The connection between the index crank through the worm, worm gear, spindle, and change gears of the differential indexing mechanism and the index plate when the index pin is in mesh with a hole in the plate would form a locked train, which must be released during the spiral cutting operation. This release is accomplished by means of the knurled knob back of the index plate which operates a friction clutch.

Frequently it is desired to roll the work on its axis a small amount without shifting the dog or losing the position of the index pin, or the amount of roll over may be so that should it be accomplished by rotating the crank, the pin would not come exactly over a hole as would be necessary.



## Fig. 2

Should it be attempted to move both plate and crank in conjunction it would be found that the back pin of the ordinary head would not engage with a back hole. In this head the pin is done away with, and the plate is held in position when resorting to plain indexing by a frictional hold on the hub of the plate gear which is clamped or released by a suitable bolt conveniently located. By this means, work may be set regardless of the position of the plate, and the plate can then be securely held in the position it takes when the work is so set.

In work requiring the head to be connected up for spiral cutting the roll over of work is made more convenient by the presence of the adjustable clutch which, as explained above, allows the disconnection of the spiral cutting train so that the spindle and work may be revolved or rolled over without changing the position in relation to the cutter in a direction parallel with the feed motion.

Its stiff and rigid construction. Its large worm and worm wheel of coarse pitch. Arrangement by which differential indexing may be accomplished regardless of the head's position on the machine platen. Arrangement by which differential indexing may be accomplished on other than plain cylindrical work, such as bevel gears. Arrangement by which differential indexing may be accomplished on work with helical grooves such as spiral gears. Arrangement by which the spindle and work may be rotated independent of the lead screw when the change gears are set for spiral milling, making the setting of the work much easier than it would otherwise be. The adjustable clutch for facilitating the above operation. The index crank with handle for rotating same separate from the index pin, giving a crank of the same throw regardless of the position of the index pin, and eliminating the danger of the pin dropping on the plate while revolving the crank. The single reversible index plate for all divisions. Adjustable dial on the spindle nose for obtaining angular divisions in degrees for work requiring no great accuracy. Means for taking up wear in worm gear or dividing wheel ..

## THE ST. LAWRENCE SHIP CHANNEL.

The St. Lawrence ship channel is one of the most important factors connected with Canada's shipping. The Government recognizes this, and improvements are being made to the waterway in order to minimize the dangers to navigation between Montreal and the sea. The channel is being deepened, straightened, and widened. Mr. F. W. Cowie, C.E., Chief Engineer of the Montreal Harbour Commission, has a general supervision of the work, and under him D. W. Forneret, C.E., is resident engineer of the channel.

It is not infrequently claimed, particularly by those not acquainted with the situation, that Montreal cannot in the future maintain its position as the foremost sea port in Canada, owing to the increasing size of vessels, and the difficulty or impossibility of making the channel to Montreal safe. It is not probable that this state of affairs will come to pass for a very long time, if ever. When spoken to on this subject, Mr. Cowie said, "By the expenditure of time and money the channel may be made any size which the conditions of navigation and the future may demand." Past experiences go to show that this is no idle statement. It is certain that, with an expenditure which would be more than justified when compared with that undertaken in other countries with a much less hope of success, the channel could be made to accommodate vessels very much larger than those now calling at the port of Montreal.

Since 1884, at which date the first dredge was put in operation, up to the end of the fiscal year 1905-6 only \$9,000,000 was spent on the St. Lawrence channel, and of this expenditure, equipment to the value of \$2,000,000 still exists. When it is remembered that the St. Lawrence is one of the longest inland channels available for ocean going vessels in the world, this sum. compared with what has been spent in other



## Fig. 1.—The "Calveston," looking aft, showing water pouring from openings in long pipe into hoppers... The gearing operates the hopper doors.

countries on channels of much smaller dimensions, for instance, the Manchester ship canal on which about \$80,000, 000 was spent to complete thirty-five miles for inland navigation, it will be seen that for the splendid results obtained, a minimum amount has been spent in improving the St. Lawrence.

Up to the end of June, last year, over 48,000,000 cubic yards of material had been removed from the channel. This work was accomplished under many unfavourable conditions, such as swift currents, and heavy storms, which frequently made it necessary to cease work. The dredges below Quebec

September 6, 1907.