitch diameter is located at the other end of said countershaft. A clutch shaft 28 is rotatably and slidably mounted in a second spider 29, which spider is rigidly held in said sleeve 20 and has passageways 30 therethru. A driven pinion 31 also of predetermined pitch diameter is located at one end of said clutch shaft and is engageable with pinion 27, and a clutch plate 32 held rigid thereon is located at the other end. The spider 29 has thereon lugs 33 wherewith to engage corresponding recesses 34 in the clutch plate. The clutch plate 32 is in the form of a spider having passageways 35 therethru. The clutch shaft 28 extends into a bore in spider 24 and is slidable and rotatable therein, and a thrust spring 36 is held in said bore against the end of said shaft 28 to normally urge the clutch plate 32 away from and out of engagement with spider 29. At the bottom of the pump cylinder or working barrel 1, and above standing valve 3 is another spider 37 held rigid on said working barrel and having passageways 38 therethru and also having an upwardly extending hollow projection which forms a cup 39 wherein the clutch shaft end and the nut 40 thereon, which secures the clutch plate thereto, may retreat when the clutch plate is brought in contact with said spider 37 as will later be explained. The spider is shown in the drawing as being a part of the valve cage coupling 41 wherein valve 3 is retained on its seat 43 in the conventional manner. 44 is the inlet port to the pump. As has previously been mentioned, the plunger 22 is rigidly affixed to the coupling 19. This sleeve is of sufficient length in proportion to the length of stationary tube 4, to permit its upper end to come into engagement with pump head 2. On pump head 2 are lugs 45 and on the upper end of sleeve 22 are corresponding recesses 46 engageable with said lugs to lock said sleeve 22 against rotation, as will later be explained, it being understood that the pump head 2 is held stationary with reference to the well tubing, which is not shown in the drawing.

It will be noted that the pinions mentioned are all of a predetermined pitch diameter. The reason is that the train of gears must be such that when pinion 16 is rotated by turning the sucker rods when said pinion is in engagement with pinion 26 of the counter shaft 23, the clutch 28 is caused to be turned at a greater speed than that at which pinion 16 rotates. Thus, when clutch plate 32 is in engagement with spider 29 as shown in Fig. 1, the sleeve 20 together with coupling 19 thereon is caused to rotate in the same direction as the tubular follower 12 of which pinion 19 is a part, and consequently threads 21 on member 19 revolve at a greater speed than threads 18 on member 12. As a result, if member 12 is caused to rotate to the right, member 19 also is caused to rotate to the right but at a faster speed, and hence as the connection between the two members is of left hand threads, the faster rotating member overtakes and passes the travel of the slower rotating member and the two members may thus be screwed together.

In operation with the pump constructed as shown in the drawing and with the head of the pump secured to the well tubing or casing in the usual manner, and with traveling tube 6 attached to the string of sucker rods, and assuming that the large volume pump plunger is disconnected from traveling tube 6 as is shown in Fig. 3 of the drawing, the sucker rods may be reciprocated in the usual manner to operate the pump plunger within stationary tube 4, and the liquid to be pumped will flow thru passageway 44 past valve 3 into the chamber provided by the working barrel 1 and thru the various passageways of the spiders mentioned, then thru traveling tube 6, past valve 7 thru the valve cage crown 8 and thence into the well tubing.

When it is desired to change the pump to a large volume pump traveling tube 6 is let down until pinions 16 and 26 slide into engagement with each other and threads 18 are in position to engage threads 21. In this position clutch plate 32 is also in engagement with spider 29 thru lugs 33 engaging recesses 34, as the weight of the coupling mechanism is sufficient to overcome the pressure of spring 36 on the clutch shaft 28 when the mechanism is resting on cup 39 of spider 37, whereon it is free to rotate upon being turned as previously explained. The string of sucker rods is then turned to the right, and as the sucker rods have right hand thread connections they will not be unscrewed in so turning. This causes traveling tube 6 to also turn to the right, thus accomplishing a connecting of traveling tube 6 to spider 19 which bears the large volume plunger sleeve 22 and the plunger head sleeve 20. Fig. 1 shows the completed operation of coupling 19 to traveling tube 6, and shows the connecting mechanism in the position assumed during this operation.

When it is desired to change the pump back to a small volume pump the traveling tube 6 is pulled up by lifting the sucker rods until lugs 45 on the upper end of sleeve 22 are in engagement with recesses 46 in pump head 2 or can be brought into such engagement by rotating the sucker rods. In this position with lugs 45 so engaged the sucker rods are again rotated to the right thus causing pinion 16 also to rotate to the

right, but in this position the clutch plate is now disengaged inasmuch as it no longer is in contact with spider **37** and the spring **36** has forced it out of engagement with spider **29**. Consequently the train of gears merely idles and their movement has no effect upon plunger sleeve **20** which is connected to coupling **19**, to the effect that inasmuch as the threaded connection between coupling **19** and traveling tube **6** is a left hand thread, and the coupling **19** is locked stationary, the rotating of said traveling tube **6** merely unscrews said left hand thread connection. Whereupon with the coupling **19** disconnected from traveling tube **6** the connecting mechanism with its plunger head sleeve **20** and its plunger sleeve **22** drops to the bottom of the pump, and clutch plate **32** again rests on cup **39** and the entire connecting mechanism is once more in readiness to be connected to traveling tube **6** whenever it is desired to use the large volume pump.

It is to be understood by the term "plunger" as used in the specification that the same designates a fluid displacing member, of which the pump has two, one of smaller volumetric displacement than the other, and that the plunger of the smaller pump when it is operating the plunger of the larger pump does not function as a plunger but as a plunger piston rod or stem or traveling tube of the larger plunger. The smaller plunger shown in the drawing would be the volumetric displacement member **6** with its related displacement parts as shown in Fig. 3 wherein it appears disconnected from the larger plunger. The larger plunger shown in the drawing would be the volumetric displacement member **20** with its related displacement parts as shown in Fig. 2. Member **6** when connected to member **20** with its related displacement parts does not displace any fluid itself and does not operate as a plunger but serves as a piston rod for the larger plunger.

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

1. A reciprocating plunger oil well pump, including a working barrel forming a closure with an inlet valve thereto and an outlet valve therefrom and with said working barrel having therein two cylindrical bores of different diameters, a plunger operable in one of said bores, a second plunger operable in the other of said bores, and rotatable connecting and disconnecting means between the two plungers aforesaid, and means connected with one of said plungers for operating said last named means in the usual course and customary use of said pump.

2. A reciprocating plunger pump including a working barrel forming a closure, an inlet port thereinto, a standing valve therein, a plunger for said working barrel, a second working barrel within said first named working barrel, a plunger for said last named working barrel, a valve on said last named plunger, and means for selectively connecting and disconnecting one of said plungers to and from the other of said plungers.

3. In a reciprocating well pump, a working barrel, a standing valve therein, a slidable hollow tube in said working barrel, a valve on said tube, a plunger head on said tube, and means for connecting and disconnecting said tube from said plunger head by turning said tube in the same direction for both connecting and disconnecting said tube from said plunger head.

4. In a reciprocating well pump, operable thru a string of sucker rods, a traveling plunger, a plunger head of one cross sectional displacement area, a second plunger head of a different cross sectional displacement area, and mechanical means operable by said sucker rods for interchangeably operating either of said plunger heads through said traveling plunger.

5. A reciprocating well pump operable thru a string of sucker rods, including a traveling plunger, a plunger head of one cross sectional area, a plunger cylinder therefor, another plunger head of a different cross sectional area than that of said first named plunger, a plunger head cylinder therefor, and mechanical means for selectively and at will successively operating either of said plunger heads through said plunger.

6. A coupling and uncoupling mechanism for use in a well wherein a threaded coupling joint of male and female threads engageable with each other is employed, including a coupling member having a male thread, a coupling member having a female thread engageable with said male thread, means for rotating one of said coupling members, and means, engageable with said first named means, for rotating the other of said coupling members at the same time in the opposite direction and at a greater speed than that at which said other coupling member is rotated, while said male and female threads are in engagement with each other.

7. In an oil well, the combination of a male threaded coupling member, a female threaded coupling member engageable therewith, means for rotating one of said coupling members, and means engageable with said first mentioned means for concurrently with the rotating of said coupling member also rotating the other coupling member in the opposite direction and at a greater speed.

8. A reciprocating deep well pump operable thru a string of sucker rods, including a working barrel, a fluid intake thereto, a standing valve in said fluid intake, a plurality of fluid displacement members each of different volumetric displacement area and operable in said working barrel, a fluid passageway from said working barrel thru one of said displacement members, a traveling valve in said fluid passageway, a fluid outlet from said fluid passageway and located above said displacement member which has said fluid passageway therein, and means for selectively and at will successively operating any of said displacement members without changing the speed at which the string of sucker rods is operated.

9. A reciprocating plunger pump operable thru a string of sucker rods for pumping a deep well, including a working barrel, a fluid intake thereto, a standing valve in said fluid intake, plunger means for displacing fluid from said working barrel, a fluid passageway from said working barrel thru said plunger means, a traveling valve in said fluid passageway, a fluid outlet from said fluid passageway and located above said plunger means, and mechanical means operable thru said string of sucker rods for varying the volumetric displacement of said plunger without changing its distance of travel.

GEORGE A. GAGE.