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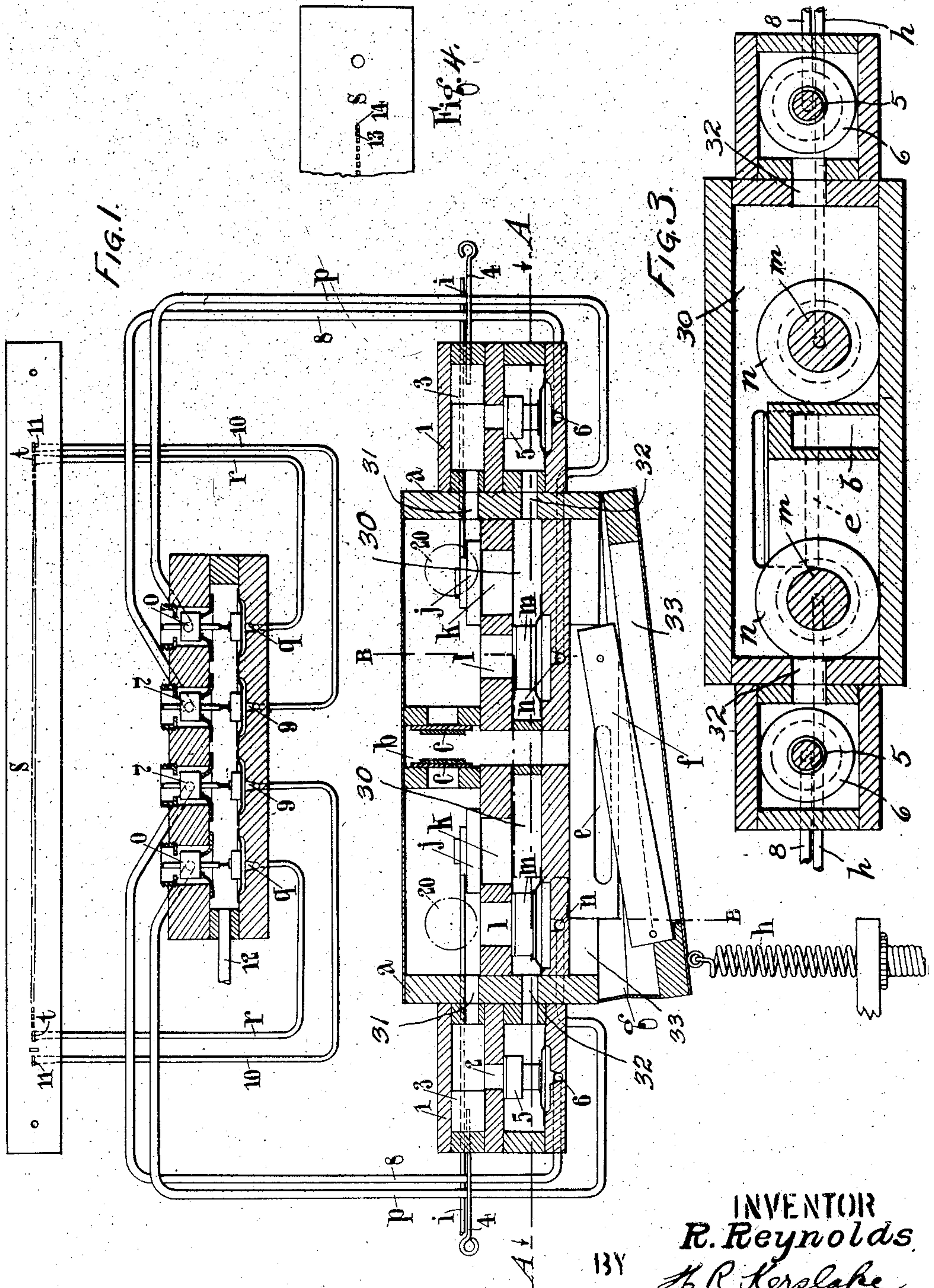
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MUSICAL INSTRUMENT OPERATED BY AIR UNDER CONTROL OF PERFORATED TUNE SHEETS.

FILED JUNE 24, 1919.

2 SHEETS—SHEET 1.



INVENTOR
R. Reynolds
H. R. Kerslake
 ATTORNEY

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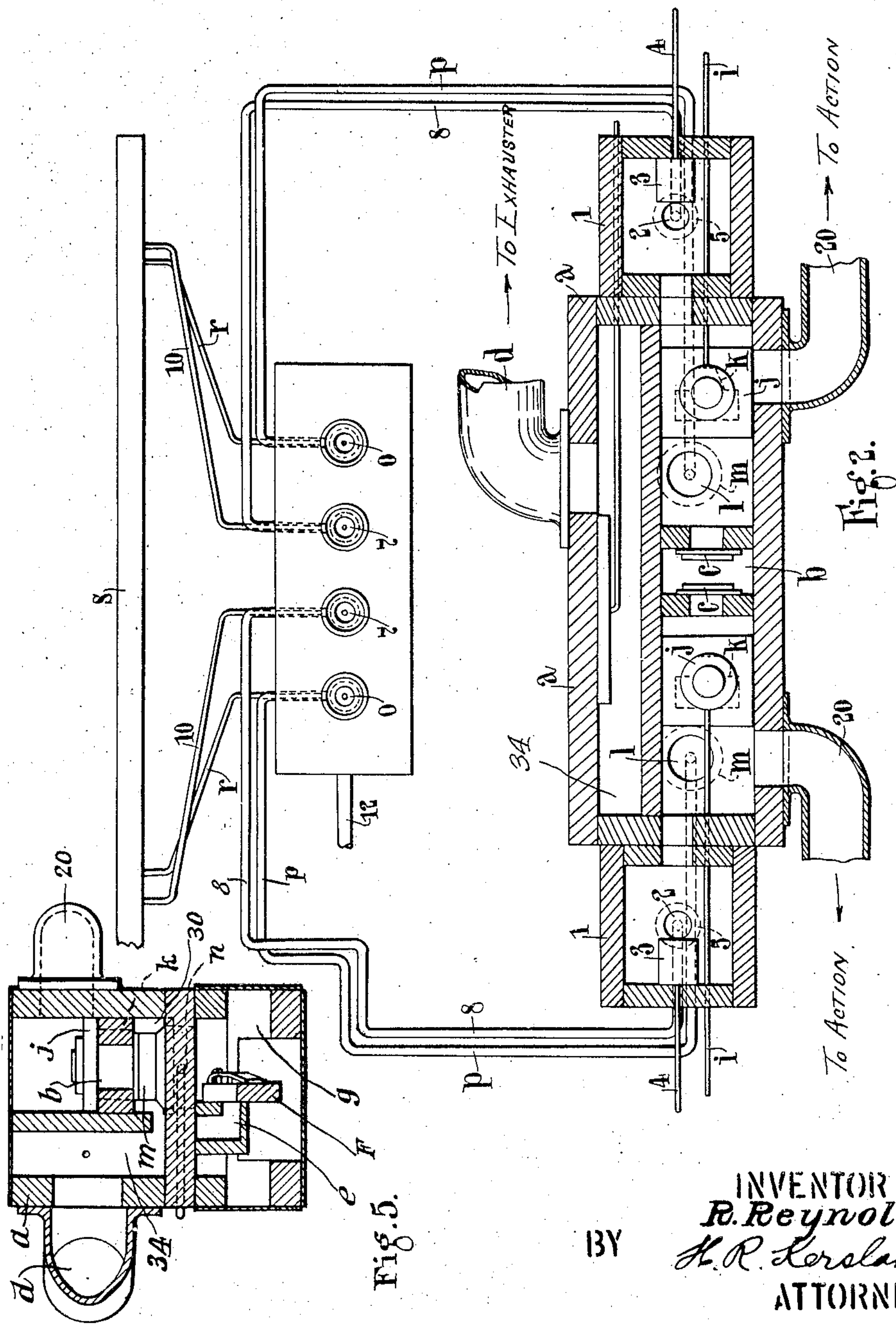
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H. R. Lerslake
ATTORNEY

UNITED STATES PATENT OFFICE.

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MUSICAL INSTRUMENT OPERATED BY AIR UNDER CONTROL OF PERFORATED TUNE
SHEETS.

Application filed June 24, 1919. Serial No. 306,318.

To all whom it may concern:

Be it known that I, REGINALD REYNOLDS, a
subject of the King of Great Britain and
Ireland, and residing at 34 The Crescent,
5 Barnes, London, S. W., England, have in-
vented certain new and useful Improvements
Relating to Musical Instruments Operated
by Air Under Control of Perforated Tune
Sheets, of which the following is a specifi-
10 cation.

This invention relates to musical instru-
ments operated by exhaust or pressure at-
mosphere and perforated tune sheets, and
has for its object to provide improvements
15 in the mechanism used for accenting various
notes or chords, melodies or passages of
music.

In such instruments, the accenting or
playing of certain melodies or passages with
20 an increased force over that of the accom-
paniment is effected by an arrangement for
governing the wind pressure or suction by
means of a small governor bellows held by a
spring in the reverse position to that which
25 is produced by the suction or pressure. The
said spring is adjustable, so that various ten-
sions may be obtained, but in working it re-
mains fixed at a given tension and is not
controlled by the operator. The moving
30 board of the governor bellows is attached on
the inside to a valve covering an orifice
which is in direct communication with the
main wind supply. The action of the wind
tends to close the governor bellows and will
35 do so up to a point where the spring tension
equalizes the wind pressure and consequently
the wind pressure will be maintained at a
value determined by the spring. This gov-
ernor bellows is also provided with a valve
40 and membrane to open same which allows
the full force of the main wind to be ex-
erted while the valve is open. The perfora-
tions in the paper and through the tracker
bar are designed to open and close this valve
45 at specific times, so that the selected notes or
passages are played with greater force than
those which not influenced by the perfora-
tions and valves.

According to the present invention in ad-
50 dition to the above mentioned main accen-
tuating valves there are provided pneumati-
cally operated auxiliary accentuating valves
designed to be opened and closed at other
specific times (i. e., alternatively to the open-

ing and closing of the main accentuating 55
valves) by other perforations in the paper
and other tracker bar ducts. The effect of
the opening of these auxiliary accentuating
valves is adjustable so as to enable the de-
gree of subordinate accentuation attainable 60
thereby to be varied.

I find it necessary in practice for the best
effects to arrange for accurate adjustment of
the orifices controlled by these auxiliary ac-
centuating valves to suit particular instru- 65
ments and in order to secure uniformity be-
tween the performance of various instru-
ments.

My invention therefore consists in the
combination in musical instruments oper- 70
ated by exhaust or pressure and perforated
tune sheets of a pneumatic action, an ex-
hauster, an airway connecting said exhauster
with said pneumatic action, a governing bel-
lows chamber in said airway, a second air- 75
way in parallel with said first mentioned air-
way, a pneumatically operated valve in said
second airway, a third airway coupled in
parallel with said second airway, a pneu-
matically operated valve in said third air- 80
way adapted for operation alternatively to
the valve in said airway and adjustable
means co-acting with said third airway en-
abling the relative accentuating effect due
to the said pneumatically operated valve in 85
the latter to be adjusted.

Referring to the accompanying diagram-
matic drawings:—

Figure 1 is a sectional elevation; and

Figure 2 is a part sectional plan of an ar- 90
rangement according to one form of the
present invention.

Figure 3 is a horizontal section taken on
line A—A of Figure 1.

Figure 4 is a detail of a tracker bar ac- 95
cording to a modified form.

Figure 5 represents a sectional view taken
on the line B—B of Figure 1.

In carrying the invention into effect in one
form by way of example where only two de- 100
grees of accented power are required, a box
is attached to the side of the governor bel-
lows, provided with the necessary ducts of
a suitable size controlled by valves and the
actuating membranes, and ducts leading 105
from the valves are provided with slides for
reducing the size of these orifices to just the
exact requirements. These orifices being of

a smaller air-carrying capacity than the loud accenting orifices, the result is that it is possible to obtain an absolute modification of accented power intermediary between the loud accents and the soft accompaniment, the latter being maintained as already explained by the governor bellows.

Such an arrangement is shown in Figures 1, 2 and 3 in which the governor bellows chest *a* is provided, as in known constructions, with a central air-way *b* provided with flap valves *c* leading to the main suction pipe *d* (Figure 2) by way of the bellows chamber 33 orifice *e* (opened and closed by the valve *f* according to the motion of the bellows *g*, against the action of the tension spring *h* and chamber 30). The main suction pipe *d* is connected with chamber 34, which is in open communication with chamber 30. There are also provided known tapered orifices *k* controlled by slides *j* operated by rods *i*, such giving a soft control by varying the acting size of the apertures *k* leading to the main suction from the bellows. Again as is known, ordinary main accentuating means are provided comprising orifices *l* of fixed aperture governed by valves *m*. The orifices and valves to the right of the central passage *b* deal with the treble and those to the left with the bass. The valves *m* are raised and lowered by pneumatic cushions *n* worked from primary valves *o* through pneumatic tubes *p*, these valves *o* themselves being actuated by way of cushions *q* operated by air supplied through tubes *r* under the control of orifices *t* in the tracker bar *s*.

In the ordinary course of events during playing of a piece suction is applied continuously at *d*, thus subjecting the chamber 30 (Figure 1) beneath the apertures *k* to its effect. Air may pass into the inlet pipes 20 past the flap valves *c*, down the central air-way *b* and through the orifice *e* and so to pipe *d*, provided *e* be not closed entirely by the valve *f*. The exhaustor is thus placed in communication with the action under the prevailing suction determined by the setting of the governing bellows. Increase of suction in the action is attainable by opening the tapered orifices *k*. When the main accentuating valves *n* are depressed by the opening of the appropriate tracker bar ducts the suction to which the action is subject is increased greatly by the opening of the ducts *l* to establish a communication independent of the governing bellows.

A parallel path alternative to that through the ducts *l* is provided, through ducts 32, 2 and 31 under control of the manually adjustable slide valves 3 when the auxiliary accentuating valves 5 are depressed.

This invention is applied in one way to such an arrangement by the provision of a box 1 at each side of the aforesaid box *a*, the boxes 1 containing orifices 2 the acting aper-

ture of which can be varied by means of plungers 3 externally operated, say, by the rods 4. The opening and closing of the orifices 2 are governed by valves 5 operated from pneumatic cushions 6 worked from primary valves 7 by way of the pneumatic leads 8. The primary valves 7 are raised and lowered by pneumatic cushions 9 as air is supplied by way of the leads 10. This is effected in the form shown in Figures 1, 2 and 3 by the provision of a special pair of holes 11 on the tracker bar *s*. Where, therefore, a certain amount of accenting is to be given to a sub or secondary theme it is arranged that these holes 11 shall come into action.

When this takes place air may pass from the inlet pipes 20 to the pipe *d* by way of orifices 31, orifice 2 (the valves 5 being depressed as explained below), orifice 32 and chamber 30 alternatively to passing through the ducts *l*, the other paths mentioned above being unaffected. A consequential accentuation inferior in magnitude to that attainable by the main accentuation valves and ducts is thus achieved, and is regulable in degree according to the setting of the plungers 3.

The depression of the valves 5 to effect the subordinate accentuation alternatively to the main accentuation is controlled by the registering of the duct 11 with a perforation in the tune sheet in the following manner.

Normally the valves 7 occupy the position which they occupy in Figure 1, i. e., a position such that the upper ends of the pipes 8 are open to the atmosphere. Thus, since the chamber 30 is subject to main suction, the pneumatic cushions 6 are raised and the valves 5 raised. When air is admitted to the pipes 10, however, the suction applied through the pipe 12 causes the valves *q* to be raised, thus in addition uncovering the upper ends of the pipes 8 to the influence of this suction.

The pneumatic cushions 6 are thus deflated and the orifices 2 opened by the consequent dropping of the two valves 5.

In many tracker bars of existing instruments there are wide orifices at the extreme ends of the tracker bar for the ordinary main accenting mechanism and two holes are punched in the tune sheet, both of which however lead into the one orifice in the tracker bar. One perforation in the tune sheet, therefore, is quite sufficient; so that in order to apply this invention to these instruments it is only necessary to divide these wide orifices into two and then arrange for either the outer or inner perforations in the tune sheet to operate either the loud accenting device or the improved graduated subordinate accenting device to produce the additional musical effects, and to apply the valve mechanism to the existing governing bellows in the instrument.

A modification of this kind is shown in Figure 4 wherein the two holes 13 and 14 occupy the place of a similar single hole of area equal to the area of those two. The hole 13 as regards operation corresponds to the hole *t* in the tracker bar of Figure 1 and 14 is equivalent to 11.

Although this is a simple way of applying the invention, in the case of eighty-eight note instruments it may be more convenient to provide extra apertures in the tracker bar, as in the form shown in Figure 1, and corresponding additional marginal perforations in the music rolls; instead of dividing the ordinary main accentuation duct, which method would be necessary in the case of sixty-five note players, if applied to standard scale music, as there is now no available margin upon the sixty-five note music roll.

It will be understood that it is preferred to arrange the main accentuation orifices so that their effective areas can be conveniently varied either to suit a particular instrument or during performance to suit needs of the composition. Whether these holes are variable or not it is found desirable in practice for the best effects to arrange for accurate adjustment of the subordinate orifices and any further orifices of this kind to obtain such an area with relation to that of the orifices *e* and *l* that a suitable intermediate degree of tone accentuation is secured.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. In musical instruments operated by air, under control of perforated tune sheets, the combination of a pneumatic action duct, an exhaustor duct, an air-way connecting said exhaustor duct with said pneumatic action duct, a governing bellows chamber in said air-way, a second air-way through said governing bellows chamber, in parallel with said first mentioned air-way, and connecting said exhaustor duct with said pneumatic action duct, a pneumatically operated valve in said second airway, a third air-way coupled in parallel with said second air-way, and connecting said exhaustor duct with said pneumatic action duct, a pneumatically operated valve in said third air-way adapted for operation alternatively to the valve in said second air-way, and adjustable means co-acting with said third air-way, enabling the relative accentuating effect due to said pneumatically operated valve in the latter to be adjusted.

2. In musical instruments operated by air, under control of perforated tune sheets, the combination of a pneumatic action duct, an exhaustor duct, an air-way connecting said exhaustor duct with said pneumatic action duct, a governing bellows chamber in

said air-way, a second air-way through said governing bellows chamber, in parallel with said first-mentioned air-way, and connecting said exhaustor duct with said pneumatic action duct, a pneumatically operated valve in said second air-way, a third air-way coupled in parallel with said second air-way, and connecting said exhaustor duct with said pneumatic action duct, a pneumatically operated valve in said third air-way adapted for operation alternatively to the valve in said second air-way, a fourth air-way in parallel with the said second air-way, connecting said exhaustor duct with said pneumatic action duct, and a manually operable valve in said fourth air-way.

3. In musical instruments operated by air, under control of perforated tune sheets, the combination of a pneumatic action duct, an exhaustor duct, an air-way connecting said exhaustor duct with said pneumatic action duct, a governing bellows chamber in said air-way, a second air-way through said governing bellows chamber, in parallel with said first mentioned air-way and connecting said exhaustor duct with said pneumatic action duct, a pneumatically operated valve in said second air-way, a third air-way coupled in parallel with said second air-way, and connecting said exhaustor duct with said pneumatic action duct, a pneumatically operated valve in said third air-way adapted for operation alternatively to the valve in said second air-way, and a hand-operated slide valve controlling said third air-way.

4. In musical instruments operated by air under control of perforated tune sheets, the combination of a pneumatic action, an exhaustor, a governing bellows chamber, an airway through said governing bellows chamber, a second airway in said governing bellows chamber in parallel with said first airway, a pneumatically operated valve in said second airway, an auxiliary chamber in connection with said governing bellows chamber, a separating partition in said auxiliary chamber, an airway connecting said auxiliary chamber with said governing bellows chamber disposed on one side of said partition, another airway communicating between said auxiliary chamber and said governing bellows chamber and disposed on the other side of said partition, an aperture in said partition, a pneumatically operated valve adapted to open or to close said aperture, and manually adjustable means operable to control said aperture.

5. In musical instruments operated by air under control of perforated tune sheets, the combination of a pneumatic action, an exhaustor, an airway connecting said exhaustor with said pneumatic action, a governing bellows chamber in said airway, a second airway in parallel with said first

mentioned airway, a pneumatically operated valve in said second airway, a separate third airway coupled in parallel with said second airway, a pneumatically operated valve in said third airway operated alternatively to the valve in second airway adjustable means co-acting with said third airway enabling the relative accentuating effect due to the said pneumatically operated valve in the latter to be varied, a

tracker bar, a subdivided orifice therein, one opening of which communicates with said pneumatically operated valve in the second airway and another opening thereof communicating with said pneumatically operated valve in the third airway.

In testimony whereof I have signed my name to this specification.

REGINALD REYNOLDS.