

Aug. 8, 1961

H. FRITSCH

2,994,917

APPARATUS FOR ROLLING METAL POWDER

Filed July 28, 1954

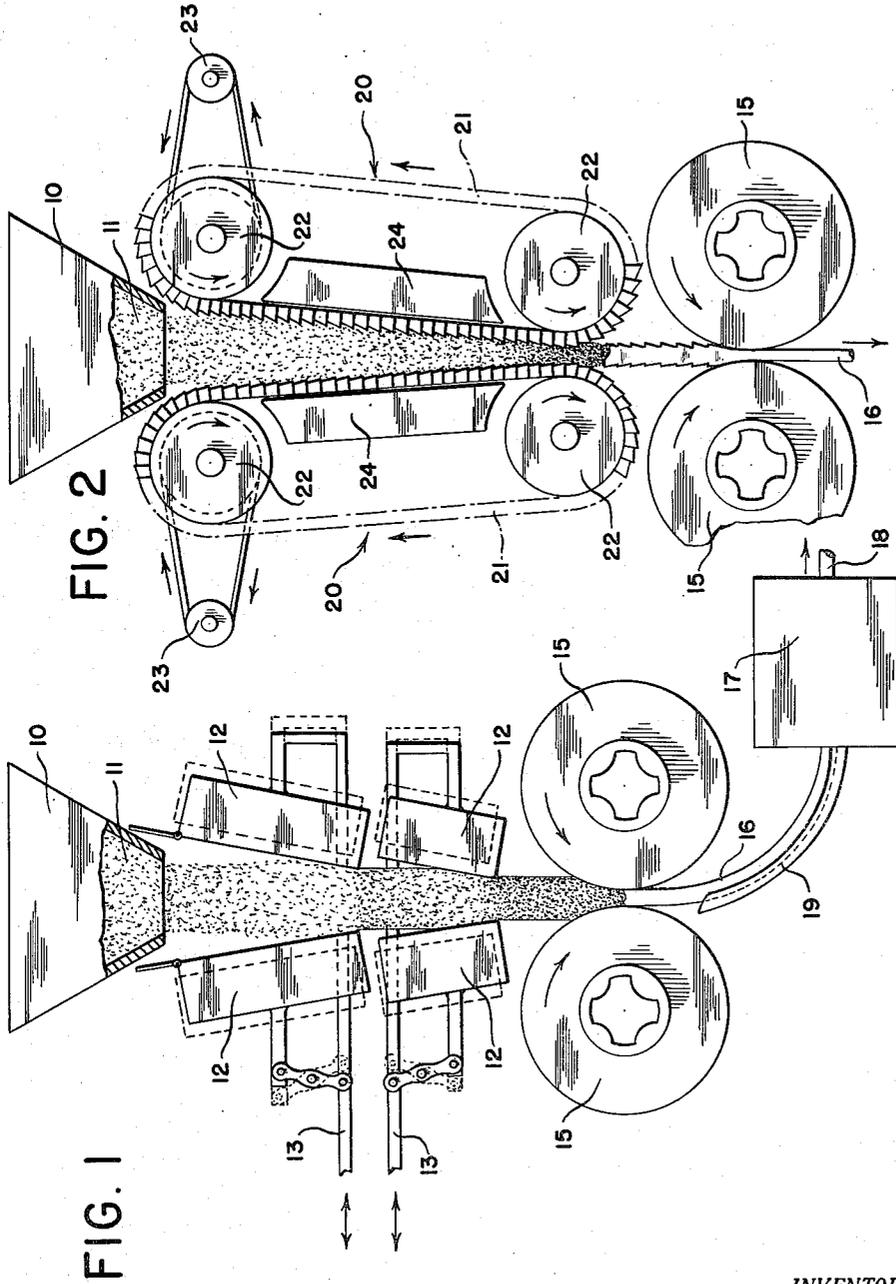


FIG. 2

FIG. 1

INVENTOR.

Hermann Fritsch

BY *Rennie, Columbus, Winter, Barrows and Taylor*

ATTORNEYS.

1

2,994,917

APPARATUS FOR ROLLING METAL POWDER.
Hermann Fritsch, Dusseldorf, Germany, assignor, by
mesne assignments, to Chemetals Corporation, New
York, N.Y., a corporation of Delaware

Filed July 28, 1954, Ser. No. 446,351

Claims priority, application Germany July 31, 1953

5 Claims. (Cl. 18—9)

This invention relates to an apparatus for converting
metal powder into wrought metal shapes, such as metal
sheets, strips, rods, wires and the like.

Metal powder has heretofore been rolled into wrought
metal shapes by tightly compressing the powder between
oppositely disposed, laterally spaced pressure rolls. The
wrought metal shapes thus produced are invariably then
sintered in a suitable furnace to produce metal products
having a substantially coherent structure. The loose
metal powder, which is introduced into the roll gap
between the spaced rolls by means of a suitable hopper, is
compacted by the rolls into a dense mass in which the
individual particles of metal powder cling together with
surprising tenacity. When metal powder is rolled in this
manner, it is essential that the pressure rolls have a
diameter many times larger than the thickness of the
strip of compressed metal powder produced by the rolls.
Because of the relationship between the diameter of the
rolls and the thickness of the strip that can be compacted
by such rolls, rolling apparatus adapted to produce a
compressed metal strip lacks flexibility with regard to the
thickness of the strip that can be produced thereby.
Moreover, difficulty is experienced in producing a strip
of compressed metal powder having uniform density and
surface, due to the problems encountered in feeding loose
metal powder directly to the rolls and having the rolls
draw this loose powder uniformly and smoothly down
into the roll gap to produce the compressed metal powder
strip.

I have now found that, by precompacting loose metal
powder into a lightly precompressed strip of metal powder
prior to introducing the metal powder into the roll gap
defined by the pressure rolls, I can produce a compressed
powdered metal strip uniform in density and surface,
and in a wider range of thickness of strip than has heretofore
been produced by a pair of pressure rolls of a
given diameter. Moreover, I have devised a novel apparatus
for producing wrought metal shapes which includes
means for lightly precompressing the loose metal powder
into a strip unsuitable for sintering, and means for tightly
compressing the strip thus produced into a strip suitable
for sintering into a substantially coherent strip of metal.
The apparatus of the present invention comprises compactor
means for compacting loose metal powder into a
lightly precompressed strip, and a pair of oppositely disposed
laterally spaced pressure rolls defining a roll gap
the width of which is less than the thickness of the lightly
precompressed strip of metal powder prepared by the
compactor means. The compactor means advantageously
comprises at least one pair of convergent compactor elements,
each of which is disposed at an acute angle to the
common axis of the pair of elements whereby the
elements define between them a truncated V-shaped passageway
adapted to compress loose metal powder fed
into the wide end of the passageway into a lightly pre-
compressed strip of powder that is discharged from the
narrow end of the said V-shaped passageway.

For a more detailed description of the invention, refer-
ence may be had to the drawings in which:

FIGURE 1 is a schematic view of an embodiment of
my invention in which the convergent compactor elements
comprise oppositely disposed reciprocating plates; and

FIGURE 2 is a schematic view of another embodiment

2

of my invention in which the compactor elements com-
prise a pair of link belts mounted for convergent travel.

In the embodiment of my apparatus shown in FIG-
URE 1, a hopper 10 feeds loose metal powder 11 into
the space between a pair of oppositely disposed laterally
spaced convergent compactor elements 12. In the appa-
ratus shown, two pairs of compactor elements 12 in
axial alignment comprise the compactor means of my
invention. Each compactor element 12 is disposed at a
slightly acute angle with respect to the common axis of
the pair of elements so that the pair defines a truncated
V-shaped passageway. The common axis of the pair of
elements is the axis of symmetry lying between the pair.

The compactor elements 12 of each pair are movable
laterally with respect to each other and means 13 are
provided for moving these compactor elements in syn-
chronization alternately toward and then away from each
other. The amount of lateral movement of the com-
pactor elements 12 is regulated so that the loose metal
powder 11 introduced into the passageway between the
compactor elements is lightly compressed by these com-
pactor elements when they move toward each other. The
compacting pressure exerted by the compactor elements
on the loose metal powder necessary to form a lightly
precompressed metal powder strip will depend upon the
kind, the degree of subdivision and the cohesive properties
of the metal powder employed as well as the thickness
of the strip to be produced. The lightly precompressed
strip of metal powder should have sufficient mechanical
strength to retain its form while being introduced into
the pressure rolls, but should not be so tightly compressed
as to be suitable for direct sintering into a substantially
coherent strip of metal.

The lightly precompressed metal powder emerging from
the discharge end of the V-shaped passageway defined
by the compactor elements 12 is introduced into the roll
gap defined by a pair of oppositely disposed, laterally
spaced pressure rolls 15. The diameter of each of these
pressure rolls is many times larger than the width of the
strip of metal powder introduced thereto. The width
of the roll gap defined by the pressure rolls 15 is appre-
ciably less than the thickness of the lightly precom-
pressed strip of powder which is, of course, determined
by the lateral spacing of the compactor elements 12 at
the discharge end of the passageway defined thereby.
Thus, the lightly precompressed strip of metal powder
produced by the convergent compactor elements 12 is
tightly compressed by the pressure rolls 15 into a strip
16 suitable for sintering in a sintering furnace 17.

The sintering furnace 17 sinters the tightly compressed
strip of metal powder to form a substantially coherent
strip of metal 18 suitable for many purposes, including
subsequent cold rolling to reduce the sintered strip to a
solid bar, rod, or wire of the parent metal. In the appa-
ratus shown in FIG. 1, the sintering furnace 17 is offset
to one side of the vertically aligned compactor means 12
and pressure rolls 15, necessitating the use of a guide
trough 19 having a relatively large radius of curvature to
guide the tightly compressed strip of powder 16 into the
furnace 17.

In the embodiment of my invention shown in FIGURE
2, the compactor means comprises a pair of oppositely dis-
posed laterally spaced compactor elements 20 each com-
prising a link belt 21 mounted to travel around a pair
of supporting wheels 22. The compactor elements 20 are
disposed at a slight acute angle to the common axis of the
pair of elements so that a truncated V-shaped passageway
is defined by the adjacent outer surfaces of the links in
the link belts 21. The outer surfaces of the links in the
link belt 21 form substantially continuous pressure sur-
faces adapted to compress loose metal powder received
in the V-shaped passageway into a lightly precompact

metal powder strip. Drive means 23 are provided for rotating the wheels 22 so that the adjacent surfaces of the link belts 21 will move downwardly toward the narrow end of the passageway defined by said adjacent surfaces at the same rate of speed, thus insuring uniform compaction of the powdered metal.

The wheels 22 on which the link belts 21 are mounted are advantageously laterally adjustable so that the width of the wide entrance and the narrow exit end of the convergent V-shaped passageway may be adjusted as circumstances warrant. The under sides of the link belts extending between the wheels 22 are provided with support members 24 adapted to support the pressure surfaces of the link belts employed in the compressing operation. The links of the link belts 21 advantageously overlap each other slightly to provide the pressure surfaces of the link belts with a saw-tooth configuration that facilitates the precompression of the metal powder by drawing the loose powder evenly downwardly into the converging passageway defined by the link belts of the compactor elements 20.

The convergent compactor elements 20 of my apparatus lightly precompress the loose metal powder 11 into a strip having moderate mechanical strength and not sufficient density to be successfully sintered into a substantially coherent metal strip. The lightly compressed strip of metal powder discharged from the compactor elements 20 is introduced into the roll gap of a pair of oppositely disposed, laterally spaced pressure rolls 15. The width of the roll gap defined by the pressure rolls 15 is appreciably less than the thickness of the lightly precompressed strip of metal powder introduced thereinto. The width of the precompressed strip of metal powder, of course, is determined by the lateral spacing of the convergent compactor elements at the narrow end of the V-shaped passageway defined thereby. The pressure rolls thus further compress the lightly precompressed strip of metal powder into a dense strip of tightly compressed powdered metal 16 suitable for sintering in a sintering furnace (not shown).

Advantageously, a strip of elastically deformable material is introduced between the pressure rolls 15 and the metal powder being compressed thereby in the manner described in the copending application of Gerhard Naeser, Serial No. 417,322, filed March 19, 1954, and now abandoned. By the use of such an elastically deformable material in rolling metal powders, undesirable sidewise spreading of the compressed metal strip is avoided as described in the aforesaid application.

The apparatus of the present invention may be used to compress many different metal powders, such as copper, iron, lead, nickel, cobalt, and the like, into wrought metal shapes. Various mixtures of metal powder may also be used to produce metal alloys.

Although various changes and modifications may be made in the particular constructions illustrated and described without departing from my invention, I presently prefer to employ the embodiment of my invention shown in FIGURE 2.

I claim:

1. Apparatus for converting metal powder into wrought metal shapes comprising at least one pair of oppositely disposed laterally spaced convergent vertical compactor elements, each of said compactor elements comprising an endless link belt mounted to travel about a pair of supporting wheels, the adjacent outer surfaces of said link belts forming substantially continuous pressure surfaces inclined at an acute angle to the common axis of said pair of compactor elements whereby said adjacent pressure surfaces define a truncated V-shaped passageway, means for moving said link belts at the same rate of speed and in opposite directions so that said adjacent pressure surfaces travel uniformly toward the narrow end of the truncated V-shaped passageway defined by said compactor elements for compacting loose metal pow-

der into a lightly precompressed strip of metal powder having sufficient mechanical strength to retain its form while being introduced into a pair of pressure rolls but not of a sufficient density to be successfully sintered into a substantially coherent metal strip, a metal powder feed hopper adapted to introduce loose metal powder into the wide end of said truncated V-shaped passageway, and a pair of oppositely disposed laterally spaced pressure rolls having the axis of the rolls disposed in a horizontal plane defining a roll gap the width of which is appreciably less than the width of the narrow end of the passageway defined by said compactor elements for compacting the lightly precompressed strip of metal into a compressed strip of metal of a sufficient density to be successfully sintered into a substantially coherent metal strip, said pressure rolls being disposed adjacent the narrow end of said compactor elements with the roll gap in alignment with the truncated V-shaped passageway defined by said compactor elements.

2. Apparatus according to claim 1 in which one edge of each link in said link belt overlaps one of the adjoining links while the opposite edge of said link is overlapped by the other of the adjoining links in said link belt.

3. Apparatus according to claim 1 in which the pair of compactor elements are laterally adjustable with respect to each other whereby the width of the truncated V-shaped passageway defined by said compactor elements may be adjusted.

4. Apparatus for converting metal powder into wrought metal shapes comprising at least one pair of oppositely disposed laterally spaced vertical compactor elements, each of said compactor elements being inclined at an acute angle to the common axis of said pair of compactor elements whereby said pair of elements define a truncated V-shaped passageway, means for moving said pair of compactor elements in a reciprocating lateral path of travel alternately toward and away from each other for compacting loose metal powder into a lightly precompressed strip of metal powder having sufficient mechanical strength to retain its form while being introduced into a pair of pressure rolls but not of a sufficient density to be successfully sintered into a substantially coherent metal strip, a metal powder feed hopper adapted to introduce loose metal powder into the wide end of said truncated V-shaped passageway, and a pair of oppositely disposed laterally spaced pressure rolls having the axis of the rolls disposed in a horizontal plane defining a roll gap the width of which is appreciably less than the width of the narrow end of said truncated V-shaped passageway defined by said pair of compactor elements, said pressure rolls being disposed adjacent said narrow end of said pair of compactor elements with said roll gap in alignment with the truncated V-shaped passageway defined by said pair of compactor elements for compacting the lightly precompressed strip of metal into a compressed strip of metal of a sufficient density to be successfully sintered into a substantially coherent metal strip.

5. Apparatus for converting metal powder into wrought metal shape comprising at least one pair of oppositely disposed laterally spaced convergent vertical compactor elements defining a truncated V-shaped passageway for compacting loose metal powder into a lightly precompressed strip of metal powder having sufficient mechanical strength to retain its form while being introduced into a pair of pressure rolls but not of a sufficient density to be successfully sintered into a substantially coherent metal strip, a metal powder feed hopper adapted to introduce loose metal powder into the wide end of said truncated V-shaped passageway, and a pair of oppositely disposed laterally spaced pressure rolls having the axis of the rolls disposed in a horizontal plane defining a roll gap the width of which is appreciably less than the closest distance separating said convergent compactor elements disposed adjacent and in alignment with the narrow end of said truncated V-shaped passageway defined by said compactor elements for compacting the lightly precom-

5

pressed strip of metal into a compressed strip of metal of a sufficient density to be successfully sintered into a substantially coherent metal strip.

References Cited in the file of this patent

UNITED STATES PATENTS

2,027,164	Grubman	Jan. 7, 1936
2,075,735	Loomis	Mar. 30, 1937

5

2,341,732
2,422,281
2,602,960
2,651,952
2,657,427
2,689,975
2,708,770
2,717,419
2,784,453

6

Marvin	Feb. 15, 1944
Adams	June 17, 1947
Fischbein	July 15, 1952
Leavenworth	Sept. 15, 1953
Upton	Nov. 3, 1953
Leng	Sept. 28, 1954
Herres et al.	May 24, 1955
Dickey	Sept. 13, 1955
Hjulian	Mar. 12, 1957