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called out that another pipe had broken, and away he went with the valve key to shut off that section of the system.

When we arrived at the scene of the break the men were already digging away to uncover the pipe. The break had occurred in a 1½" line that led to one outlet a distance of 60 feet from the 6 inch main. The operating pressure at this point was about 100 pounds we later found by test, and the operating pressure in the 6-inch main was 118 pounds. Under these conditions the sprinkler was discharging a little better than 50 gallons per minute according to the manufacturer's table. But we are interested in what was going on under the ground while this sprinkler was operating.

With an operating pressure of 118 pounds in the 6-inch main, and an operating pressure of 100 pounds at the sprinkler, it indicates that the 1½" pipe was setting up a friction loss of 18 pounds. But that is not the only fact to be considered. The cross sectional area of a 1½" pipe is 1.767 square inches. A gallon of water is 231 cubic inches. With these figures it is not hard to figure that 50 gallons per minute through a 1½" pipe has to travel at a velocity of 109 feet per second to keep the sprinkler going. That is going at the rate of almost a mile and a quarter a minute.

Hydraulic engineers consider velocities of greater than 8 feet per second bad practice in pipe sizes of 4" and larger, and although they allow greater velocities than that in smaller pipe, a speed of over 100 feet per minute is far in excess of good practice where the valve is of the quick-closing type. A water system on a golf course is no different than a water system anywhere else when it comes to a matter of pipe sizes and pressures. If anything, the operating conditions imposed on a golf course irrigation system by the type of valves used as well as the layout of the course make it necessary to guard against water hammer and surge, by adequate design. Thus we can take one lesson from Bill's experience: See to it that pipe sizes are sufficient not only from the standpoint of volume and pressure-loss, but that we also keep within the limits of allowable velocities.

When a quick-coupling valve closes, it closes. There is no fussing around about it. One minute the water is rushing out at full capacity, and in the next instant the valve is shut smack in its face. There is no preliminary ceremony, no "excuse me, please"; the water is stopped dead in its tracks. Try driving your car at 75 miles an hour against a brick wall, and you will get some idea of what we are talking about. That's the kind of punishment the pipe has been taking on Bill's golf course for the past 10 years, and it

is small wonder that the pipe finally gave way at its weakest point.

If Bill could eliminate or even reduce the water hammer on his sprinkler system his weakened pipe could be made to hold out a while longer, at least until the time comes when he can make replacements. And it wouldn't be a bad idea to keep the hammer and surges as low as possible when he gets the new pipe, too. A check-over of his repairs for the past year leads us to believe that the majority of his leaks have been brought on much ahead of their normal time due to the punishment the pipe lines have been taking from improper closing of the valves, and the use of pipe too small in the first place just because there was sufficient pressure to overcome the friction loss. This conclusion is supported by the fact that in the same system there are other pipes with just as much corrosion and with walls just as thin as those that have broken, but today are still intact. These pipes are located at points in the system where there is not so much surge or variation of pressure.

Bill can help himself to some extent by more careful supervision of his watering crew. Their habit of kicking the handles of the couplers to shut off the sprinklers is doing the system no particular good. We realize that the watering crew cannot make up for the inherent design of a valve that snaps shut, but with a little care such a valve can be closed slowly if the men will only take the time to do it.

A hint to the wise should be sufficient. Manufacturers of irrigation valves would do well by themselves as well as by the greenkeepers if they would manufacture a slow-closing valve. There is one type of so-called flow-control valve on the market that is intended to dampen the shock of closing to some extent but there is still much room for improvement. In fact, it would not be impossible for all existing quick-coupling valves to be easily converted to a slow-closing type if manufacturers would recognize the need and manufacture the simple little gadget necessary to do it. In no time at all a greenkeeper could convert his system without removing a thing from the ground and save himself many headaches for a long time ahead.

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#### WOOD LEAVES WINGED FOOT—

Craig Wood, duration National Open champion, resigned July 24 from Winged Foot CC to go with MacGregor Golf, Inc. in promotion work. MacGregor has extensive sales development work already under way for postwar golf. Wood's new job calls for vigorous campaigning to put these plans in operation to strengthen the pro shop sales position.