May 16, 1944. W. P. HILL 2,349,168

METAL WORKING MACHINE

Filed Feb. 23, 1942 6 Sheets-Sheet 1

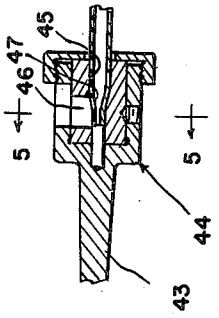


FIG. 4.

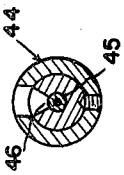


FIG. 5.

FIG. 1.

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METAL WORKING MACHINE

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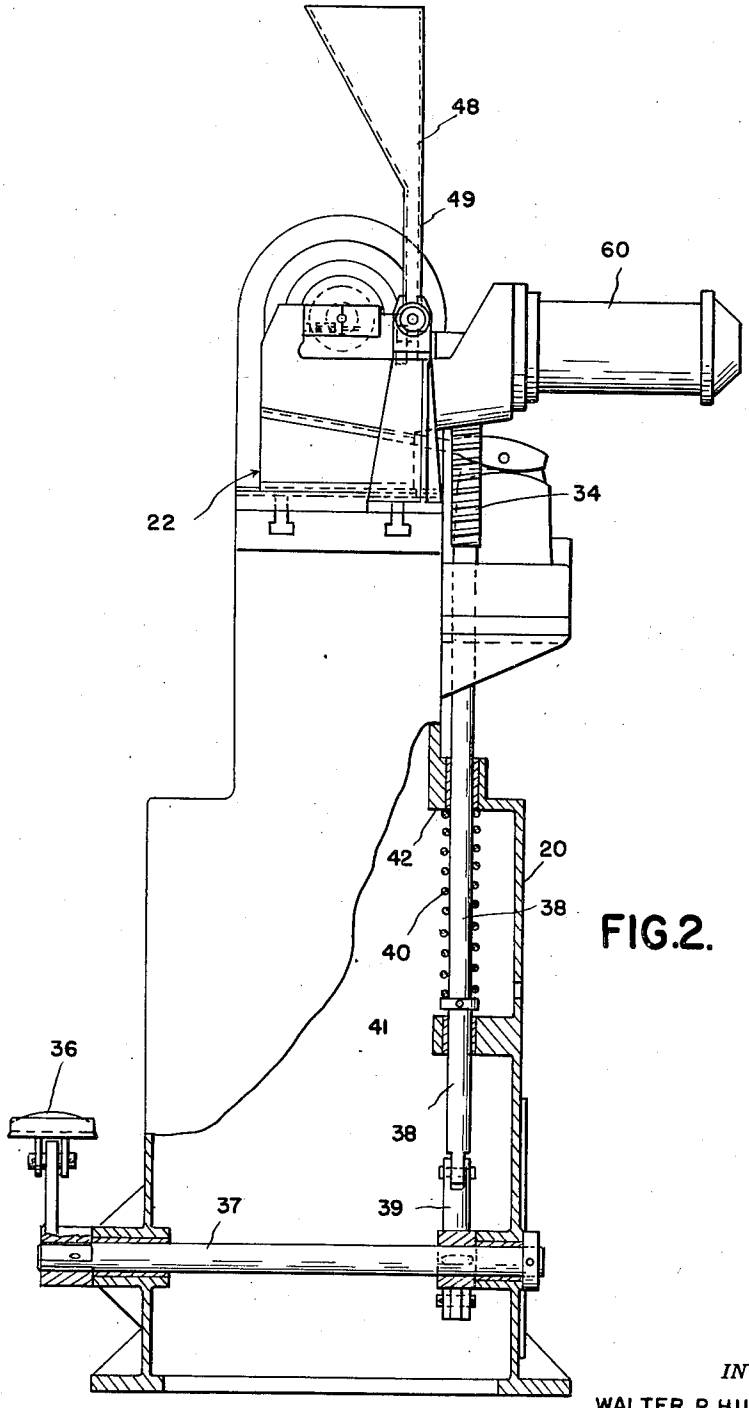


FIG.2.

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METAL WORKING MACHINE

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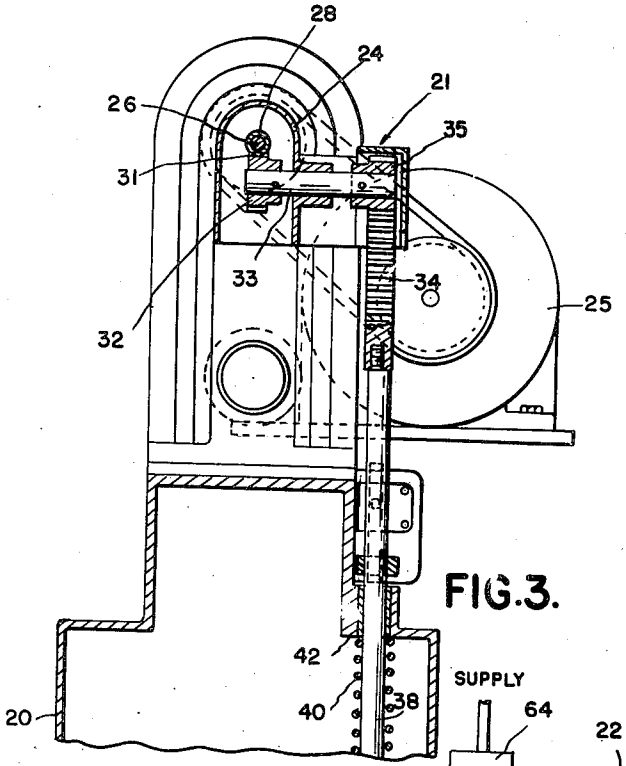


FIG.3.

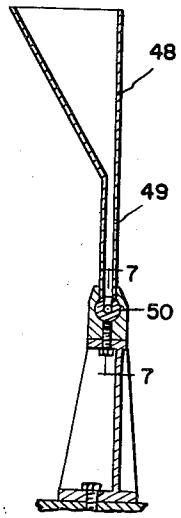


FIG.8.

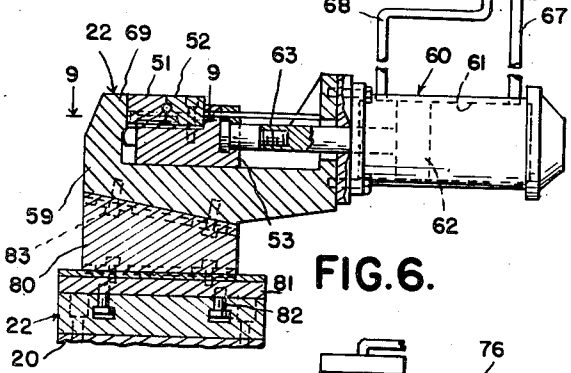


FIG.6.

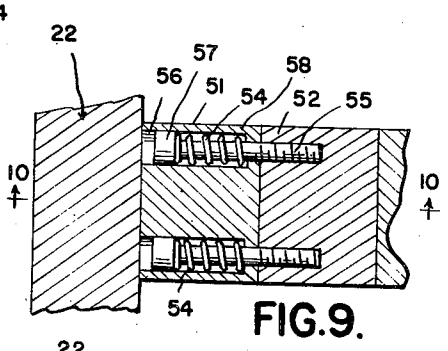


FIG.9.

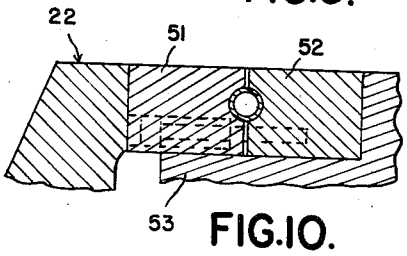


FIG.10.

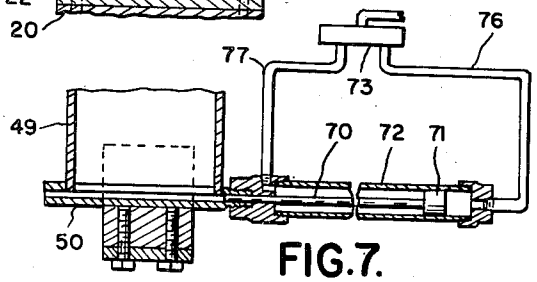


FIG.7.

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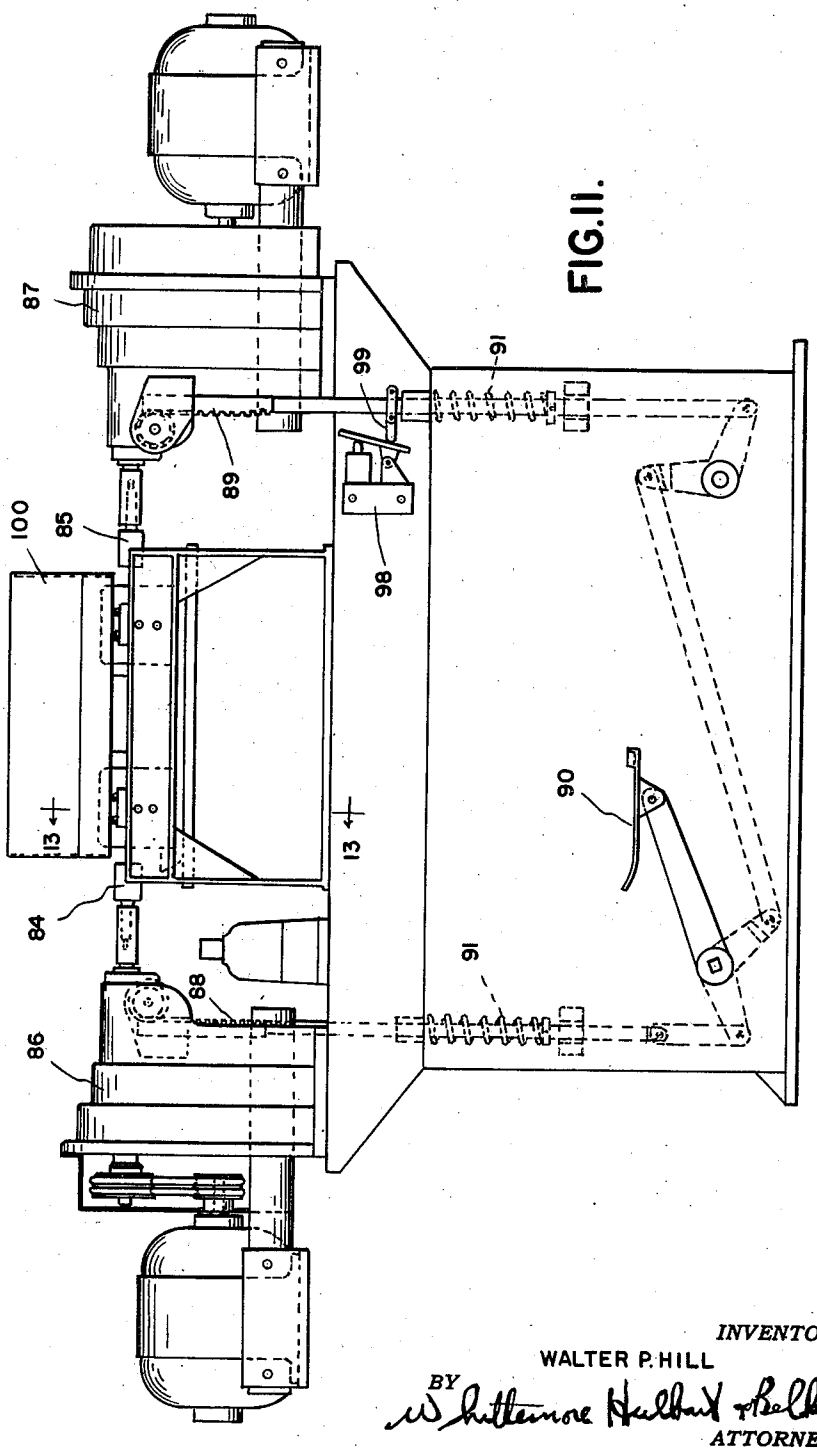


FIG. II.

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METAL WORKING MACHINE

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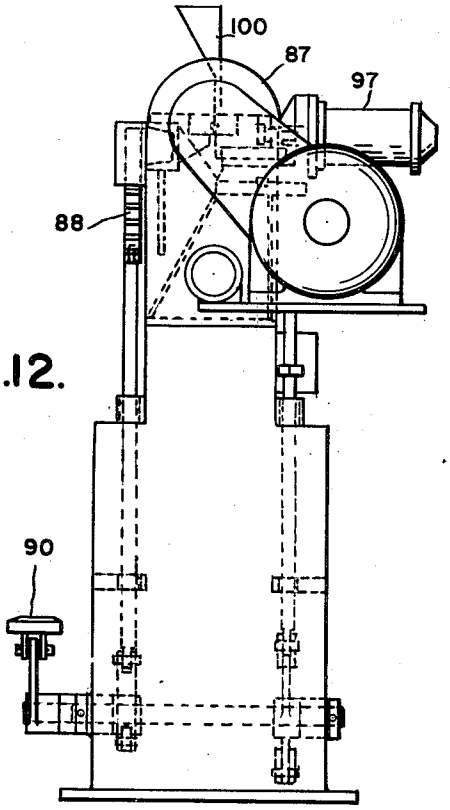


FIG.12.

FIG.15.

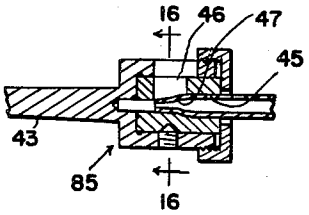
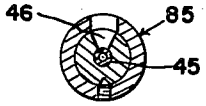


FIG.16.



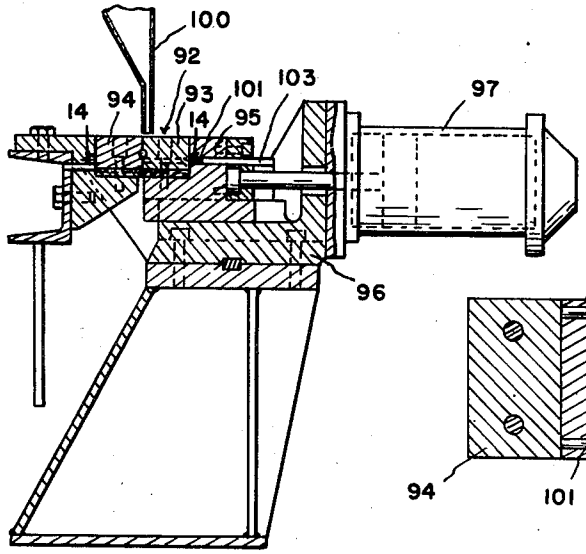


FIG.13.

FIG.14.

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May 16, 1944. W. P. HILL 2,349,168

METAL WORKING MACHINE

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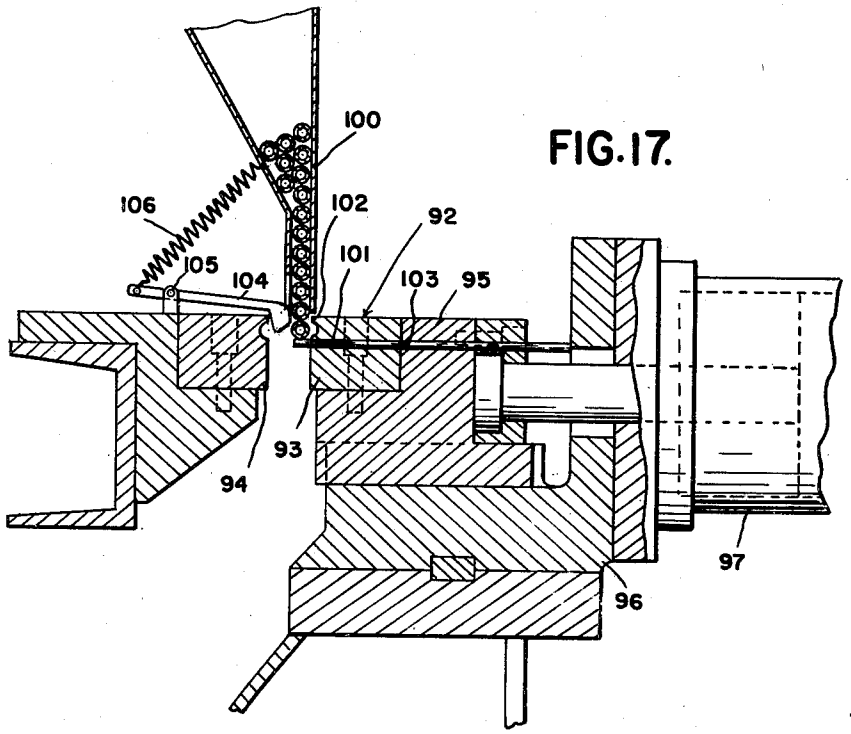


FIG.17.

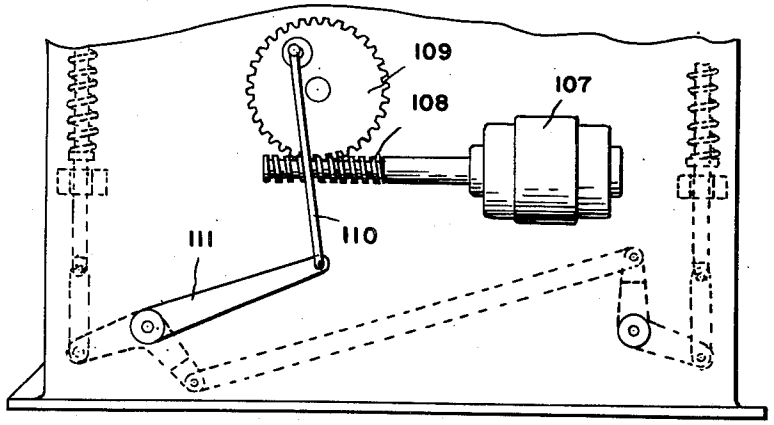


FIG.18.

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Patented May 16, 1944

2,349,168

UNITED STATES PATENT OFFICE

2,349,168

METALWORKING MACHINE

Walter P. Hill, Detroit, Mich., assignor, by mesne assignments, to Calumet and Hecla Consolidated Copper Company, Calumet, Mich., a corporation of Michigan

Application February 23, 1942, Serial No. 432,070

5 Claims. (Cl. 153—81)

This invention relates generally to metal working machines and refers more particularly to improved means for handling the stock to be worked or otherwise fashioned in metal working machines.

One of the principal objects of this invention is to substantially increase the capacity of metal working machines to perform their intended functions by providing stock feeding mechanism which operates in conjunction with one or more tools on the machine to continuously supply separate lengths of stock to the tool or tools in such a manner that lost motion in the cycle of operation of the machine is reduced to a minimum.

Another object of this invention which contributes materially to increasing the production rate of metal working machines is to provide means for successively feeding a plurality of lengths of stock by gravity to a work holding clamp which operates periodically to transfer the lengths of stock to a position in operative relation to the tool or tools associated with the metal working machine.

Still another object of this invention is to provide a metal working machine having means for returning the work holding clamp with the finished length of stock therein to a position adjacent the feeding means and having means for ejecting the finished length of stock from the clamp by forcing an unfinished length of stock into the clamp.

A further object of this invention is to provide a metal working machine having axially aligned revoluble tools spaced from each other a distance sufficient to enable a length of stock to be inserted therebetween and having cooperating clamping jaws respectively supported on opposite sides of the axis of the tools for relative movement into and out of clamping engagement with a length of stock.

A still further object of this invention is to support a length of stock to one side of the axis of rotation of the tools in such a manner that the lowermost length of stock is positioned between the clamping jaws in the open position of the latter and is moved by one of the jaws into alignment with the tools as the jaws are closed.

In addition to the foregoing this invention contemplates a construction of the type set forth in the preceding paragraph wherein the finished length of stock is automatically ejected upon opening of the clamp and a length of unfinished stock falls in place between the clamping jaws.

The foregoing, as well as other objects, will be made more apparent as this description proceeds, especially when considered in connection with the accompanying drawings, wherein:

Figure 1 is a side elevational view partly in section of a metal working machine constructed in accordance with this invention;

Figure 2 is an end elevational view partly in section of the machine shown in Figure 1;

Figure 3 is a sectional view taken substantially on the plane indicated by the line 3—3 of Figure 1;

Figure 4 is a fragmentary sectional view taken substantially on the plane indicated by the line 4—4 of Figure 1;

Figure 5 is a cross sectional view taken substantially on the plane indicated by the line 5—5 of Figure 4;

Figure 6 is a sectional view taken substantially on the plane indicated by the line 6—6 of Figure 1;

Figure 7 is a sectional view taken substantially on the plane indicated by the line 7—7 of Figure 8;

Figure 8 is asectional view taken substantially on the plane indicated by the line 8—8 of Figure 1;

Figure 9 is a sectional view taken substantially on the plane indicated by the line 9—9 of Figure 6;

Figure 10 is a sectional view taken substantially on the plane indicated by the line 10—10 of Figure 9;

Figure 11 is a side elevational view of a slightly modified form of metal working machine;

Figure 12 is an end elevational view of the machine shown in Figure 11;

Figure 13 is a sectional view taken substantially on the plane indicated by the line 13—13 of Figure 11;

Figure 14 is a sectional view taken substantially on the plane indicated by the line 14—14 of Figure 13;

Figure 15 is a fragmentary sectional view of one of the tools forming a part of the machine shown in Figure 11;

Figure 16 is a cross sectional view taken substantially on the plane indicated by the line 16—16 of Figure 15;

Figure 17 is a sectional view of the work holding clamp and stock feeding mechanism of the machine shown in Figure 11; and

Figure 18 is a fragmentary elevational view of a further embodiment of this invention.

For the purpose of illustrating this invention I have shown a metal working machine especially designed for reducing one or both ends of a length of tubular stock, although it will be understood as this description proceeds that the invention is applicable in practically any case where it is desirous of feeding stock to forming mechanism regardless of the specific nature of the latter.

Referring now more in detail to the embodiment of the invention shown in Figures 1 to 10, inclusive, it will be noted especially from Figure 1 that my improved metal working machine com-

prises a base 20 of suitable design having provision for supporting a tool head 21 and a work holding clamp 22. The tool head 21 comprises a tubular drive shaft 23 suitably supported on a housing 24 for rotation and having the outer end operatively connected to a prime mover 25 which is also carried by the tool head 21. The drive shaft 23 is internally splined and is adapted to receive the outer end of a correspondingly splined driven shaft 26 which is supported for sliding movement on the housing 21 and has a tool holder 27 secured to the inner end thereof.

It will also be observed that an intermediate portion of the shaft 26 is supported in a non-rotatable sleeve 28 having the opposite ends respectively engaging abutments 29 and 30 fixed on the shaft 26. The arrangement is such that axial movement of the sleeve 28 in opposite directions affects a corresponding axial movement of the shaft 26 without interfering with rotation of the latter shaft.

In the present instance the sleeve 28 is provided with a series of rack teeth 31 on the underside thereof for engagement with corresponding teeth on a suitable pinion 32. As shown in Figure 3 of the drawings, the pinion 32 is secured to a rock shaft 33 which, in turn, is rotatably supported on the housing 24 and is operated by a reciprocable rack 34. The rack 34 meshes with a gear 35 secured to the shaft 33 in such a manner that movement of the rack in an upward direction causes an axial movement of the tool holder 27 in an inward direction and movement of the rack in a downward direction imparts a movement to the tool holder 27 in an outward direction.

In the embodiment of the invention shown in Figures 1 to 10, inclusive, the rack 34 is moved in an upward direction to feed the tool holder 27 inwardly by a manually operated foot pedal 36 positioned for ready accessibility to one side of the base 20 of the machine and secured to a rock shaft 37. As shown in Figure 2, the shaft 37 is supported for rocking movement in suitable bearings carried by the base 20 of the machine and is operatively connected to the lower end of the rack 34 by means of a rod 38 and a link 39. The connection between the rock shaft 37 and the rack 34 is such that downward movement of the foot operated pedal 36 moves the rack 34 in an upward direction to, in turn, move the tool holder 27 in an inward direction. The return or outward movement of the tool holder 27 is effected by a spring 40 having the lower end engaging a fixed shoulder 41 on the rod 38 and having the upper end abutting a part 42 of the machine base 20.

The tool holder 27 on the inner end of the shaft 26 may be of any suitable design depending upon the type of tool to be employed. In the present instance the tool holder 27 is fashioned with a tapered recess and is adapted to receive a correspondingly tapered spindle 43 of a suitable reducing tool 44. As shown in Figures 4 and 5, the reducing tool 44 selected herein for the purpose of illustration is of the same general construction as the reducing tool shown and described in my copending application, Serial No. 366,757, filed November 22, 1940.

Briefly described the reducing tool 44 has a recess 45 therein for receiving one end of a length of tubular stock to be reduced. The recess 45 tapers inwardly to the extent necessary to provide the desired reduction and the tapered portion of the recess is relieved in the manner indicated by the reference character 46 in Figures 4 and 5. The purpose of the relief portion is to permit the stock to deform relatively freely during the reducing operation and this is advantageous not only because it compensates for expansion of the stock resulting from increases in temperature but also because the marginal edges of the relief portion constantly work the stock during the reducing operation and maintain the stock in a workable condition without overheating the stock. It will also be noted from Figure 4 that the entrant end of the reduced portion of the recess extends continuously around the circumference of the stock. This continuous reduced surface is important because it applies sufficient initial reducing pressure on the stock to heat the latter to the temperature required to render the stock easily workable.

Upon reference to Figures 2, 7 and 8 of the drawings, it will be noted that a plurality of lengths of tubular stock are supported to one side of the axis of rotation of the tool 44 in a hopper 48 having a delivery portion 49 at the lower end of a width approximating the diameter of the tubular stock and having a stock supporting trough 50 at the lower end of the delivery portion 49. The above construction is such that a single row of stock is supported in a vertical stack and successive lengths of stock are fed by gravity to the trough 50 in response to the removal of lengths of stock from the trough 50.

The work holding clamp 22 not only functions to rigidly clamp the stock during the operation of the reducing tool 44 but also serves to transfer the stock from the trough 50 to a position in alignment with the reducing tool. With the above in mind reference is made to Figure 6 wherein it will be noted that the stock holding clamp 22 comprises a pair of cooperating jaws 51 and 52. The cooperating clamping jaws are supported on a slide 53 for relative movement toward and away from each other and are normally yieldably urged in a direction toward each other by means of the springs 54 shown in Figure 9 of the drawings. In detail, a pair of laterally spaced studs 55 are threaded in the jaw 52 and respectively extend into aligned recesses 56 formed in the cooperating jaw 51. The springs 54 respectively surround the portions of the studs 55 in the recesses 56 in such a manner that the outer ends of the springs abut suitable heads 57 on the studs and the inner ends of the springs abut suitable shoulders 58 formed on the clamping jaw 51. It follows from the above that the clamping jaw 51 is yieldably urged toward the clamping jaw 52 by the springs 54.

As stated above the clamping jaws are mounted on the slide 53 and it will be noted that the latter is supported on a block 59 for sliding movement transversely of the axis of rotation of the tool 44. The block 59 affords sufficient travel of the slide 53 to enable the clamping jaws to move from a position in alignment with the axis of rotation of the tool 44 to a position in registration with one end of the trough 50. As shown in Figure 6, the clamping jaws are reciprocated between the two above mentioned positions by a fluid pressure motor 60 having a cylinder 61 rigidly secured to the block 59 and having a piston 62 reciprocably mounted on the cylinder. The piston 62 is connected to the slide 53 by means of a connecting rod 63.

The piston 62 and, accordingly, the clamping jaws are moved in opposite directions by fluid under pressure alternately admitted to the oppo-

site ends of the cylinder 61 through a two-way solenoid valve 64. The solenoid operated valve 64 is controlled by a limit switch 65 mounted on the base 20 of the machine in a position to be engaged by a cam 66 which is shown in Figure 1 as mounted on the rod 38. The arrangement is such that initial upward movement of the rod 38 to move the tool 44 toward the work holding clamp 22, engages the cam with the limit switch 65 and closes the latter. As a result of this operation, fluid under pressure is admitted to the cylinder 61 through the conduit 67 and fluid pressure is exhausted from the opposite end of the cylinder through the conduit 68. Accordingly, the piston 62 is advanced to move the clamping jaws in registration with the tool so that as the latter continues to advance, the length of stock between the jaws enters the recess 45 in the tool.

Attention is called to the fact at this time that as the clamping jaws move into registration with the tool 44, the jaw 51 engages an abutment 69 on the block 59 in such a manner that continued movement of the piston 62 in the above mentioned direction compresses the springs 54 and rigidly clamps a length of stock between the cooperating jaws. As a result, the length of stock is positively held by the clamping jaws during the operation of the tool to reduce the stock.

The clamping jaws remain in registration with the tool 44 until the latter completes the reducing operation or until the operator releases the foot pedal 36. As soon as the foot pedal 36 is released, the spring 40 moves the rod 38 in a downward direction to return the tool 44 to its outermost position and, since the cam 66 is secured to the rod 38, the limit switch 55 is automatically opened. Movement of the limit switch 55 to its open position operates the valve 64 to admit fluid under pressure into the cylinder 61 through the conduit 68 and to exhaust fluid under pressure from the opposite end of the cylinder through the conduit 67. As a result of this operation, the clamping jaws with the finished work therein are returned to a position in registration with the trough 50.

As soon as the clamping jaws are moved into registration with the trough 50, the length of stock supported by the trough 50 is transferred from the trough to a position between the clamping jaws and the finished length of stock is ejected from the clamping jaws by the unfinished length of stock entering the jaws. For accomplishing the above results a fluid pressure operated plunger 70 is supported in axial alignment with the outer end of the trough. As shown in Figure 7, the plunger 70 has a piston 71 secured thereto and the piston 71 reciprocates in a cylinder 72 having the opposite ends respectively connected to a source of fluid under pressure through the medium of a solenoid operated two-way valve 73.

The valve 73 is automatically operated by a limit switch 74 mounted on the base 20 of the machine in a position to be engaged by a cam 75 which is shown in Figure 1 as secured to the rod 38 for movement as a unit with the latter. The arrangement is such that when the rod 38 is moved in a downward direction by the spring 40 to return the tool 44 to its outermost position, the limit switch 74 is closed by the cam 75. Closing of the limit switch 74 operates the valve 73 to admit fluid under pressure into the outer end of the cylinder 72 through the medium of the conduit 76 and to exhaust fluid under pressure from the inner end of the cylinder through the medium of the conduit 77. As a result, the plunger 70 is moved in an inward direction along the trough 50 to force the length of stock in the trough to a position between the clamping jaws 51 and 52. It will, of course, be understood that the timing between the operation of the two limit switches 65 and 74 is such that the clamping jaws assume positions in registration with the trough before the plunger 70 operates to transfer the length of stock in the trough to the clamping jaws.

It follows from the above that as soon as the operator again raises the rod 38 by depressing the foot pedal 36, the limit switch 74 is opened and the valve 73 is operated to admit fluid under pressure into the inner end of the cylinder 72 and to exhaust fluid under pressure from the outer end of the cylinder. Thus, during the interval that the clamping jaws move into registration with the tool 44, the plunger 70 is retracted to enable the lowermost length of stock in the stack or in the portion 49 of the hopper to fall to a position in the trough 50 so as to be engaged by the plunger 70 during the next cycle of operation.

It will be noted from the above that it is important to accurately locate the clamp with respect to both the tool 44 and the trough 50. In this connection attention is directed to Figure 6 wherein it will be noted that the block 59 on which the clamp is supported is mounted on a bracket 80 which, in turn, is connected to a plate 81 in a manner to enable the position of the clamp to be adjusted transversely of the axis of rotation of the tool. The plate 81 is supported on the base 20 of the machine by means of bolts 82 in a manner to enable the clamp to be adjusted fore and aft or in the general direction of the axis of the tool 44. It will also be noted from Figure 6 that the meeting surfaces of the block 59 and the bracket 80 are inclined and that the two are connected together by bolts 83 in a manner to enable the block 59 to slide relative to the bracket 80. Owing to the inclination of the meeting surfaces of the block 59 and the bracket 80, it will be noted that movement of the block 59 relative to the bracket 80 varies the elevation of the clamping jaws 51 and 52. Thus, it will be noted that provision is made for accurately positioning the clamping jaws with respect to both the tool 44 and the trough 50.

In the embodiment of the invention illustrated in Figures 11 to 15, inclusive, I have shown a metal working machine capable of simultaneously reducing opposite ends of a length of tubing. Upon reference to Figure 11, it will be noted that the machine is provided with a pair of aligned reducing tools 84 and 85 normally spaced from each other a sufficient distance to enable a length of stock to be inserted therebetween. Both tools are identical in construction and one of the tools is shown in detail in Figures 15 and 16 of the drawings. In the interest of simplicity the tools illustrated in connection with the machine shown in Figure 11 are identical in construction and operation to the tool 44 previously described. Accordingly, corresponding parts of the tools are designated by the same reference characters employed in describing the tool 44.

The tools 84 and 85 are not only rotatable around their common axis but are also movable toward and away from each other along this axis. For accomplishing this result the tools are respectively mounted in heads 86 and 87 which are

preferably identical in construction to the head 21 previously described. In general, the tools 84 and 85 are moved toward and away from each other by a pair of racks 88 and 89, respectively, mounted at opposite sides of the machine for reciprocation in a vertical direction. The lower ends of the racks are operatively connected by suitable linkage to a foot pedal 90 in such a manner that downward movement of the foot pedal raises both racks and affects a movement of the tools toward each other. The tools are retracted or returned to their inoperative positions by means of springs 91 respectively acting on the racks 88 and 89 in the same manner as the spring 40 described in connection with the first embodiment of this invention.

During the time the tools are respectively reducing opposite ends of a length of stock, the latter is rigidly clamped intermediate its ends by a clamp 92 having cooperating jaws 93 and 94. Upon reference to Figures 13 and 17 it will be noted that the clamping jaw 94 is fixed at one side of the axis of rotation of the tools and that the clamping jaw 93 is supported at the opposite side of this axis on a slide 95. The slide 95 is mounted on a bracket 96 for movement toward and away from the fixed jaw 94.

In the present instance the slide is moved in opposite directions by means of a fluid pressure operated motor 97 identical in construction to the fluid pressure operated motor 60 and controlled in substantially the same manner as the latter motor. In general, the flow of fluid pressure to the fluid motor 97 is controlled by a solenoid operated valve (not shown) similar to the valve 64 previously described.

As in the first embodiment of the invention, the value is automatically operated by a limit switch 98 supported on the machine frame in the path of travel of a cam 99 which is movable as a unit with the rack 89. The arrangement is such that when both racks are moved in an upward direction to initially move the tools toward each other, the limit switch is closed by the cam 99 and the fluid motor 97 is operated to move the slide 95 together with the clamping jaw 93 toward the fixed clamping jaw 94.

The two clamping jaws remain in their clamping position until the tools are returned by the racks to their inoperative positions. At this time the limit switch 98 is opened by the cam 99 and the fluid motor 97 operates to move the slide 95 together with the jaw 93 in a direction away from the fixed jaw 94 to open the clamp.

In the present instance the lengths of stock to be reduced by the tools are successively fed by gravity to a position directly between the clamping jaws when the clamp 92 is in its open position. As shown in Figure 17, a vertical stack of stock is positioned to one side of the axis of rotation of the tools by a hopper 100 similar in construction to the hopper 48. The delivery end of the hopper 100 registers with the space between the clamping jaws in the open position of the clamp and the stack of stock is supported by pins 101 slidably mounted in bores extending through the jaw 93.

The above construction is such that when the clamping jaw 93 is retracted to the position shown in Figure 17, the lowermost length of stock in the stack falls by gravity to a position in engagement with the projecting ends of the pins 101. The pins 101 are so located that the lowermost length of stock in the stack is supported between the clamping surfaces of the jaws and the length of stock directly above the lowermost length of stock is positioned so as to be substantially free from the clamping surfaces of the jaws. As a result, movement of the jaw 93 toward the jaw 94, from the position thereof shown in Figure 17, shifts the lowermost length of stock laterally against the fixed jaw 94 and clamps the stock in the proper position for engagement by the reducing tools 84 and 85. It will be noted that as the jaw 93 approaches the jaw 94, the top edge 102 of the jaw 93 moves beneath the stack of stock and supports the latter until the jaw 93 is again retracted.

It is also important to note that as the jaw 93 is moved toward the jaw 94 the projecting ends of the pins 101 abut the jaw 94 in such a manner that continued movement of the jaw 93 is affected relative to the pins 101. The above arrangement is such that initial return movement of the jaw 93 is accomplished while the projecting ends of the pins 101 are substantially flush with the adjacent surface of the jaw 93 and, as a result, the finished stock drops out of the machine by gravity. As the jaw 93 approaches its retracted position shown in Figure 17, the outer ends of the pins 101, respectively, abut the fixed pins 103 in such a manner that the pins 101 are shifted inwardly in ample time to engage the lowermost length of stock in the stack as it falls between the jaws.

If desired, ejection of the completed stock may be assisted by means of a lever 104 pivoted intermediate its ends as at 105. The inner end of the lever 104 is normally urged to a position between the clamping jaws by a spring 106 which connects the outer end of the lever to a fixed part of the machine. The above construction is such that when the jaw 93 is initially moved toward its retracted position the inner end of the lever engages the finished length of stock and applies a downward force on the latter which is sufficient to overcome any tendency for the stock to stick or to remain on the jaw 94.

In Figure 18 of the drawings I have shown means for automatically raising the racks 88 and 89 to move the reducing tools toward one another. In detail, a prime mover 107 drives a worm 108 which, in turn, meshes with a worm wheel 109 and rotates the latter. The worm wheel 109 is connected at a point offset from its axis of rotation with a rod 110 and this rod is, in turn, operatively connected by suitable linkage 111 to the lower ends of the racks for reciprocating the latter.

Operation

The operation of the embodiment of the invention shown in Figures 1 to 10, inclusive, will first be described. Assuming that the several parts of the machine are in the relative positions they assume when the tool 44 has just completed reducing one end of a length of stock and that the operator has released the foot pedal 36, it will be noted that the rack 34 is moved in a downward direction by the spring 40. Movement of the rack 34 in a downward direction retracts or returns the tool 44 to its inoperative position wherein the length of stock is released from the tool.

During initial downward movement of the rack 34, the limit switch 35 is opened and the valve 64 is operated to shift the clamp 22 to a position wherein the length of finished stock between the clamping jaws is aligned with the plunger 70. Continued downward movement of the rack 34

closes the limit switch 74 and operates the two-way valve 73 in a manner to move the plunger 70 in a direction to transfer the length of stock on the trough 50 to a position between the clamping jaws. It will be noted that as the unfinished stock enters the clamping jaws the completed length of stock is ejected from the jaws.

Upon completion of the above operations, the operator depresses the foot pedal 36 to raise the rack 34 and move the tool 44 in an inward direction toward its operative position. Initial upward movement of the rack 34 opens the switch 74 and operates the valve 73 to retract the plunger 70 and permit another length of stock to fall from the hopper 48 onto the trough 50. Continued upward movement of the rack 34 closes the switch 65 and operates the valve 64 to shift the clamp to a position wherein the stock is aligned with the advancing tool 44 and wherein the stock is rigidly clamped between the clamping jaws by engagement of the jaw 51 with the fixed abutment 64. The switch 65 remains closed and, accordingly, the work is held by the clamp in operative relation to the tool 44 until the operator again releases the foot pedal 36 to repeat the above cycle of operations.

Referring now to the operation of the embodiment shown in Figures 11 to 17, inclusive, it will be noted that as the operator depresses the foot pedal 90 the racks 88 and 89 are raised to move the reducing tools 84 and 85 in directions toward each other. Initial upward movement of the racks closes the limit switch 98 and effects an operation of the fluid motor 97 to shift the clamping jaw 93 toward the cooperating jaw 94. As the jaw 93 moves toward the jaw 94, the length of stock between the jaws is shifted into engagement with the jaw 94 and is clamped between the adjacent surfaces of the jaws. When in this latter position, the length of stock is aligned with the tools so that continued movement of the tools toward each other effects a reduction of the opposite ends of the length of stock.

The length of stock is held in operative relation to the tools until the reducing operation is completed and until the operator releases the foot pedal 90. At this time the racks 88 and 89 are moved downwardly by the springs 91 to return the tools to their inoperative positions and the limit switch 98 is opened to effect operation of the fluid motor 97 to retract the clamping jaw 93.

As pointed out above, during movement of the clamping jaw 93 toward the clamping jaw 94, the pins 101 are retracted so that initial return movement of the clamping jaw 93 enables the finished length of stock to fall out of the machine between the jaws. When the jaw 93 approaches its retracted position, the pins 101 are shifted inwardly relative to the jaw 93 by the abutments 103 to again project the inner ends of the pins beyond the adjacent face of the jaw 93. Attention is called to the fact at this time that the pins are moved to their projected positions prior to disengagement of the top surface of the jaw 93 with the lowermost length of stock in the stack so that when the jaw 93 is completely retracted the pins are in a position to engage the lowermost length of stock in the stack as it drops from the delivery end of the hopper.

What I claim as my invention is:

1. A metal working machine having a revoluble tool, a work clamp comprising a pair of separable jaws for engaging the work intermediate the ends thereof, a stationary rigid positioning abutment for one of said jaws adapted to hold the work when engaged therewith in axial alignment with and in operative relation to said revoluble tool, means for feeding the work between said jaws in a position out of alignment with said tool, and means for moving the other one of said jaws to carry the work into operative position and to rigidly clamp the same against the first jaw and the latter against said stationary rigid abutment.

2. A metal working machine having a revoluble tool, a work clamp comprising a pair of separable jaws for engaging the work intermediate the ends thereof, a stationary rigid positioning abutment for and in fixed relation to one of said jaws adapted to hold the work when engaged therewith in axial alignment with and in operative relation to said revoluble tool, means for feeding the work between said jaws in a position out of alignment with said tool, and means for moving the other one of said jaws to carry the work into operative position and to rigidly clamp the same against the first jaw and the latter against said stationary rigid abutment.

3. A metal working machine having a revoluble tool, a work clamp comprising a pair of separable jaws for engaging the work intermediate the ends thereof, means for feeding the work between said jaws when in a position laterally offset from alignment with said revoluble tool, means for moving said jaws with the work therebetween from the work receiving position to a position in alignment and in operative relation to said revoluble tool, and a stationary rigid abutment against the resistance of which said jaws are pressed when the work is in operative position to rigidly clamp the same.

4. A metal working machine having a revoluble tool, a work clamp comprising a pair of jaws spring pressed towards each other, means for feeding the work longitudinally between and in engagement with said spring pressed jaws when in a position laterally offset from alignment with said revoluble tool thereby ejecting any work previously engaged therewith, a stationary rigid positioning abutment for said jaws adapted to hold the work when engaged therewith in axial alignment with and in operative relation to said revoluble tool, and fluid pressure means for moving said jaws from the work receiving position to a position adjacent to said stationary abutment and for rigidly clamping the work in the latter position.

5. A metal working machine having a revoluble tool, a work clamp comprising a pair of jaws spring pressed towards each other, a rigid abutment for said work clamp positioned to hold the work in the clamp in axial alignment with and in operative relation to said revoluble tool, a holder for a stack of work in a position offset laterally and longitudinally from the work in axial alignment with said tool and with the lowermost work piece in said stack in axial alignment with said work clamp in one of its positions, means for moving said lowermost work piece in the stack into said work clamp when in registration therewith and thereby ejecting any work piece previously engaged with said clamp, and fluid pressure operated means for moving said work clamp between the positions in registration with said stack and in engagement with said abutment whereby the work in said clamp is rigidly held in the latter position.

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