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TRANSFER MACHINES

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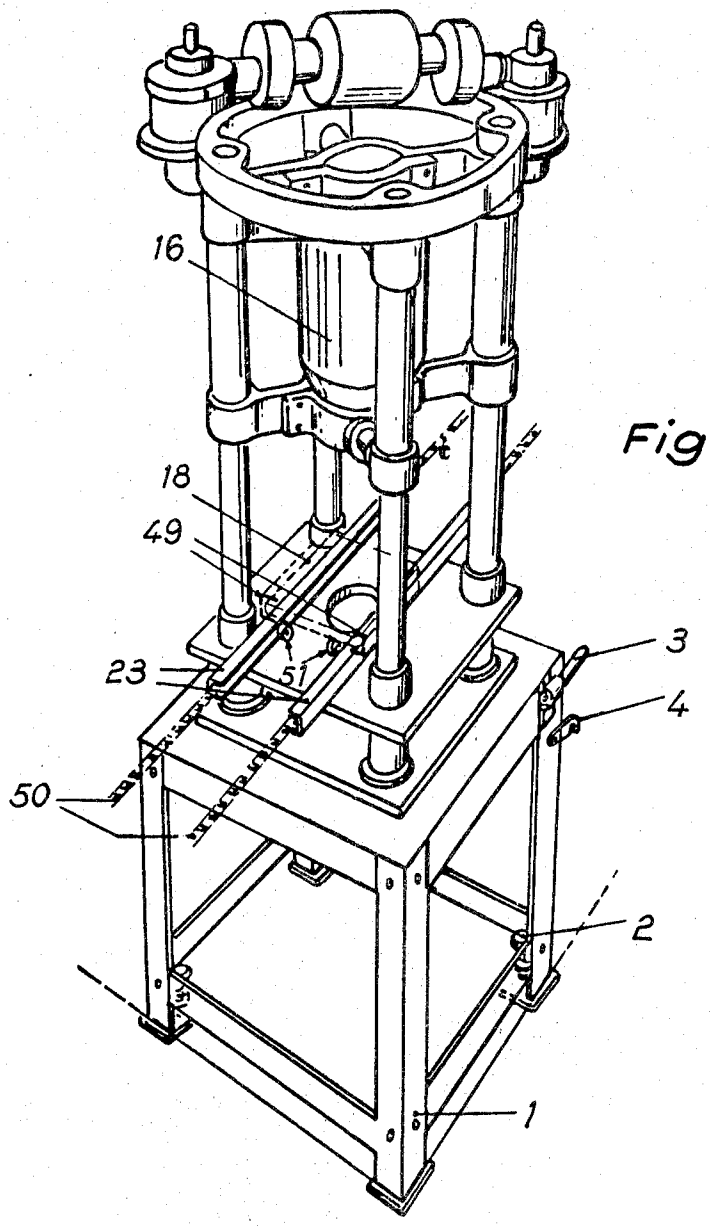

Fig. 1

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Fig. 2

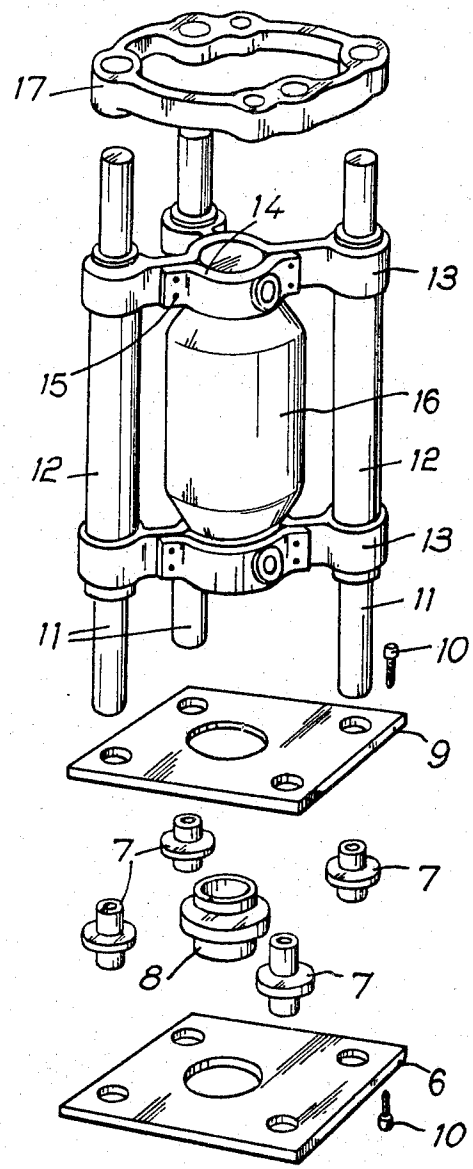

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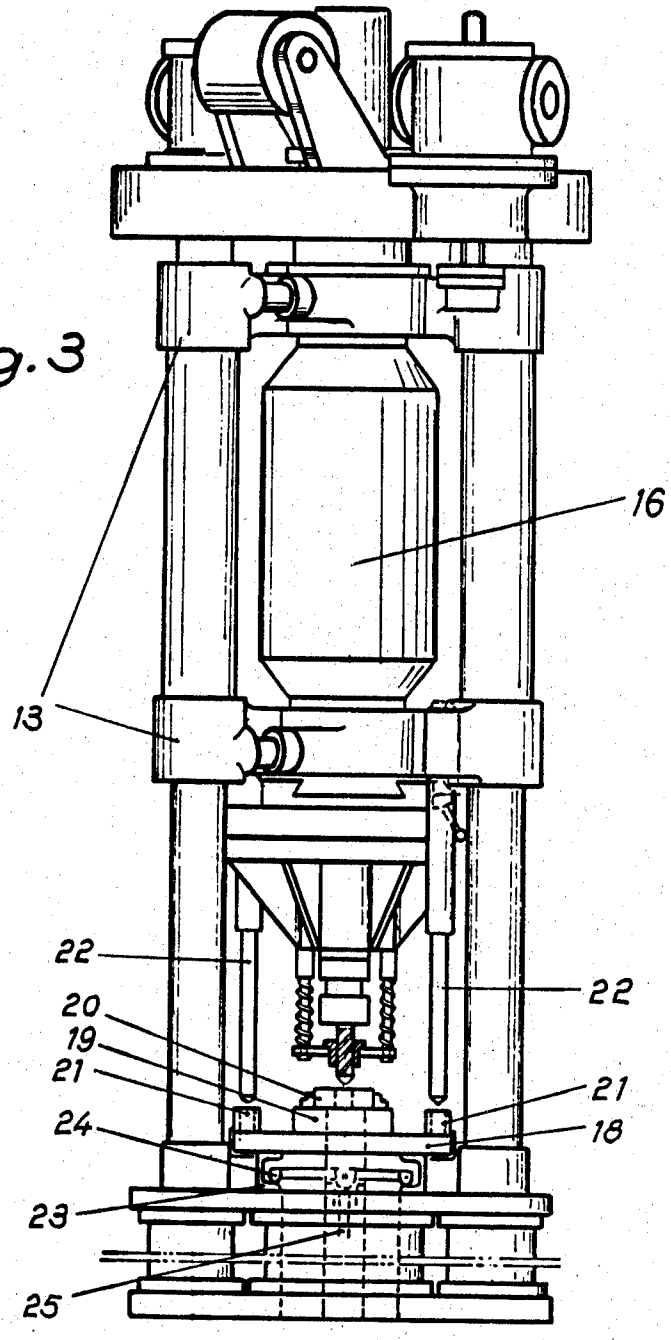
Fig. 3



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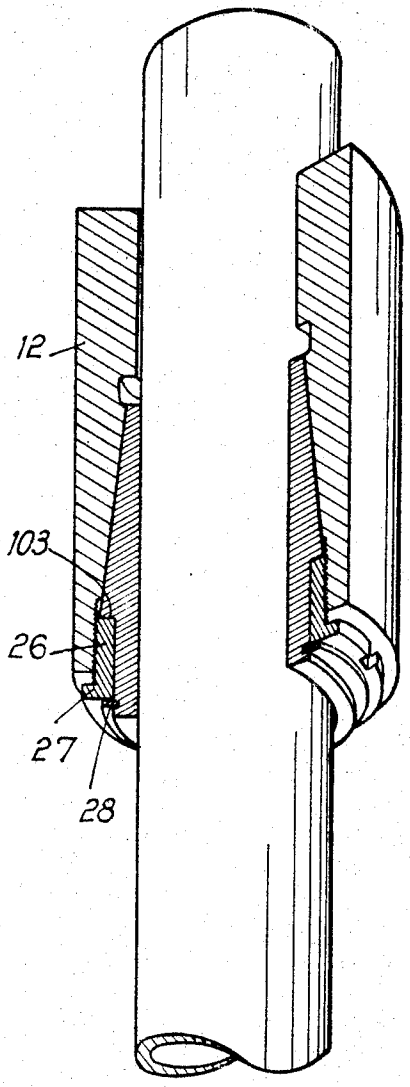

Fig. 4

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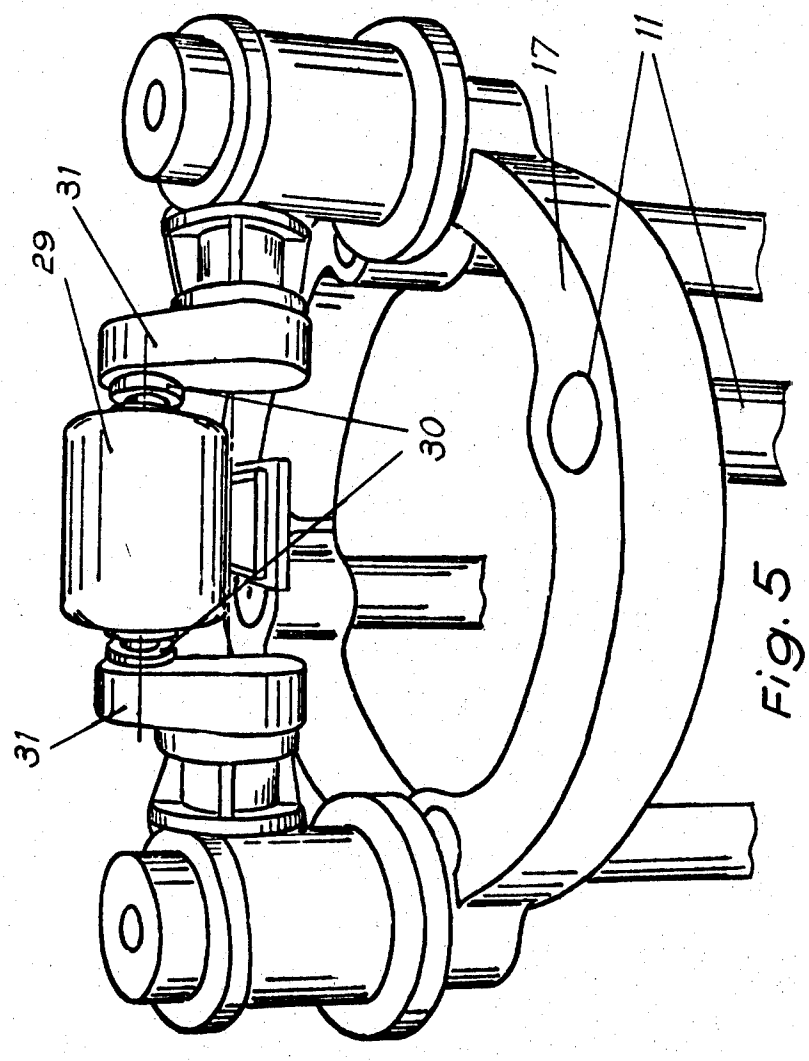

Fig. 5

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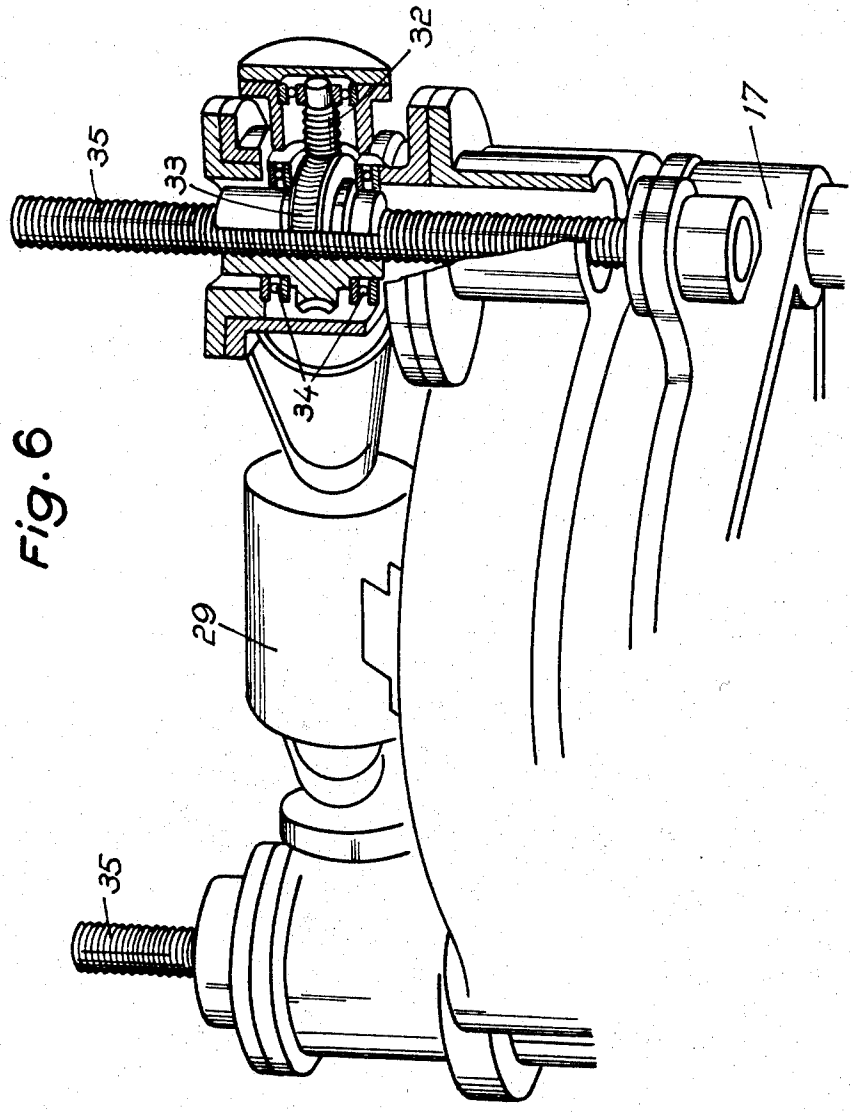

Fig. 6

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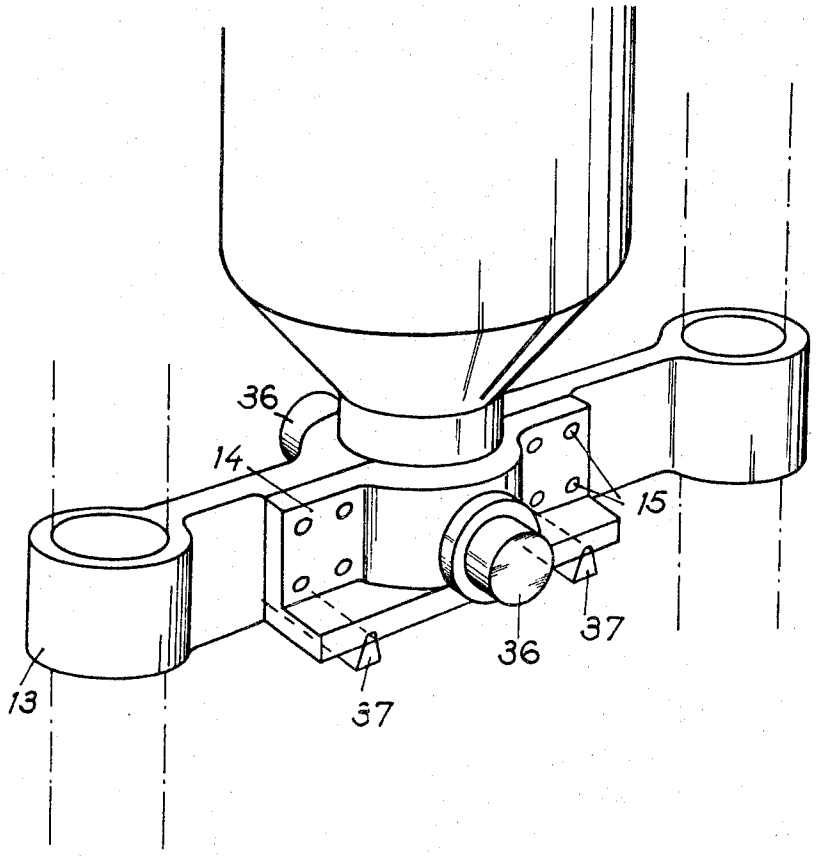
Fig. 7



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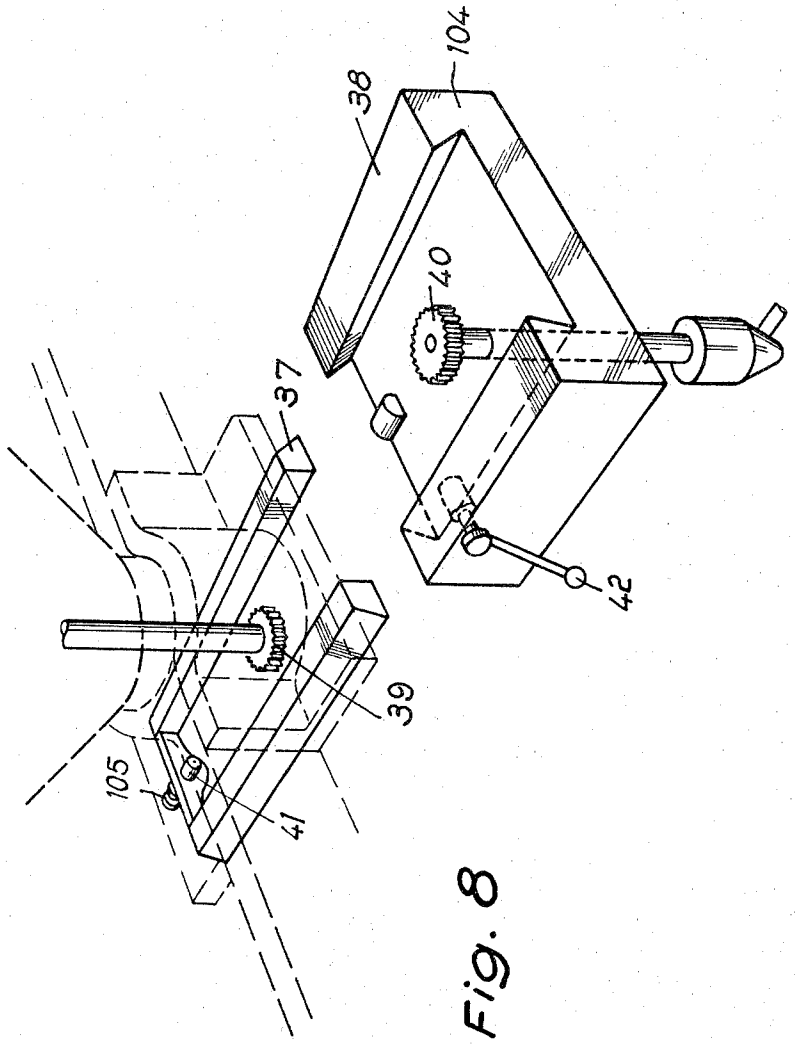

Fig. 8

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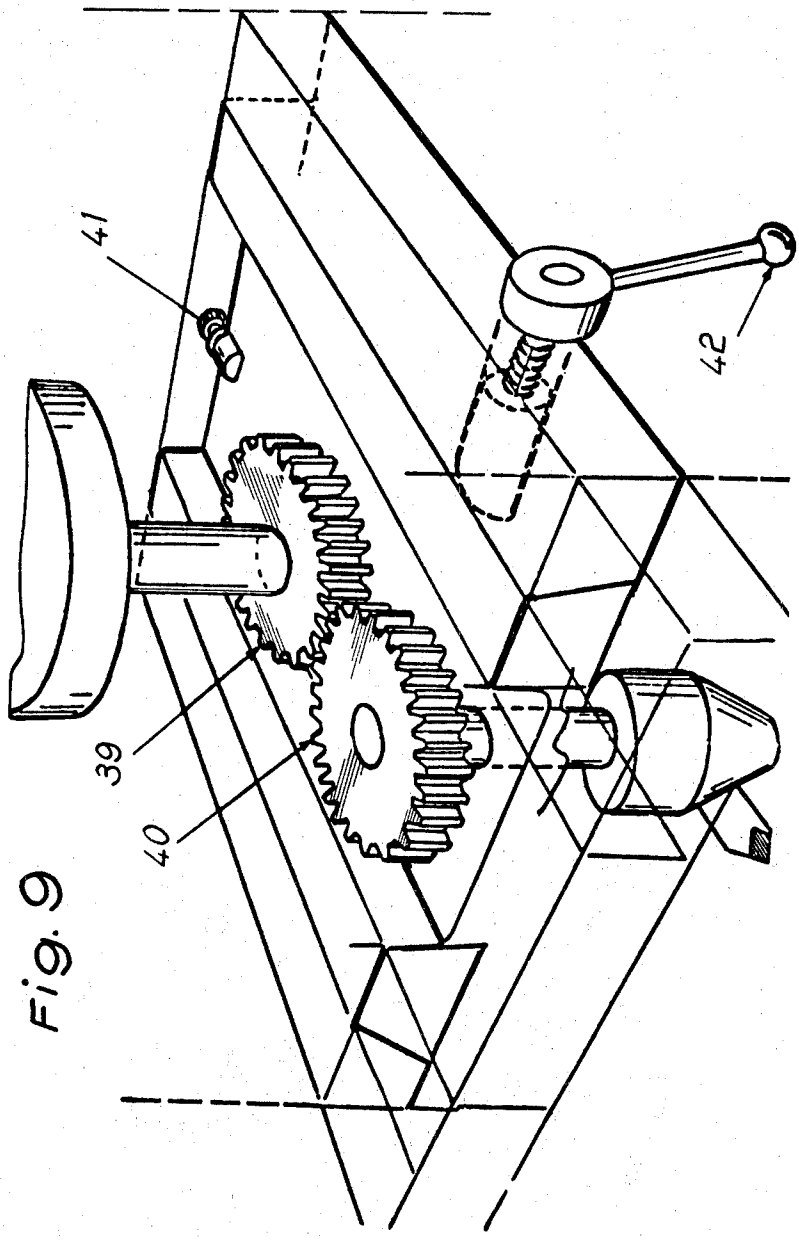

Fig. 9

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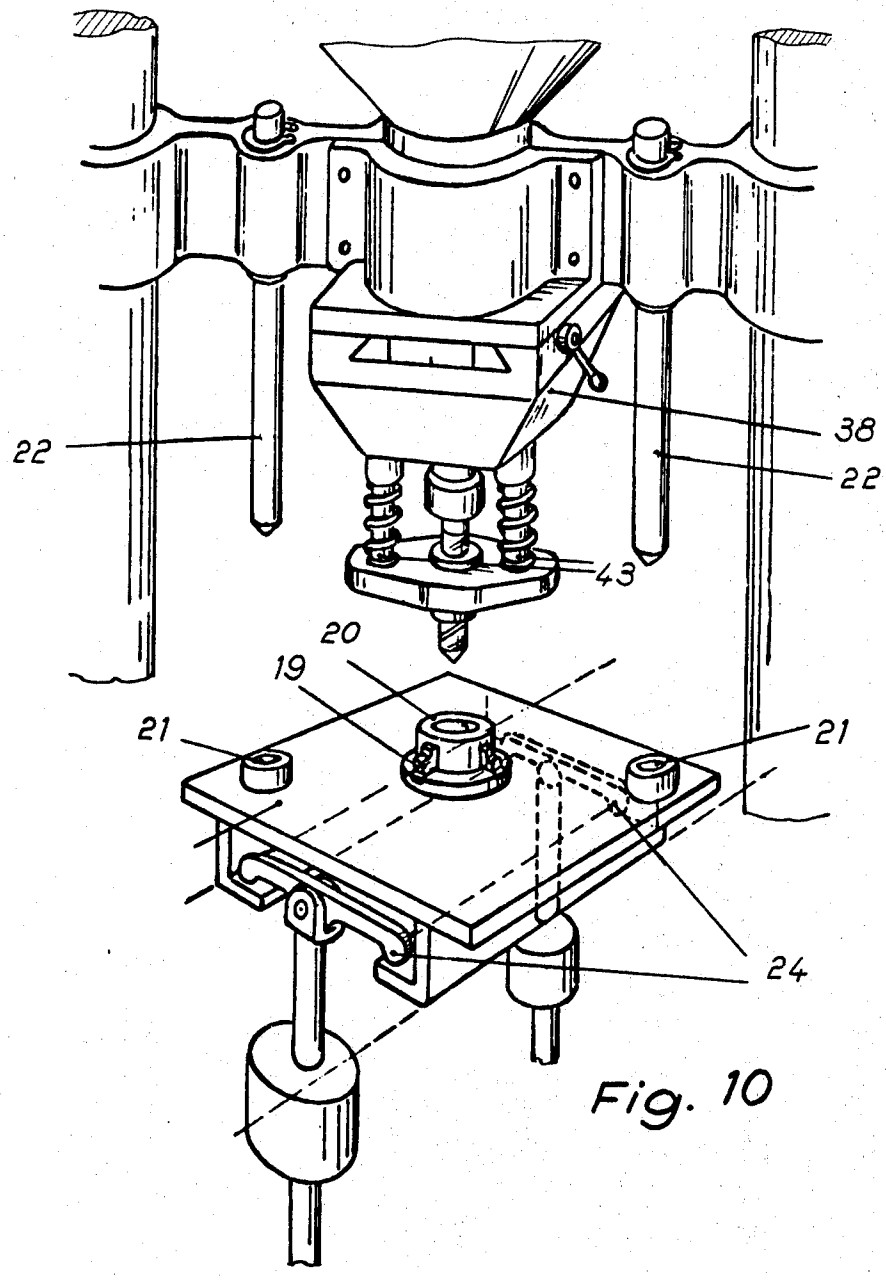

Fig. 10

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Fig. 11

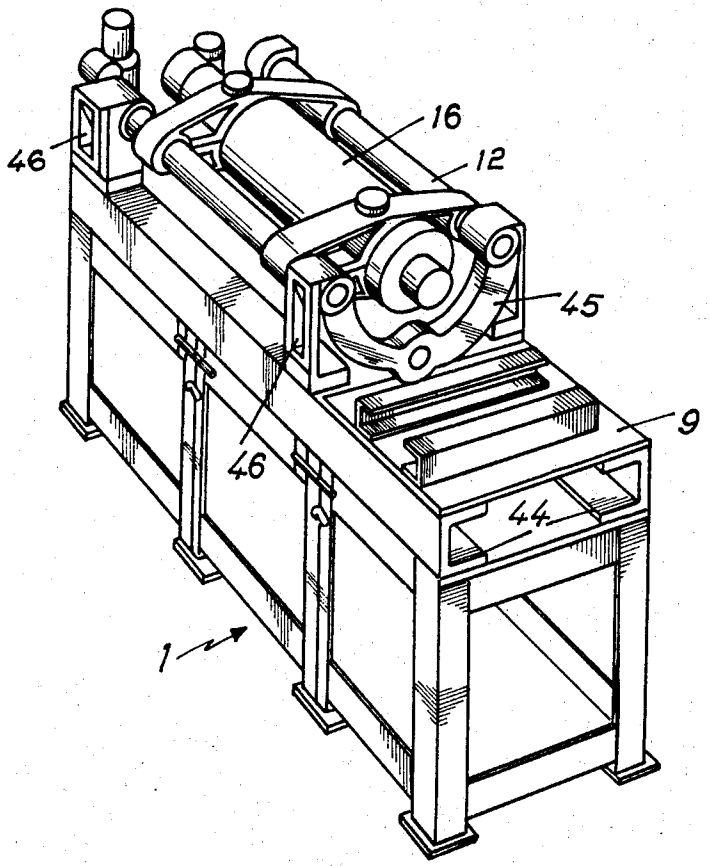


Fig. 12

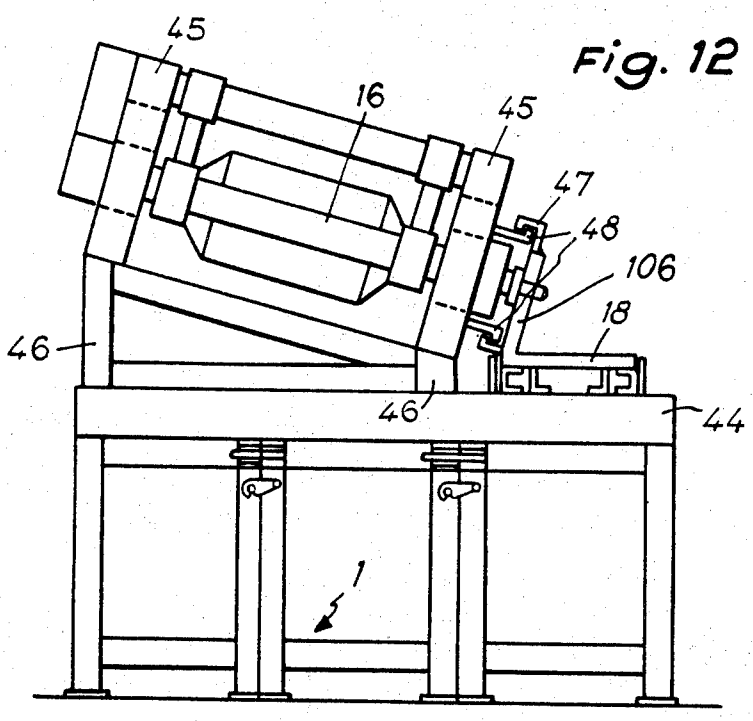
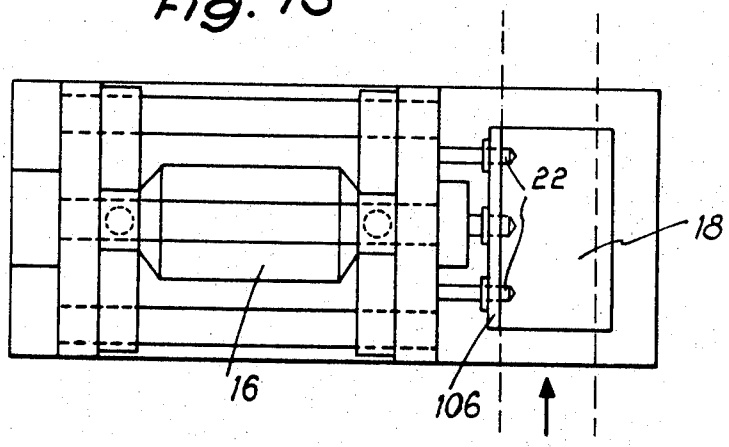


Fig. 13



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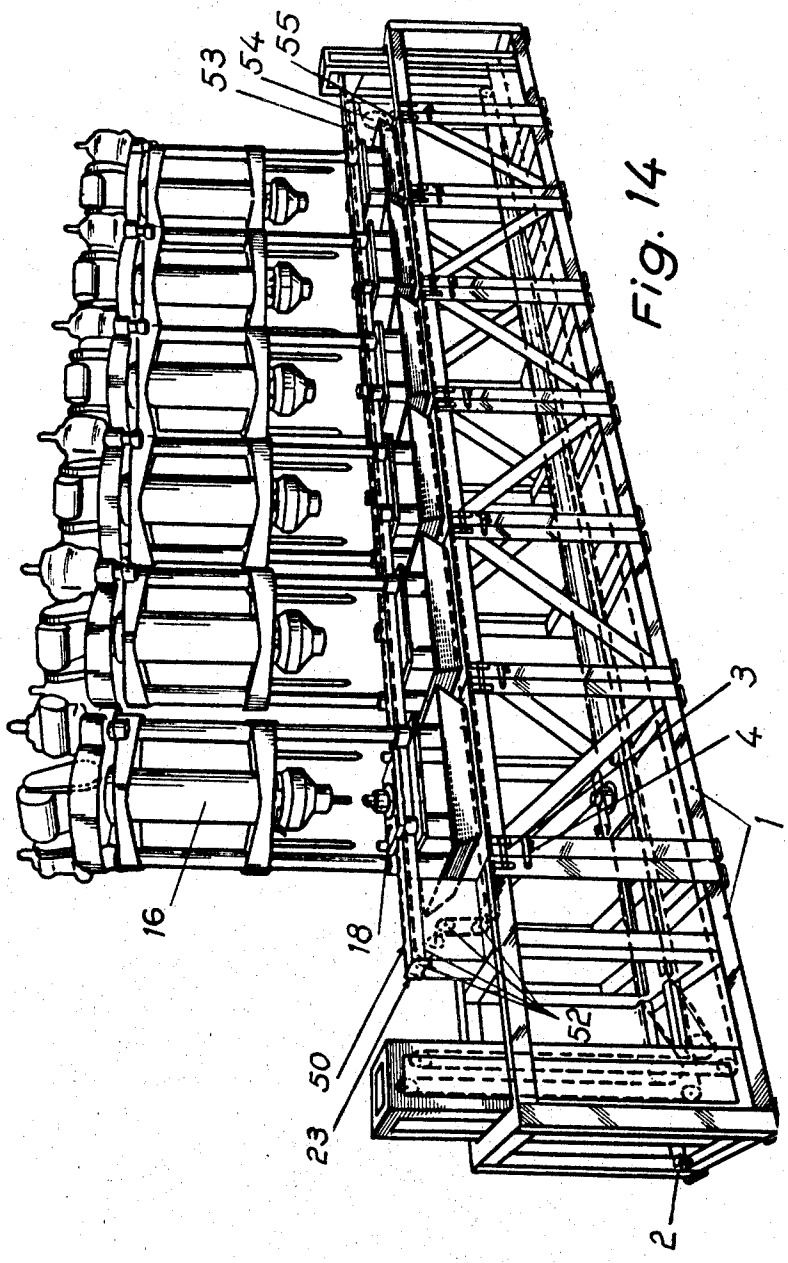

Fig. 14

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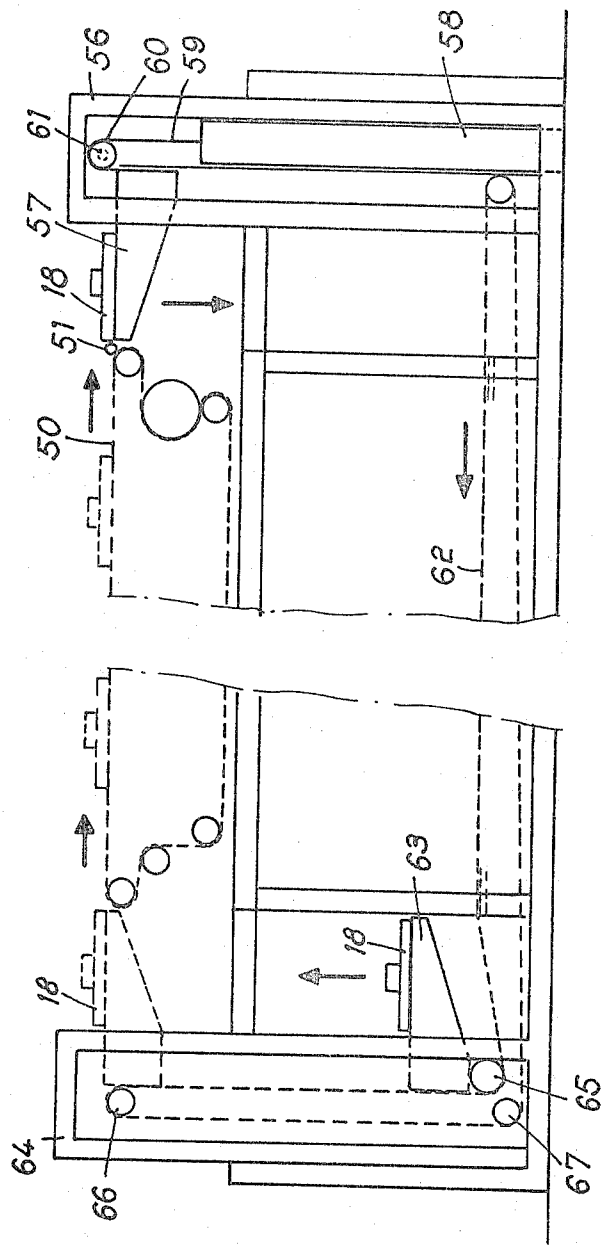
Fig. 15



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TRANSFER MACHINES

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9 Claims. (Cl. 29—33)

ABSTRACT OF THE DISCLOSURE

A transfer machine composed of several similar removal work stations mounted in abutment. Each station consisting of a base, a rigid framework secured to the base, a work set slidably mounted on the framework and a transmission set disposed adjacent to the work set on the framework. Mounting elements to hold a workpiece to be machined, a first endless train transmission means running through the upper portion of each of the bases including rollers to move the mounting elements from one workset to another and a second endless chain transmission means running through the lower portion of each of the bases for returning the mounting elements to a starting position.

This invention relates to transfer machines.

Hitherto, transfer machines have had a certain number of disadvantages, including the fact that they are designed primarily for a single type of workpiece, their working life being tied to that of the manufacture of the said workpiece. These machines cannot be used for a series of workpieces of different dimensions, even in cases wherein the transformation cycle is similar.

Present-day transfer machines carry out only certain operations, while it is often necessary to carry out a multiplicity of different transformation techniques which are often of a heterogeneous nature and which cannot be carried into effect on the transfer machine without considerable difficulty, these treatments including thermal treatments, stamping, pressing, swaging, etc.

Thus, the workpiece must be conveyed, before and after the transfer operations, on to other machines and on to varying and successive mountings, in such manner that during these operations a part of the precision is lost and the idle periods required for the preparation of the machines are progressively increased.

The design of transfer machines requires considerable care, it is costly and requires the utilization of supports of considerable size, which are difficult to machine and which do not remain stable. The time elapsing between the creation of a new product and the commencement of manufacture thereof is therefore very long. Even for mass production, now that the evolution of a product is rapid, the transfer machine has become costly.

Undertakings of medium and small-scale production, which are the most numerous, require on the other hand flexible transfer machines which can easily be designed and which are not costly. Production has been improved proportionally with the evolution of technical procedures and frequently cannot be modified because of transfer machines which are not suitable for easy conversion.

When a new product is created, it is not possible to manufacture the members of which it consists on the existing transfer machines. This results in uncertainty, due to the fact that the prototype members are manufactured with means which differ from those used for mass production.

It is the object of the work unit according to the invention to transform, in an economical manner and without difficulty, any raw material or rough blank to a finished and utilizable member.

According to the invention there is provided a transfer machine comprising a plurality of standard, removable work stations which are mounted in series and each of which comprises a base on each of which is secured a rigid framework carrying a work set slidingly mounted on the latter and controlled by a transmission set disposed at the end of the framework remote from the base, a mounting element on which is secured the workpiece to be machined, the mounting element being caused to move under the various work sets by rollers carried by a first endless chain transmission arrangement disposed in the upper portion of the bases, a second endless chain transmission arrangement being disposed in the lower portion of the bases for the return of the mounting elements, a device being provided for lowering the mounting elements from the first to the second transmission chain.

With the transfer machine of the present invention it becomes possible to eliminate specific and different equipment for each workpiece, long idle periods lost in the preparation of machines, costly runs of material in course of machining. It permits the elimination of defects in present-day production whereby the necessary operations are effected by passing the raw material, or the rough blanks, through costly and long working cycles the elementary operations of which, such as cutting, turning, milling, boring, are spread over a plurality of machine tools which are often placed wide apart, so that long and complicated displacement, stopping and returning are necessary.

The transfer machine can be adapted to any desired production assembly whether small, medium or large, and it may be fed with workpieces of small, medium or large dimensions.

It enables each user having a number of basic units rapidly to assemble a transfer machine to effect, for a given product, all the necessary operations, e.g., stamping, swaging, milling, knurling, drilling, planing, surface treatment, or grinding.

The transfer machine is able to impart a movement of variable rotation either to the workpieces or to the tools, it is able to supply the power and to provide for the displacement, positioning, rapid adjustment, within a wide range, with the object of fulfilling all the working conditions.

It has been designed in such manner as to provide the necessary precision with each machining step, on circular guide elements which do not require, in the manufacture thereof, long squaring and surfacing operations. The unit, even after years of work, will retain its precision in respect of sliding and positioning.

The strength of the unit can be progressively increased, as may be required, whilst leaving the basic structures intact, due to the addition of supplementary elements.

The invention thus has a remarkable economic advantage over and above the technical advantage, since it permits the reduction to a minimum of the period of time interposed between the commercial order and the supply of the finished products, thus eliminating the necessity for stocks of the latter.

The present invention will be more fully understood from the following description of one embodiment, given purely by way of example, with reference to the accompanying drawings, wherein:

FIGURE 1 is a perspective view of a standard removable work station;

FIGURE 2 is an exploded, schematic view of the various elements forming the rigid framework and the working set of the work station of FIGURE 1;

FIGURE 3 is an elevational view of the central part of the standard removable work station of FIGURE 1;

FIGURE 4 is a view in perspective and in partial sec-

tion showing, in detail, the guide members on the support column of the framework of FIGURES 1, 2 and 3;

FIGURE 5 is a perspective view of the upper part of a standard removable work station;

FIGURE 6 is a view partly in section of the part of FIGURE 5;

FIGURE 7 is an enlarged perspective view of the lower portion of the work set;

FIGURE 8 is an exploded view of a portion of the mechanism for controlling a tool;

FIGURE 9 is a perspective view of the parts of FIGURE 8 shown in the assembled position;

FIGURE 10 is a portion view of the lower central portion of a standard removable work station;

FIGURE 11 is a perspective view of a horizontally positioned work set;

FIGURE 12 is an elevational view of an obliquely positioned work set;

FIGURE 13 is a plan view of the same work set of FIGURE 12;

FIGURE 14 is a perspective view of a transfer machine according to the invention, comprising a plurality of standard removable work stations;

FIGURE 15 is a diagrammatic view showing the members for transferring the workpieces.

FIGURE 1 shows a base **1** comprising L-section elements which are assembled in such manner as to be adjusted in height by means of adjusting screws **2** disposed in the lower portion of the base. On the sides of the base are interlocking sliding members **3** which permit the vertical alignment of one base with further similar bases which may be arranged in series, the bases being secured together by means of hooks **4**. Mounted on the base **1**, is a rigid framework **5**, shown in FIGURE 2 as an exploded view.

Referring again to FIGURE 2, a lower plate **6** is formed with four bores arranged in the corner in which are engaged four spacing members **7** the lower shoulders of which bear on the plate **6**.

In the center of the plate **6**, a spacing member **8**, which is similar to but larger than the others is engaged in a central bore in the same plate.

The spacing members **7** and also the spacing member **8** are internally bored. Mounted on their upper portion is the plate **9** which is also centered and separated relatively to the lower plate **6** by means of the spacing members.

This assembly is secured in a precise and non-deformable manner by means of lower and upper screws **10**.

Engaged in the bores in the spacing members **7** (which are illustrated undersize in FIGURE 2) are two or more posts **11** which are utilized as guide members for the sliding of tubes **12**.

Mounted on the tubes **12** are upper and lower arms **13** forming a rigid framework with the tubes **12** and the posts **11**. The arms **13** comprise, in the illustrated embodiment, a central bore consisting of two portions one of which **14** is removable and has the shape of a half-collar the purpose of which is to center, guide and lock the cylindrical ends of a work set **16** which may comprise a mechanical, hydraulic or pneumatic press, a variable-speed rotary unit for the removal of chips, for grinding, thermal treatment, regulation, etc.

Once the work set **16** has been mounted, the two half-collar portions **14** are locked on the arms **13** by means of screws **15**. The set thus remains perfectly aligned and assists in the rigidity of the assembly.

The posts **11** extend above the upper arms **13** and carry a ring **17** which also forms a guide element and an upper reinforcing member for the framework.

It will thus be clear that sliding and positioning of the work set **16** can readily be achieved in industrial usage, since the assembly comprising the tubes **12**, the arms **13** and the work set **16** can slide on the posts **11** between the upper ring **17** and the lower framework without it being necessary to adjust the work set on the arms **13**.

The number of posts **11** will be chosen according to the working conditions which the work set **16** is required to withstand.

FIGURE 3 shows the framework, on the lower portion of which there is mounted a sliding plate **18** for supporting a locking member or vice **19**, carrying a workpiece **20**.

Secured, furthermore, on the plate **18** are centering rings **21** through which, as the work unit descends, there are guide posts **22**, the purpose of which is to center the workpiece with respect to the tool on the work set. The plate **18** is adapted to be displaced on slides **23**. When it is centered on the work set, the plate **18** is locked by means of pivoting arms **24** the members **25**, carrying the pivots, of which are controlled by pneumatic pistons or other control arrangements.

FIGURE 4 shows, in section, the ends of the tubes **12**. The said tubes carry in cooperating conical recesses, conical rings **26**, the purpose of which is to guide and regulate precisely the clearance between the posts **11** and the tubes **12**. Disposed on the outer side of the rings **26** is a screw-threaded ring **27** bearing on the one side on a shoulder **103** of the ring **26** and on the other on a shoulder formed by a resilient locking ring **28**. The rotation of a ring **27** varies the diameter of the conical ring **26** which is longitudinally split or formed of resilient material, thus permitting the adjustment of play.

FIGURE 5 shows the upper ring **17** on which the posts **11** are adapted to engage. Disposed horizontally on this ring is a variable-speed motor **29** the purpose of which is to control, with long intervals between each operation, the displacement of the set **16**, through the intermediary of two electromagnet and pneumatic couplings **30** disposed on either side of the motor and the pivot of which extends beyond the two sides. The couplings **30** connect the motor **29** to the transmission members disposed in housings **31**.

These transmission arrangements have variable ratios to increase the variations in drive to the worms **32** provided by the variable-speed motor. The worms **32** transmit their movement to helical gear wheels **33** which are held against conical movement by bearings **34**.

Disposed in the central portion of each of the helical wheels **33**, which said portion is internally screw-threaded, are threaded rods **35** the purpose of which is to control the displacement of the framework containing the driving unit on the posts **11**.

The transmission sets **33**, **32**, **35** are two in number, one being associated with each of the two main posts **11**, to produce displacement movements at various ratios.

In order to distribute the displacement forces in a uniform manner over the two posts **11**, the two transmission sets may be connected by means of rigid shafts, chains or belts.

A similar transmission set is disposed in the centre of the upper ring **17**, to effect rotation of a shaft which, extending through the hollow central shaft of the work set **16**, causes the operation of controls, reductions and displacements independently of the movements of the ring **17**.

FIGURE 7 shows the lower arm **13** carrying, at 90° relatively to the bores, shafts **36** for mounting supplementary arms, in cases wherein more than two posts are utilized, for connecting them to the ring **17** and making the assembly still more rigid.

Mounted on the lower portion of the set formed by the arms **13**, the collars **14** and the screws **15** are guide members of dove-tail shape **37**, intended for holding and guiding intermediate assembly **104** containing mechanism permitting the immediate change of production techniques.

FIGURE 8 shows dove-tail slideways **38** forming an integral part of the assembly **104**. When the assemblies **104** are used, the work set includes a hollow shaft carrying a gear **39** which engages with a gear **40** forming a part of the intermediate assembly **104** and controlling the

rotation of the tool driving mechanisms of the said assemblies and controlling the relative movement of rotation and displacement of the tools and of the workpieces.

The dove-tail slideways 38, which are engaged and guided on the dove-tail guide members 37, bear on stops 41 which are adjusted by means of a micrometric screw 105, thus permitting precise positioning between the gears 39 and 40. The slideways 38 are locked by means of a clamping lever 42. FIGURE 9 shows the slideway in the working position with the gearings 39 and 40 engaged, and also the adjusting stop 41 and the clamping lever 42.

In FIGURE 10 a particular intermediate assembly having a rapid-change housing is shown in the working position. FIGURE 10 also shows the device for centering the mounting plate 18 with the aid of rings 21 and posts 22, and also the locking of the plate by means of pivoting flanges 24. By way of example, there are also shown two posts 43 by means of which it is possible to achieve the precise positioning of a tool on the workpiece 20.

FIGURE 11 shows a horizontal mounting of the work set 16, displaced on the tubes 12 and on the posts 11. In this case, below the work set and on the base 1, there are disposed beams 44 on which bear the plates 9. Disposed above the beams are cradles 45 serving as guides, the cradles 45 bearing on the supports 46. This mode of assembly is a variant of that illustrated in FIGURE 2 and can also be mounted in a horizontal manner.

FIGURES 12 and 13 show a work set 16, inclined relatively to the plate 18. The cradles 45 are mounted on inclined supports 46 bearing on the beams 44. In this case, the mounting plate 18 forms an angle of less than 90° with the axis of the set 16 which is guided by means of posts 22 in an inclined plate 106 fast secured to the plate 18. Laterally, the inclined plate 106 carries guides 47 having locking means 48 for locking the assembly in the direction of the axis of the unit, after the positioning thereof.

Referring again to FIGURE 1 there are shown U-shaped guide members 49 the upper surface of which forms the guide members 23 carrying the mounting plates 18, and in the inner portion of the U, driving chains 50. The said chains 50 carry on the side thereof laterally towards the web of the U-section, plastic rollers 51 which are utilized for urging and displacing the moving plates 18.

FIGURE 14 shows, by way of example, a work unit consisting of standard elements and having vertical work sets mounted in series and on the same level. The drive chains are guided at the ends of the transfer machine on sprockets 52 and pinions 53, and they are driven by driving sprockets 54 and further guided by sprockets 55.

FIGURE 15 shows, at the end of the transfer movement, a framework 56 containing the system for lowering the machined workpieces, wherein a carriage 57 directs the members from an upper level to a lower level. The mounting plate 18 is urged by the rollers 51 on the chains 50 on to the carriage 57, and then displaced downwardly at the desired speed, since it is controlled by a counterweight 58, which is connected to the carriage 57 by means of a cable 59 passing over a pulley 60.

The arrival at the lower level and the return towards the upper level are damped through the agency of a friction member 61 or other damping means.

Lower return chains 62 are displaced in the direction opposite to that of the upper chains with a rapid and continuous movement, rapidly to return the mounting plate 18 on a lifting plate 63 disposed on a framework 64 at the head of the transfer machine by means of sprockets 65, 66, 67 raise and return the mounting plates 18 to the point from which they had started.

A single operator is required for removing the machined workpiece, for controlling the transfer machine and for placing in position a further rough blank on the plate 18, so as to re-commence a further working cycle.

I claim:

1. A transfer machine, comprising a plurality of similar, removable work stations mounted in abutment; each station consisting of a base, a rigid framework secured to the base, a work set slidably mounted on the framework, and a transmission set disposed adjacent to said work set on said framework; a plurality of mounting elements each capable of holding a workpiece to be machined; first endless chain transmission means traversing the upper portion of each of said bases; rollers carried by said first chain means for moving said mounting elements from one work set to another; a second endless chain transmission means running through the lower portion of each of said bases for returning the mounting elements to a starting position; and means for lowering the mounting elements from said first to said second endless chain transmission means.

2. A machine according to claim 1, wherein the rigid frameworks each comprise two plates separated by spacers and posts connecting the plates to an upper ring, the said posts being engaged in the spacers and constituting guide members on which are slidingly mounted tubes secured to arms carrying a work set.

3. A machine according to claim 1, wherein the transmission set is secured on the upper ring and consists of a motor which drives two worms and cooperating pinions which rotate threadedly on screw-threaded portions of two rods secured to the arms supporting the work set.

4. A machine according to claim 1, wherein the mounting plate for the workpiece, which slides in guide members secured to the rigid framework, comprises centering rings in which guide rods on the work set engage when the latter descends, the said mounting plate being adapted to be locked in the working position.

5. A machine according to claim 1, wherein an intermediate assembly is adapted to be mounted on the work set, e.g., by means of a dove tail slide connection, said assembly including at least one pinion to which a tool may be attached, said pinion being adapted to be meshed with at least one pinion mounted on a drive shaft of the work set, the position of the intermediate assembly being determined by a stop which is adjustable.

6. A machine according to claim 1, wherein the device for lowering the mounting elements consists of a carriage guided in a framework and under the action of a counterweight to which it is connected by a cable.

7. A machine according to claim 1, wherein at least one framework carrying a work set is mounted horizontally on at least one base by cradles secured on supports bearing on beams cast with the said one base.

8. A machine according to claim 1, wherein at least one framework carrying a work set is mounted with the axis of the work set inclined to the horizontal.

9. A machine according to claim 1, wherein the bases are provided with locking and engagement members to locate the bases securely together with their upper portions situated in the same horizontal plane.

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