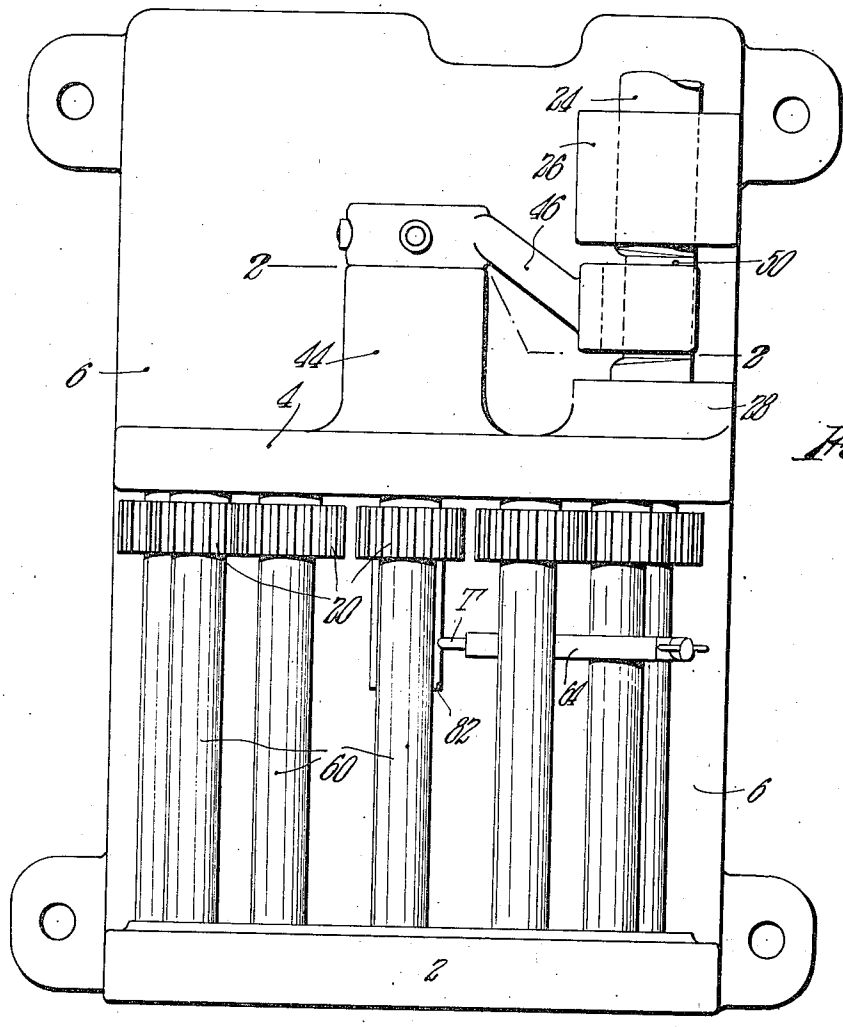
June 10, 1941. R. F. SICKLES 2,245,304

PIERCING MACHINE

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Fig. 1.



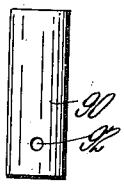


Fig. 3.

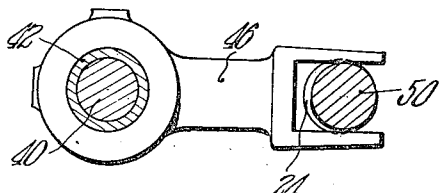


Fig. 2.

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PIERCING MACHINE

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Fig. 5.

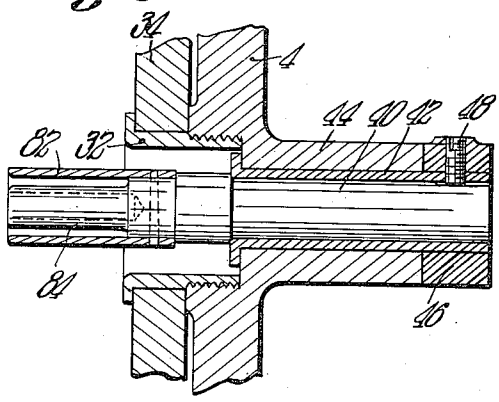


Fig. 6.

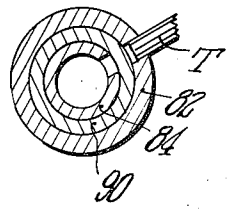


Fig. 4.

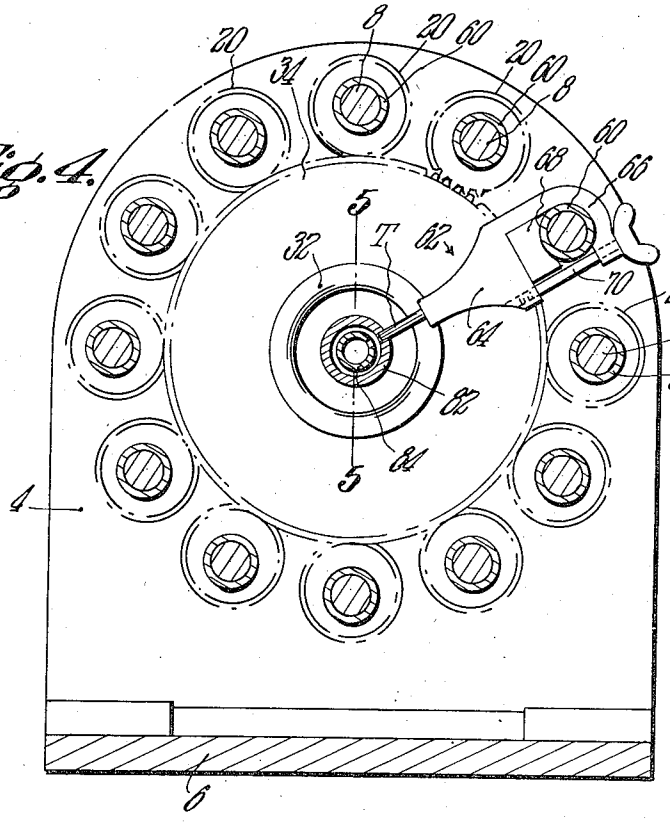
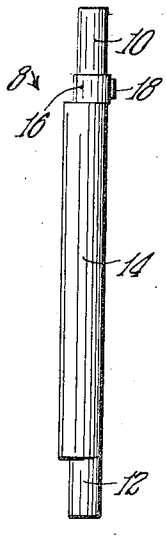


Fig. 7.



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UNITED STATES PATENT OFFICE

2,245,304

PIERCING MACHINE

Royal F. Sickles, Springfield, Mass., assignor to The F. W. Sickles Company, Springfield, Mass., a corporation of Massachusetts

Application June 19, 1939, Serial No. 279,827

20 Claims. (Cl. 164—108)

This invention relates to improvements in apparatus for operating on tubes, sheets or the like and is directed more particularly to improvements in machines for piercing or punching holes in such tubes, sheets or the like.

The principal objects of the invention are directed to the provision of a machine of novel form and construction which is adapted and arranged for piercing or punching holes in tubular objects of any desired size and shape and of any desired relative disposition.

While the novel features of the invention are adapted for broad application, one use for which the machine is particularly adapted is for piercing or punching tubular objects of various cross-sectional shapes, various materials and sizes with holes or openings of any desired size and shape.

According to novel features of the invention, the machine of the invention is so constructed and arranged that an object such as a tube or the like may be pierced with one or a multiplicity of holes while the said machine is readily adjustable to facilitate the relative location of the tools for piercing the work as may be desired. The machine is characterized by its simplicity and operating efficiency, all to the end that separate pieces of work such as tubes and the like may be operated on in rapid succession.

Various other novel features and advantages of the invention will be observed from the following description of the present preferred form of the invention with reference to the accompanying drawings, wherein:

Fig. 1 is a plan view of a machine embodying the novel features of the invention;

Fig. 2 is a sectional elevational view on the line 2—2 of Fig. 1;

Fig. 3 is an elevational view of a tube which represents one form of an object such as may be operated upon by the machine;

Fig. 4 is a transverse sectional elevational view through the machine shown in Fig. 1;

Fig. 5 is a sectional elevational view through the central part of the machine shown in Fig. 4;

Fig. 6 is an enlarged sectional view through the tool guide and work support of the machine; and

Fig. 7 is an elevational view of one of the shafts of the machine shown in Fig. 1.

Referring now to the drawings more in detail, the invention will be fully described.

A forward bracket or end member is represented by 2 and a somewhat similar member is represented by 4. The members 2 and 4 may be suitably secured to any supporting means such as a base plate 6.

Between the members 2 and 4 there extend a plurality of shafts such as 8 shown in Figs. 4 and 7. These shafts are preferably spaced around a circle and they have journal parts 10 and 12 which are journalled in the members 2 and 4 respectively.

Each shaft 8 has an intermediate or central part 14 which is eccentrically disposed relative to the aforesaid journal parts and a part 16 provided with a key or keys 18. Gears or pinions 20 are carried by the parts 16 of the shafts.

A drive shaft 24 is journalled in bearings 26 and 28 and it is operatively connected in some suitable manner to one of the shafts 8. In the embodiment of the invention being described the shaft 24 is connected to that shaft 8 which is designated by 8'.

A bushing 32 is associated with the bearing member 4 in some suitable manner as by the screw threads indicated in Fig. 5. On this bushing there is freely rotatable a gear 34 which gear is in mesh with each one of the gears 20.

The said gears 20 are non-rotatable relative to their respective shafts 8 by means of the keys 18 so that as the shaft 8' is rotated the gear 20 rotates gear 34 which in turn rotates the shafts 8 through the gears 20. In this way all of the shafts 8 are rotated simultaneously as one of them is rotated.

A shaft 40 has a sleeve 42 associated therewith and these are oscillatable in a hub 44 of the member 4 as shown in Fig. 5. A lever 46 is secured to the members 40 and 42 as by one or more set screws 48 or the like and said lever has an outer forked end as shown in Fig. 2.

The drive shaft 24 has an eccentrically-disposed part 50 which operates in the said forked end of lever 46 and as shaft 24 rotates the lever 46 is swung up and down thereby to oscillate the shaft 40 and the member 42.

Tubes such as 60 are provided on the shafts 8 and these are arranged for rotation thereon. Tool holders 62 are provided which may include a body part 64 having a curved end 66 adapted to engage and embrace the tubes 60.

A block 68 having a curved seat is provided for each tool holder and tightening screws 70 are arranged to draw the curved part of the tool holders downwardly so that the tube is clamped or firmly embraced by the tool holder. The tool holders are easily and readily secured to or removed from the tubes and they are as readily shiftable therealong and clamped thereto as may be desired.

Each tool holder may carry a tool represented by T and said tool may be of any cross-sectional shape desired and, of course, may be of any desired size.

On the end of the shaft 40 there is provided a guiding means for the tools. In the form of the invention being described the guide means is in the form of a tubular member 82. Also in the present form of the invention a tubular part 84 is concentrically disposed relative to the guide

82, as shown in Fig. 4. The guide has an opening for each one of the tools relatively disposed in the manner it is desired that the tools operate upon the work.

While the machine of the invention is adapted for many and various uses, the present preferred form thereof is described in connection with a tube such as 90 shown in Fig. 3 which it is desired to pierce with one or more holes such as 92. As stated there may be any number of tool holders and tools depending upon the number of holes or openings which it is desired to provide in the tube and they may be disposed and spaced along the tube 60 in any desired manner.

The guide 82 will be constructed and arranged to support the tube or other piece of work according to the shape or form thereof. Where a tube such as 90 is to be pierced it is slipped between the members 82 and 84 which are provided with suitable openings or guideways for the tool or tools according to the desired relative spacing and position and size thereof.

In the operation of the apparatus the shaft 24 is rotated in any desired manner as by a motor or the like through a clutch mechanism. Preferably the shaft 24 is operated through one revolution at a time or it is operated intermittently through 360° to allow for a tube to be inserted in the guide 82 for the piercing or punching operation and its removal after said operation.

As the shaft 24 is rotated the gear 20 of the shaft 8' to which the shaft 24 is connected rotates the gear 34 and thereby all of the gears 20 and their respective shafts 8 are rotated.

As the shafts 8 rotate the eccentric portions thereof carry the tubes 60 thereon around the axes of rotation of the said shafts 8. The tool holders having the tools thereof guided in the guide 82 are given a circular motion while the tools are reciprocated so as to act on the work or pierce it.

Simultaneously with the rotation of the shafts 8 the shaft 40 is oscillated to oscillate the guide 82 so that the guideways thereof are properly positioned for and guide the tool or tools. That is to say, as a tube 60 is moved eccentrically relative to the axis of rotation of the shaft 8 on which it is rotatable, the tool T passes through a varying angle relative to a certain plane passing through the axis of shaft 40, or as a tool is moved in and out by rotation of its actuating shaft 8 it assumes various angular positions. By oscillating shaft 40 and thereby the guide 82 in which the tool T is reciprocable, the guideway in the guide accommodates itself to the angularity of the tool so that the said tool is guided in its reciprocating movements as its angularity changes.

As has been explained, there may be as many tool holders and tools such as or similar to those shown as may be desired to perform various punching or piercing operations. The tool holders may be relatively disposed along the tubes 60 to provide the desired and necessary spacing and relative positioning of the tools. The guide 82 shown is suitable for a circular tube such as 90 but its form may be modified to serve for supporting tubes of other forms and objects to be pierced or punched.

While I have described the invention in great detail and with respect to the present preferred form thereof, it is not desired to be limited thereto since changes and modifications may be made therein without departing from the spirit and scope of the invention. The invention may be embodied in other specific forms without departing from the essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What it is desired to claim and secure by Letters Patent of the United States is:

1. A machine of the class described, a support, a plurality of tool shafts journalled in said support and circularly spaced therearound, a guide oscillatable centrally of said shafts having a guideway for a tool, a tool guided in said guideway, and connections between said tool and one of said shafts whereby the tool is reciprocated relative to said guide as said one shaft is rotated.

2. A machine of the class described, a support, a plurality of tool shafts journalled in said support and circularly spaced therearound, a guide oscillatable centrally of said shafts having a guideway for a tool, a tool guided in said guideway, and connections between said tool and one of said shafts whereby the tool is reciprocated relative to said guide as said one shaft is rotated, said support including spaced members between which said shafts extend and in which opposite ends of said shafts are journalled.

3. A machine of the class described, a support, a plurality of tool shafts journalled in said support and circularly spaced therearound, a guide oscillatable centrally of said shafts having a guideway for a tool, a tool guided in said guideway, and connections between said tool and one of said shafts whereby the tool is reciprocated relative to said guide as said one shaft is rotated, said connections including a tube rotatable about an eccentrically disposed portion of said shaft.

4. A machine of the class described, a support including spaced members, a plurality of shafts spaced in circular relation having opposite ends journalled in said members having eccentrically disposed intermediate portions, a guide oscillatable centrally of said shafts having a guideway for a tool, a tool reciprocable in said guideway, and connections between one of said shafts and said tool whereby as said shaft rotates said tool is reciprocated relative to said guide.

5. A machine of the class described, a support including spaced members, a plurality of shafts spaced in circular relation having opposite ends journalled in said members having eccentrically disposed intermediate portions, a guide oscillatable centrally of said shafts having a guideway for a tool, a tool reciprocable in said guideway, and connections between one of said shafts and said tool whereby as said shaft rotates said tool is reciprocated relative to said guide, said connections including a tubular member rotatable on said one shaft.

6. A machine of the class described, a support including spaced members, a plurality of shafts spaced in circular relation having opposite ends journalled in said members having eccentrically disposed intermediate portions, a guide oscillatable centrally of said shafts having a guideway for a tool, a tool reciprocable in said guideway, and connections between one of said shafts and said tool whereby as said shaft rotates said tool is reciprocated relative to said guide, said guide including a tubular member and said

guideway including an opening provided in a wall thereof.

7. A machine of the class described comprising in combination, a support having spaced end members, a plurality of shafts for tools extending between said members in circular spaced relation having opposite ends journalled in said members and intermediate portions eccentrically disposed relative to said end portions, tubular members rotatable on said intermediate portions, a guide oscillatable relative to one of said end members disposed centrally of said tool shafts having a guideway for a tool, gearing connecting said tool shafts to effect simultaneous rotation thereof, a tool device having a part reciprocable in said guideway and a part secured to one of said tubular members, and means to rotate one of said shafts.

8. A machine of the class described comprising in combination, a support having spaced end members, a plurality of shafts for tools extending between said members in circular spaced relation having opposite ends journalled in said members and intermediate portions eccentrically disposed relative to said end portions, tubular members rotatable on said intermediate portions, a guide oscillatable relative to one of said end members disposed centrally of said tool shafts having a guideway for a tool, gearing connecting said tool shafts to effect simultaneous rotation thereof, a tool device having a part reciprocable in said guideway and a part secured to one of said tubular members, and means to rotate one of said shafts, said means including a drive shaft operatively connected to one of said tool shafts.

9. A machine of the class described comprising in combination, a support having spaced end members, a plurality of shafts for tools extending between said members in circular spaced relation having opposite ends journalled in said members and intermediate portions eccentrically disposed relative to said end portions, tubular members rotatable on said intermediate portions, a guide oscillatable relative to one of said end members disposed centrally of said tool shafts having a guideway for a tool, gearing connecting said tool shafts to effect simultaneous rotation thereof, a tool device having a part reciprocable in said guideway and a part secured to one of said tubular members, and means to rotate one of said shafts, said means including a drive shaft operatively connected to one of said tool shafts, and said gearing including gears on said tool shafts meshing with a gear rotatable relative to one of said spaced members.

10. A machine of the class described comprising in combination, a support having spaced end members, a plurality of shafts for tools extending between said members in circular spaced relation having opposite ends journalled in said members and intermediate portions eccentrically disposed relative to said end portions, tubular members rotatable on said intermediate portions, a guide oscillatable relative to one of said end members disposed centrally of said tool shafts having a guideway for a tool, gearing connecting said tool shafts to effect simultaneous rotation thereof, a tool device having a part reciprocable in said guideway and a part secured to one of said tubular members, and means to rotate one of said shafts, and means to oscillate said guide.

11. A machine of the class described comprising in combination, a support having spaced end members, a plurality of shafts for tools extending between said members in circular spaced relation having opposite ends journalled in said members, and intermediate portions eccentrically disposed relative to said end portions, tubular members rotatable on said intermediate portions, a guide oscillatable relative to one of said end members disposed centrally of said tool shafts having a guideway for a tool, gearing connecting said tool shafts to effect simultaneous rotation thereof, a tool device having a part reciprocable in said guideway and a part secured to one of said tubular members, and means to rotate one of said shafts, said means including a drive shaft operatively connected to one of said tool shafts, and means to oscillate said guide including a lever connected thereto having a part actuated by an eccentric portion provided on said drive shaft.

12. A machine of the class described comprising in combination, a support having spaced end members, a plurality of shafts for tools extending between said members in circular spaced relation having opposite ends journalled in said members and intermediate portions eccentrically disposed relative to said end portions, tubular members rotatable on said intermediate portions, a guide oscillatable relative to one of said end members disposed centrally of said tool shafts having a guideway for a tool, gearing connecting said tool shafts to effect simultaneous rotation thereof, a tool device having a part reciprocable in said guideway and a part secured to one of said tubular members, and means to rotate one of said shafts, said guide including outer and inner tubular members spaced apart for receiving therebetween a tube to be operated on by said tool.

13. A perforating machine comprising a mandrel to receive an article to be perforated, a punch arranged to be reciprocated substantially radially with respect to said mandrel, eccentric means for effecting radial movement of the punch, and means to oscillate the mandrel to compensate for the component of the punch movement which is non-radial with respect to the mandrel.

14. A perforating machine comprising a mandrel to receive an article to be perforated, a plurality of perforating punches arranged to be moved substantially radially with respect to the mandrel, eccentric means individual to each punch for effecting said radial movement, and eccentric means common to the punches for oscillating the mandrel around its axis in timed relation to the movement of the punches.

15. A perforating machine comprising a central mandrel to receive an article to be perforated, a plurality of eccentrics circumferentially disposed around said mandrel, a common driving arrangement for said eccentrics and a plurality of perforating punches radially mounted with respect to said mandrel, each punch being operated by a corresponding one of said eccentrics.

16. A perforating machine comprising a main support, a mandrel receiving shaft and a plurality of punch operating shafts, all said shafts being mounted parallel to each other and perpendicular with respect to said main support and with the punch shafts arranged circumferentially around the mandrel shaft, eccentrics individual to each of said punch shafts, an eccentric for said mandrel shaft, and common means for operating all said eccentrics in timed relation so that each punch maintains its radial relation to the mandrel.

17. A machine of the character described, com-

prising a plurality of parallel eccentric shafts, a central work receiving shaft surrounded by said eccentric shafts, a tool removably fastened to each of said eccentric shafts, means to rotate said eccentric shafts in unison to oscillate and means to oscillate said central shaft in synchronism with said eccentric shafts.

18. A perforating machine comprising a central mandrel consisting of two concentric tubular members between which the article to be perforated is received, said members having a plurality of aligned punch guiding openings, means to support a plurality of perforating punches with their forward ends passing through said openings, eccentric means to oscillate said punches radially with respect to the mandrel without removing said punches from the openings in the outer one of said concentric members, and means to oscillate said mandrel to preserve a substantially fixed radial relation between said punches and the mandrel during the entire oscillatory movement thereof.

19. A perforating machine comprising a central mandrel to receive an article to be perforated, a plurality of reciprocable perforating punches mounted in a substantially radial direction with respect to said mandrel, an eccentric for each punch for operating the same, a sleeve surrounding each eccentric and to which at least one of said punches is removably fastened.

20. A machine according to claim 19, in which each punch is provided with a slot larger than the eccentric sleeve on which it is mounted and is also provided with a removable insert and a clamping arrangement for removably fastening the punch to the sleeve.

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