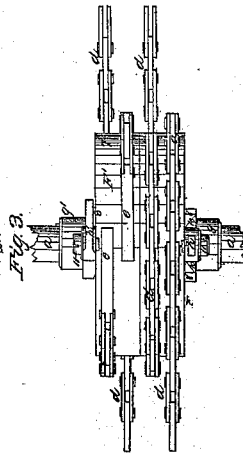
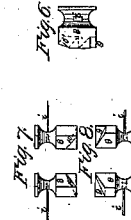
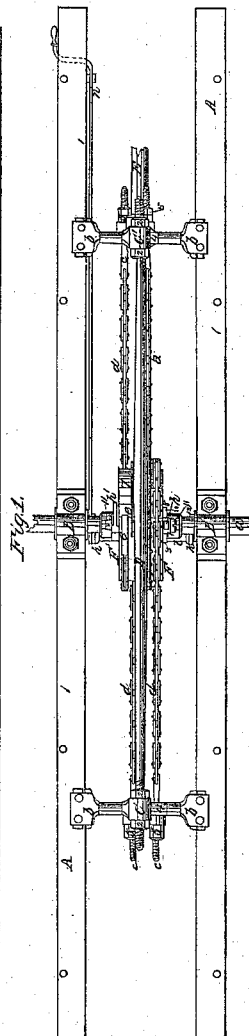
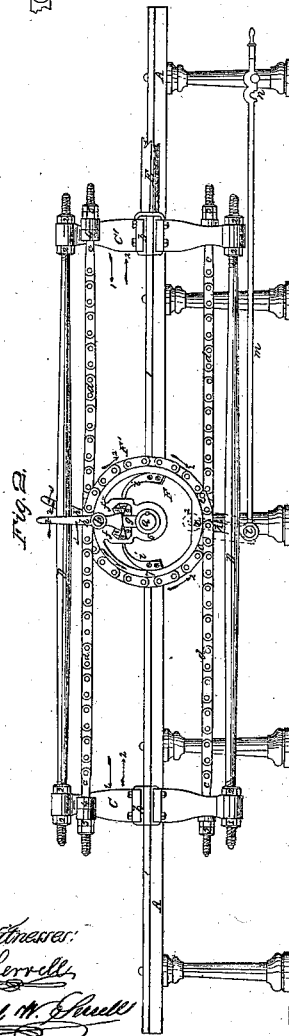
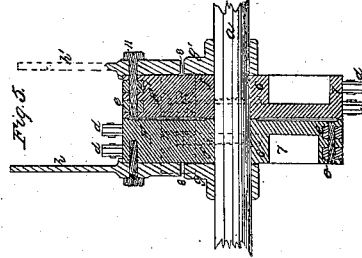
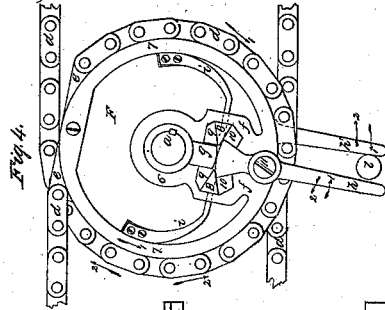


*P. Yates*

*Converting Motion.*

*N<sup>o</sup> 7316.*

*Patented Apr. 23, 1850.*



*Witnesses:*  
*W. L. Merrill*  
*Samuel M. Shurtell*

*Inventor.*  
*P. Yates*

# UNITED STATES PATENT OFFICE.

PETER YATES, OF MILWAUKEE, WISCONSIN.

## CHANGING RECIPROCATING MOTION INTO ROTARY MOTION.

Specification of Letters Patent No. 7,316, dated April 23, 1850.

*To all whom it may concern:*

Be it known that I, PETER YATES, of the town of Milwaukee, State of Wisconsin, have invented, made, and applied to use  
5 certain new and useful Improvements in the Means of Applying Power Acting Reciprocally in a Right Line to Produce Continuous Rotary Motion; that the said improvements are based on an invention for  
10 which a patent of the United States was issued to me, on the twenty-fifth day of April, 1843, parts of which invention are used in these improvements, with other parts not included in the original invention, the whole being now so constituted as  
15 to form a distinct invention, for which I seek Letters Patent of the United States, and that the construction, operation, and effects produced by the said improvements  
20 are fully and substantially set forth and shown in the following description and in the drawings, annexed to and making part, of this specification of my said improvements, wherein—

25 The Figure 1, is a plan of the same as in place for use, Fig. 2, is a side elevation with one frame removed to show the parts of the same, Fig. 3, is a plan, Fig. 4, is a side elevation, and Fig. 5, is a cross section, of the parts that the power acts  
30 through, and on, to produce a continuous rotary motion, these three last figures are drawn in larger size than the same parts in the two first figures, and the same letters  
35 and numbers as marks of reference, apply to the like parts in all the several figures as follows:

40 A, A, are side frames, on which the parts are mounted, these are shown horizontally, but may be placed either inclined or vertical.

45 B, is the plumber block carrying the main shaft *a*, which may be connected in any convenient manner to the wheels of a steam vessel, or to drive any other machinery.

50 The frames A, A, are fitted with slides 1, 1, to receive slide blocks in the ends of arms *b*, *b*, one on each side of and supporting two vertical cross heads C, C<sup>1</sup>, these are united by two connecting bars D, D, the ends of which, go through the cross heads C, C<sup>1</sup>, and are shown as secured in place by nuts and counternuts 2, 2, but these connections may be made by mortises and  
55 keys, or in any usual effective manner.

At E, is shown one end of the piston rod

of a steam engine, to be connected in any usual manner to the cross head C<sup>1</sup>, the cylinder of which, must be in the line of motion of the parts.

60 At 4, 4, are ears or bosses two on each of the cross heads, through which the screwed shafts *c*, *c*, are passed and secured by nuts and set nuts 5, 5, outside the cross head, and between these and the cross head, may be  
65 placed prepared india rubber, or any kind of elastic material, to give a slight elasticity, to the action of the parts. The inner ends of the screw shafts *c*, *c*, are jointed to one end, of the two pairs of driving chains *d*, *d*,  
70 *d*, *d*, these chains are formed of flat links of proper size and number, riveted together the other ends of each chain are jointed on the circumference of the pulleys F, F<sup>1</sup>, in such a manner, that when the motion  
75 of the cross heads, draws one chain off each pulley, the other chain winds on the pulley, in the opposite direction one pair of chains, being jointed on one pulley over the catch blocks, the chains on the next pulley  
80 are jointed on the rim on the opposite side to the catch blocks.

The pulleys F, F<sup>1</sup>, are formed alike, but set back to back, or in reverse of each other, and have a hollow or countersunk space between the boss 6, which surrounds and moves  
85 freely on the shaft *a*, and the rim 7, which forms a solid circumference to the pulley and receives the joints *e*, *e*, that connect the chains to the pulleys.

90 Between the rim 7, and boss 6, bosses or masses of metal *f*, are cast solid with the other parts of the pulleys, these bosses are mortised or countersunk, so as to receive each a pair of catch blocks 8, 8, shown detached in side view in Fig. 6, with a plan  
95 Fig. 7, of the top of the catch blocks farthest from the shaft *a*, and Fig. 8, a plan of the bottom next the shaft *a*, one part of each catch block, is beveled from the outside edge  
100 inward and upward as at 9, on the lower outside and on the upper and inside edge a similar or counter bevel is cut outward, and upward, as at 10. The inner and higher edges of the bevels 9, take the points of the  
105 crank arms *g*, *g*<sup>1</sup>, these are made with a boss, surrounding the main shaft *a*, on which they are keyed, so that the crank arms, stand on the shaft in exactly the same direction.

110 At 11, is the fulcrum of the levers *h*, *h*<sup>1</sup>, the points of which are expanded to cover a little more than the space between the catch

blocks, the under edges on each side, being slightly chamfered, to fit and pass on to the bevels 10, on the catch blocks 8. Within the recesses on the pulleys, a spring  $i$ , is secured, the point of which enters a side slot in the bosses  $f$ , and passes by a ball point into the catch blocks 8, 8, and acting outward keeps the catch blocks with the beveled parts outside the faces of the pulleys but permits the blocks to be depressed by the levers  $h$ ,  $h^1$ , and throws them out, when the lever ceases to act on the block, as hereafter described.

At 12, 12, are studs forming a joint for the upper ends of vertical arms  $k$ , the lower ends of which sustain the cross bar  $l$ , which lies across beneath the pulleys and governs the motions of the levers  $h$ ,  $h$ ,  $l$ , and causes them to lock the catch blocks 8, with or unlock them from the crank arms  $g$ ,  $g^1$ . An adjustable side rod  $m$ , is connected to the bars  $l$ , and  $k$ , that serves to move and adjust the bar  $l$ , by notches on a pin so that it gives either a direct or reversed motion to the levers  $h$ ,  $h^1$ , changing their action on the catch blocks to reverse the motion of the crank arm and shaft.

When thus constructed and adjusted for use, the operation and effects of the parts are as follows: The Fig. 2, shows the cross heads as moving to the left in the direction of the black arrow 1, the upper chain  $d$ , drawing the pulley F, and parts attached in the direction of the red arrows 1, and the right-hand catch block 8, in contact with the right side of the crank arm  $g$ , is carrying the crank  $g$ , and shaft  $a$ , in the same direction with the red arrow 1. At this time the opposite lever  $h^1$ , is canted in the contrary direction and overlies and has depressed the left hand catch block on the next pulley  $F^1$ , so that the catch block is depressed below the contact with the point of the crank arm  $g^1$ , on that side and the lower chain  $d$ , on the cross head C, is carrying the pulley  $F^1$ , with the lever  $h^1$ , in the opposite direction to the pulley F, as indicated by the blue arrow 1, the lower chain  $d$ , on the cross head C, is winding off the pulley  $F^1$ , and the chains  $d$ ,  $d$ , on the cross head  $C^1$ , are both winding on their respective pulleys. When the movement is nearly completed in the direction of the black arrow 1, the two levers  $h$ , and  $h^1$ , will be one on each side the governing bar  $l$ , as shown by dotted lines, in the lower part of Fig. 2, and by full lines in Fig. 4; moving with pulleys in the direction of the arrows 1, 1, on them the contact of the levers on the bar  $l$ , reverses the positions of the levers and catch blocks as the engine finishes its movement, placing the lever  $h$ , over the catch block 8, and depressing it out of contact with the crank arm  $g$ , on the side that the crank arm in continuing its motion has

to pass over, and placing the lever  $h^1$ , between the catch blocks on the opposite pulley  $F^1$ , leaving the spring  $i$ , to throw up the catch block at the side of the crank arm  $g^1$ , at the instant the power commences to move the cross heads in the direction of the black arrow 2, the lower chain  $d$ , on the cross head  $C^1$ , then takes the draft on the pulley  $F^1$ , and carries that in the direction of the blue arrows 2, which is the same direction that the pulley F, has previously traveled thus maintaining the same continuous rotary motion of the shaft  $a$ , the pulley F, and lever  $h$ , being unconnected to the crank arm  $g$ , turn in the direction of the red arrow 2, the crank arm on the now laboring side passing over the bevel 9, depresses and passes over that catch block the other catch block being depressed by the lever, allows the crank to move freely until the motion is completed in the direction of the black arrow 2, when the movements are again reversed the catch block on the pulley  $F^1$ , is depressed and that on the pulley F, thrown up by the spring  $i$ , takes the crank arm  $g$ , and locks the pulley, crank, and shaft together, to complete another and successive but continuous rotation as before described.

By changing the position of the governing bar  $m$ , to the point denoted at  $n$ , Fig. 2, in the drawing the positions of the levers  $h$ ,  $h^1$ , will be changed, so that they will depress the second pair of catch blocks, and thus reverse the rotation of the pulleys, the second set of catch blocks being intended for this express purpose, which is thus effected without any change in the other parts of the apparatus, and by the crank arm coming between both, the second catch block both limits the movement of the cross heads at the end of each single stroke of the engine, and also prevents what is technically termed back lath of the crank arm.

The differences between this apparatus and that shown on my specification, to the patent issued to me, on the twenty fifth of April, one thousand eight hundred and forty three, are as follows. First in the employment of the cross heads, arms, slides, and connecting bars, in place of the unwieldy gallows frame, or gate, operating its whole length in slides. By this change less friction is caused, and compactness, lightness, and increased strength are obtained. Second in the employment of the catch levers  $h$ ,  $h^1$ , to move the catch blocks and moving these in a parallel mortise by one independent spring to each block, in place of a countersunk ring, acting to depress catch blocks having two springs, by which the end not touched by the ring, canted up when the other end was depressed, thus causing the locking of the crank arms, to be uncertain, beside which the one moving almost without friction at each rotation, is not en-

dangered by straining, while the ring is subject to so much friction, as to endanger the arm. Third in the employing two catch blocks, to take the crank arm, in either required direction, and thereby giving the certain means, of bringing the acting parts into contact, without concussion, and furnishes the means of changing the rotation, by moving one bar, without interruption to other parts, while the parts described in the former patent, are liable to all the consequences of concussion and uncertainty, and are without the means of reversing the rotation.

The first and most important effect of this mode of applying power, acting reciprocally in a right line, to produce continuous rotary motion, is, that the cylinder and length of movement of the driving piston, being equal to the circumference of the pulleys, each one movement of the piston in a direct line, effects one entire revolution of the shaft through the pulley on which it is then working, instead of making two alternate movements in opposite directions, as when applied to a crank to produce one entire revolution, with this additional difference that the pull or thrust of the piston is acting on a leverage, that is equal in every part of the rotation, the leverage not varying as in the crank. Another effect may be produced by this apparatus, namely, an equal and alternating or reciprocating rotary motion, constituting any part of a revolution of the shaft, by either widening the governing bar *l*, or placing more than one bar *l*, to act on the levers *h*, *h*<sup>1</sup>, and in this case the length of movement of the piston, must be the same as the proportion of the revolution, which the parts describe, and will act precisely in the same manner, to produce an alternating rotary movement, in opposite directions, so that any proportion of a revolution, may be made with the advantage of an equal leverage, during the movement.

The valves of the steam engine may be worked to induct and educt the steam, by any convenient means, or connection between the main shaft *a*, and the steam valve rod, such means being adjusted to move the valves, at the completion of each revolution of the shaft, and the impetus of the piston may be diminished at each end of the stroke, by interposing india rubber, or compressible steel springs, or other elastic substances, in such a manner, that they com-

mence to act, as buffers, when the piston is near each end of the cylinder. Such buffers may be placed to receive each cross head at the end of each motion, so as to diminish the impetus of the piston, when coming near the ends of the cylinder, and may also be placed in any other convenient position, where they can be effective for this object.

It may be proper to state, that the parts must be so timed, or adjusted that the catch blocks *8*, *8*, and crank arms *g*, and *g*<sup>1</sup>, must alternately interlock and unlock at the same instant of time, and that these movements must be simultaneous with, or timed, so as to take place at the instant the piston of the steam engine has completed its movement in the corresponding direction, and is ready to commence the opposite motion, these adjustments being especially requisite to the complete action of the parts.

Having described the construction and operation of the parts employed, and the effects they produce, or may be made to produce, I do not herein claim to have invented any one of the parts used, irrespective of the manner in which I have described and shown them to be employed for specific purposes, nor do I claim herein, any of the parts claimed in my patent of the twenty fifth of April one thousand eight hundred and forty three, but

I do claim as new, and of my own invention, and desire to secure by Letters Patent of the United States:

1. The application of the levers *h*, *h*<sup>1</sup>, catch blocks *8*, *8*, with the bevels *9* and *10*, and springs *i*, *i*, or their equivalent to interlock and unlock with the crank arms *g*, and *g*<sup>1</sup>.

2. And I claim also making the governing bar adjustable in combination with the levers *h*, *h*<sup>1</sup>, in such a manner as to give either a direct or reversed motion to the pulley *F*, *F*<sup>1</sup>, and I claim the above applications severally, and in combination, in the whole and in the parts the apparatus being constructed and operating, substantially in the manner and for the purposes subscribed and shown.

In witness whereof I have hereunto set my signature this nineteenth day of January one thousand eight hundred and fifty.

PETER YATES.

Witnesses:

WM. SERRELL,  
LEMUEL W. SERRELL.